Agenda
Jefferson County Planning Commission
Tuesday, June 13, 2023 at 7:00 PM

By order of the President of the Jefferson County Planning Commission,
Public Participation is available in-person only.
The meeting will be broadcast live via ZOOM for viewing purposes only.

In-Person Meeting Location: County Commission Meeting Room located in the lower level of the Charles Town Library (side entrance on Samuel Street)
200 East Washington Street, Charles Town, WV 25414

ZOOM Broadcast Information*: Meeting ID: 896 9624 9269
Meeting Link: https://us02web.zoom.us/j/89696249269

**If watching live broadcast, please ensure your microphone is muted and be mindful that your video is streaming to others.*

1. **Approval of Meeting Minutes:** May 9, 2023
2. **Request for postponement.**
3. **Public Workshop:** Concept Plan for the Shannondale Lake Telecommunications Tower consisting of a 100' Monopole Telecommunications Tower to include 9 Antennas, one 10' x 3' concrete equipment pad and one 7' x 4' wide concrete equipment pad within a 50' x 50' fenced compound area. Applicant: Smartlink Group, Attn: Sonya Hemphill; Property Owner: Shannondale Enterprises Inc., Attn: Jeff Shores; Property Location: 1329 Lakeside Drive, Harpers Ferry, WV; Parcel ID: 06000600090000; Size: ~68 acres; Zoning District: Rural (File: 23-3-SP).
4. **Public Hearing:** Request for a Waiver from Section 21.101A, which requires blocks to not exceed six lots in length on one side of the street, to allow a mixture of lot numbers along both sides of the streets for the proposed Hunter Hills Subdivision (File: 21-21-SD). Property Owner/Applicant: ILA Properties, Inc.; Property Location: 4469 Charles Town Road, Kearneysville, WV; Parcel ID: 0700010002000; Size: ~107 acres; Zoning District: Residential-Light Industrial-Commercial (File: 23-10-PCW).
5. **Public Hearing:** Request for a Waiver from Section 20.102B to allow site grading and utility work to commence prior to Final Plat approval for the proposed four-lot Country Club Commons Nonresidential Subdivision (19-17-SD). Property Owner/Applicant: B.C. Partners / Dan Snyder, P.E; Property Location: Vacant lot NE corner of Route 340 and WV 24 (Country Club Road), Charles Town, WV; Parcel ID: 04001100110000; Size: 9.54 acres; Zoning District: Residential-Light Industrial-Commercial (File: 23-11-PCW).
6. **Public Hearing:** Request for a Waiver from Section 20.201A2 to reduce the width of the required access easement from 50' to 40' for a proposed four lot minor subdivision. Property Owner: Howard Wines and Regina Northcraft; Applicant: David Lutman; Property Location: 389 Billmyer Mill Road, Shepherdstown, WV; Parcel ID: 09000700150005; Size: 10.11+- acres; Zoning District: Residential Growth (File: 23-12-PCW).

7. **Public Hearing:** Request for a Waiver from Section 20.102B to allow site grading and footings to commence prior to Site Plan approval for the proposed Phase II of the AMP at Sam Michaels Park due to grant deadlines (File: 22-2-SP). Property Owner: Jefferson County Commission; Applicant: Jefferson County Parks & Recreation Commission; Property Location: 235 Sam Michaels Ln, Shenandoah Junction, WV; Parcel ID: 02000300120000; Size: 136.6 acres; Zoning District: Rural (File: 23-13-PCW).

8. **Public Hearing:** Waiver from Section 24.202A of the 2008 Subdivision Regulations, which requires "an amendment to a subdivision plat to process in the same manner as the plat was originally approved". The Waterside Reserve Subdivision (Files #02-37 and 05-19) processed under the 1979 Subdivision Ordinance, which required both the Community Impact Statement (CIS) and Final Plat to be considered during a Public Hearing before the Planning Commission. The applicant is requesting permission to amend the CIS and Final Plat for the purpose of excluding the Open Space parcel from the Waterside Reserve subdivision to allow for the continued use of an existing nonconforming campground and to allow said amendment to process administratively.; Property Owner: Whisper Ridge, LLC; Applicant: Panhandle Legal / Christopher P. Stroech; Property Location: Vacant parcel on Wilt Road, Charles Town, WV; Parcel ID: 02020B0OS10000; Size: 6.08 acres; Zoning District: Rural (File: 23-14-PCW).

There is no public comment for the following items.

9. **Discussion and Possible Direction:** Letter from Mayor Auxer, Shepherdstown, dated 5/9/23 requesting a Memorandum of Understanding regarding agenda items within Shepherdstown Growth Management Boundary.
10. **Discussion and Possible Direction:** Draft policy related to changes to WV Code 8A regarding delegating to staff the authority to determine completeness of Preliminary Plats and/or Major Site Plans, while Subdivision Regulation Text Amendment is being processed. (*to be distributed at meeting*)
11. **Discussion and Possible Direction:** Determination regarding contracts to hire a social media marketing firm to increase Public Outreach for the Comprehensive Plan Update. (*to be distributed at meeting*)
12. **Reports from Legal Counsel**
    a. Discuss and review Jefferson County Circuit Court Civil Action No. 2021-C-109.
    b. Review of Zoning Text Amendment File #ZTA19-03 related to solar energy facilities, including discussion of Jefferson County Circuit Court Civil Action No.'s 2021-C- 33 through 37 and Jefferson County Circuit Court Civil Action No.'s 2021- C-46 through 50, and WV Supreme Court No.'s 21-0727, 21-0728, and 21-0731.
    c. Jefferson County Circuit Court Case #CC-19-2022-C-81 (RE: ZTA22-01 Solar Energy Facilities).
    d. Discuss and review for possible action Jefferson County Circuit Court Civil Action No. 2023-C-48 (RE: PC File #21-8-SP Berryville Pike Telecommunications Tower).
13. **Planner's Memo**
14. **President's Report**
15. **Actionable Correspondence**
16. **Non-Actionable Correspondence**
    - Email from Alan Dattelbaum Re: Dust Control for Large Scale Projects.

Draft Meeting Minutes
Jefferson County Planning Commission
May 9, 2023

The Jefferson County Planning Commission met on May 9, 2023 at 7:00 pm with the following Planning Commission members present: Mike Shepp, President; Wade Louthan, Secretary; Jack Hefestay; J. Ware; Tim Smith; Aaron Howell; Donnie Fisher were present in person.

Steve Stolipher, County Commission Liaison and Matt Knott, Vice President were absent with notice.

Staff members present included: Jennifer Brockman, Chief County Planner; Luke Seigfried, County Planner; Alexandra Beaulieu, Deputy Director and Zoning Administrator; Jonathan Saunders, County Engineer; Nathan Cochran, Prosecuting Attorney; and Michelle Evers, Planning Clerk.

Mr. Shepp called the meeting to order at 7:02 pm. and confirmed a quorum was present. Mr. Shepp reviewed meeting protocol for those in attendance and noted that Item #3 on the Agenda would be moved to the end of the Agenda.

1. **Approval of Meeting Minutes**: March 14, 2023 (corrected), March 28, 2023, and April 11, 2023.

   Mr. Shepp made a motion to approve the Meeting Minutes as presented, Mr. Fisher seconded the motion, which carried unanimously.

2. **Request for postponement**.

3. **Public Workshop**: Solar Energy Facility Concept Plan for the Flowing Springs Farm Solar moved to later in the agenda.

4. **Public Hearing:** Request for a waiver from Appendix B, Section 2.3.B.6 of the Subdivision Regulations to reduce the radius from 35 ft. to 15 ft. for the entrance to the proposed Aspen Hill Apartments (File: 23-2-SP). Property Owner: L & C Horning LLC. Applicant: Tri-State Improvements, LLC; Property Location: Maddex Dr, Shepherdstown WV; Parcel ID: 09000800170001; Size: ~0.43 acres; Zoning District: Residential Growth (File: 23-8-PCW).

   Ms. Brockman provided an overview of the staff report.

   The applicant's engineer, Richard Klein with Alpha Associates, Inc. explained the nature of the request to the Planning Commission.

   Mr. Shepp opened the public hearing. There was no public comment. Mr. Shepp closed the public hearing.

   Mr. Louthan made a motion to approve the waiver as presented. Mr. Fisher seconded the motion, which carried unanimously.

5. **Public Hearing:** Request for a waiver from Section 20.203B of the Subdivision Regulations, which requires a Full Site Plan for any development that does not meet the Limited Site Plan Standards. The applicant is requesting to waive the requirement of a Full Site Plan for up to two 2,500 sq. ft. octagonal dog kennels and a 480 sq. ft. shed roof overhang on one existing building. Property Owner/Applicant: National Humane Education Society; Property Location:

3731 Berryville Pike, Charles Town, WV; Parcel ID: 06001100010000; Size: ~23.36+ acres; Zoning District: Industrial-Commercial (File: 23-9-PCW).

Ms. Brockman provided an overview of the staff report.

The applicant's consultant, Paul Raco with P.J. Raco Consulting, explained the nature of the request to the Planning Commission.

Mr. Shepp opened the public hearing. There was no public comment. Mr. Shepp closed the public hearing.

Mr. Louthan made a motion to approve the waiver as presented. Mr. Fisher seconded the motion, which carried unanimously.

6. **Public Hearing:** Request for a variance from Section 2.1B of the 1979 Subdivision Ordinance (parent to child exemption) to lift the single family restriction to allow for a detached Accessory Dwelling Unit (In-Law Suite). Property Owner/Applicant: Jake Lavoie; Property Location: 1196 Ward Clipp; Parcel ID: 06002800110000; Size: ~17.36 acres; Zoning District: Rural (File: 23-1-PCV).

   Ms. Brockman provided an overview of the staff report.

   Jake Lavoie, the applicant, explained the nature of the request.

   Mr. Shepp opened the public hearing. There was no public comment. Mr. Shepp closed the public hearing.

   Mr. Hefestay made a motion to approve the variance as presented. Mr. Fisher seconded the motion, which carried unanimously.

Agenda Item #3 **Public Workshop:** Solar Energy Facility Concept Plan for the Flowing Springs Farm Solar project for a proposed 125 MWac solar electric generating facility and associated battery energy storage system on approximately 660-acres. The project will consist of solar modules, a new substation to connect the solar facility with the electric grid, and underground utilities. The project site has existing high voltage power lines running through the property. (PC File #23-4-SP).

Property Owners/Location/ID/Size/Zoning District

B C Partners, Inc., Property Owner:
Vacant parcel south of Job Corps Road/south of Driswood Elementary School, Shenandoah Junction, WV; Parcel ID: 02000300130000; Lot Size: 104.7 acres; Zoning District: Rural

Butler Family Limited Partnership, Property Owner
Vacant parcel northeast of Old Country Club Rd / east of Aspen Greens Subdivision, Charles Town, WV; Parcel ID: 04001000010000; Lot Size: 133.9 acres; Project Area: 93.8 acres; Zoning District: Residential Growth & Rural

B C Partners, Inc., Property Owner
Vacant parcels east of Old Country Club Road / north of Beallair Subdivision, Charles Town, WV; Parcel ID: 04001000020000; Lot Size: 99.5 acres; Zoning District: Residential Growth & Parcel ID: 04001000030000; Lot Size: 233.5 acres; Zoning District: Residential Growth

Potomac Edison Company, Property Owner

1320 Old Country Club Road (Substation), Charles Town, WV; Parcel ID: 04001000030005; Lot Size: 3.67 acres; Zoning District: Residential Growth

B C Partners, Inc., Property Owner
Vacant parcel west of Shepherdstown Pike, Harpers Ferry, WV; Parcel ID: 04001000100000; Lot Size: 141.1 acres; Zoning District: Residential Growth & Residential-Light Industrial-Commercial

Ms. Brockman provided an overview of the staff report. Ms. Brockman also stated to the Planning Commission that as a result of the court order related to the Zoning Ordinance text amendment, Solar Energy Facilities were listed as a Principal Permitted Use in the areas located within the Preferred Growth Areas and Urban Growth Areas as delineated on the Future Land Use Guide in the Comprehensive Plan. Ms. Brockman stated that the Flowing Springs Farm Solar project is located entirely within the Residential Preferred Growth Area.

Applicants Sam Judd and John Crosby with Enel Green Power, and Kyle Spayd, Civil Engineer with WSP provided an overview of the project. Mr. Judd and Mr. Crosby noted that the proposed design included voluntary vegetative buffers that exceeded the County's requirements and would be placed along the exterior of the project fence to mitigate visual impact. *The PowerPoint presentation was incorporated into the record and is available on the County's website.*

Ms. Brockman reiterated that the project is a Principal Permitted Use and provided an overview of the Public Workshop process. Ms. Brockman noted that the Applicant submitted a list of proffers which were placed on the dais at the start of the meeting..

Mr. Shepp opened the Public Workshop.

- Mr. Kirk Hanneman, Ms. Margaret Sanders, Mr. Mike Hanscom, Mr. Robert Cooper, Mr. Marc Mayrand, Mr. Stephen Welsh, Mr. Pat Masters, and Ms. Melissa Glassock provided public comment.

Mr. Shepp confirmed that no one else in the room wanted to provide comment. Mr. Shepp closed the Public Workshop.

The applicants provided a rebuttal and responded to questions and concerns presented by the public.

The Planning Commission asked the applicant several questions.

Mr. Fisher made a motion to approve the Concept Plan with the Proffers submitted by the applicant and that any outstanding comments from staff be addressed. Mr. Smith seconded the motion, which carried unanimously.

List of Proffers submitted by applicant are attached to the meeting meetings for the record.

7. **Discussion and Action:** Review final approved amendments to WV Code 8A (effective 5/31/23) which will now allow the Planning Commission to authorize staff to have certain rights not previously permitted. This item is for discussion and direction as to whether amendments to the Subdivision Regulations, Bylaws, and/or Zoning Ordinance should be drafted.

Ms. Brockman provided an overview of the final approved amendments to WV Code 8A.

Mr. Shepp suggested that the Planning Commission implement the changes from state law as a policy and to incorporate the changes into the Subdivision Regulations as part of the ordinance rewrite project. Mr. Shepp requested that Ms. Beaulieu forward the information to Mr. Raco (consultant working on ordinance rewrite). Mr. Fisher made a motion to this effect; Mr. Shepp seconded the motion, which carried unanimously.

8. **Reports from Legal Counsel**
   a. Discuss and review Jefferson County Circuit Court Civil Action No. 2021-C-109.
   b. Review of Zoning Text Amendment File #ZTA19-03 related to solar energy facilities, including discussion of Jefferson County Circuit Court Civil Action No.'s 2021-C- 33 through 37 and Jefferson County Circuit Court Civil Action No.'s 2021- C-46 through 50, and WV Supreme Court No.'s 21-0727, 21-0728, and 21-0731.
   c. Jefferson County Circuit Court Case #CC-19-2022-C-81 (RE: ZTA22-01 Solar Energy Facilities).
   d. Discuss and review for possible action Jefferson County Circuit Court Civil Action No. 2022-C-85.

   Mr. Cochran discussed the previous cancelled Special Meeting regarding the scheduled depositions.

9. **Planner's Memo.**

   Ms. Brockman informed the Planning Commission about the upcoming Comprehensive Plan Public Input Work Session taking place on June 5, 2023.

   The Planning Commission discussed changing the Comprehensive Plan Work Session start time from 5:00. By unanimous consensus, the start time for comprehensive plan work session meetings was changed to 5:30.

10. **President's Report.** None.

11. **Actionable Correspondence.**

12. **Non-Actionable Correspondence.**
    - Email from Alan Dattelbaum and Mary Edwards Re: Dust Control for Large Scale Projects.
    - Invitation to Blake Solar Project Re: Ground Breaking Ceremony

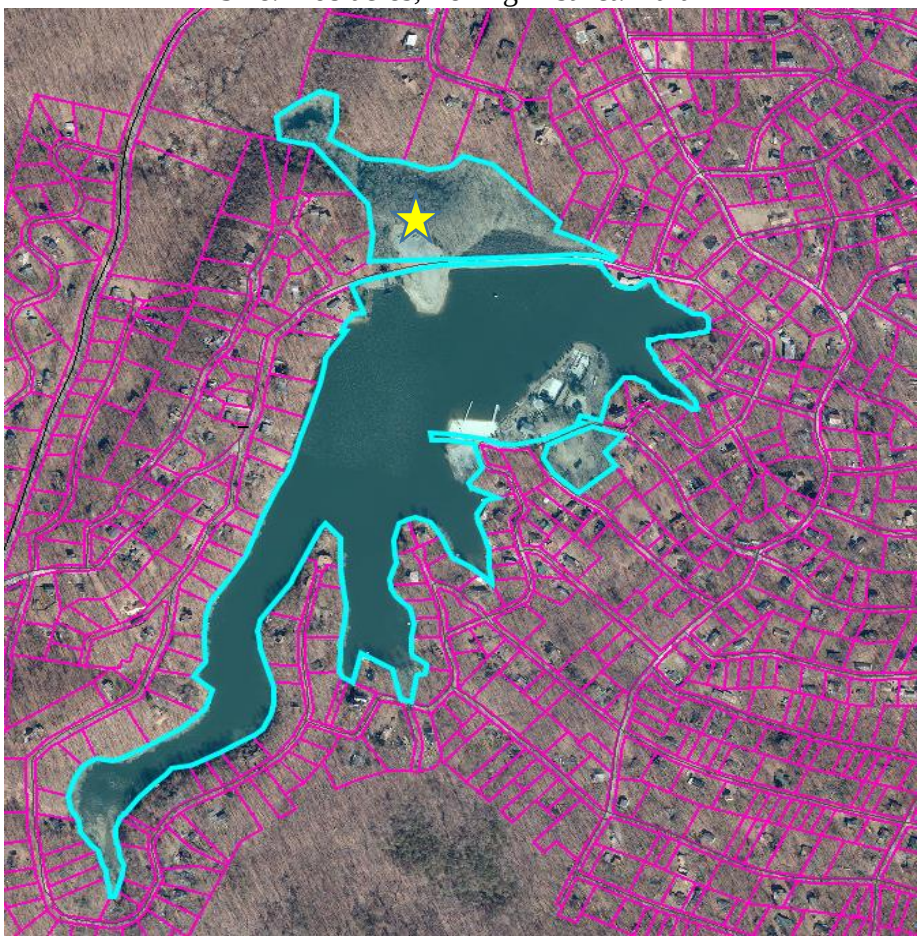
Mr. Hefestay made a motion to adjourn the meeting at 8:45 pm. Mr. Fisher seconded the motion, which carried unanimously.

These minutes were prepared by Michelle Evers, Planning Clerk.

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Shannondale Lake Telecommunication Tower Concept Plan (23-3-SP)

Item #3: **Public Workshop:** Request by Smartlink Group for approval of the Shannondale Lake Telecommunication Tower Concept Plan to allow a 100' Monopole Telecommunications Tower to include 9 Antennas and consist of one 10’ x 3’ concrete equipment pad and one 7’ x 4’ wide concrete equipment pad within a 50’ x 50’ fenced compound area.

Applicant	Smartlink Group / Sonya Hemphill
Owner	Shannondale Enterprises Inc. / Jeff Shores
Surveyor/Engineer	Morris and Ritchie Associates, Inc
Parcel Information and Location	1329 Lakeside Drive, Harpers Ferry, WV 25425; Parcel ID; 06000600090000; Size: ~68 acres; Zoning District: Rural 
Adjacent Zoning	*North, South, East, and West:* Rural
Proposed Activity	100' Monopole Telecommunications Tower
Concept Plan Status:	Submitted: 4/26/2023 1st Submittal deemed sufficient provided FCC license is submitted: 5/5/2023 2nd Submission including FCC license: 5/10/2023 3rd Submission: 5/19/2023

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Shannondale Lake Telecommunication Tower Concept Plan (23-3-SP)

Summary of Request

Smartlink Group is proposing to construct a 100' Monopole Telecommunications Tower to include 9 Antennas and consist of one 10’ x 3’ concrete equipment pad and one 7’ x 4’ wide concrete equipment pad within a 50’ x 50’ fenced compound area. The proposal includes area for three future carriers for co-location.

The subject property is owned by Shannondale Enterprises Inc., located at 1329 Lakeside Dr., Harpers Ferry and is comprised of 68 acres, approximately 55 of which consist of the lake itself.

The Concept Plan is the first step required by the Zoning Ordinance, followed by a Minor Site Development Process with a Full Site Plan in accordance with the Subdivision and Land Development Regulation, which is administratively processed. This Staff Report addresses the Concept Plan criteria only.

Article 4B Purpose Statement

The purpose of Article 4B, Wireless Telecommunication Facilities, is to balance the needs of residents of and visitors to Jefferson County for reliable access to wireless telecommunication networks and services with the community’s desire to preserve the County’s rural, historic and agricultural character and the quality of its residential neighborhoods.

Site Plan Category

Article 4B, Sections 4B.2 and 4B.7, of the Zoning Ordinance requires that a site plan for a proposed Wireless Telecommunications Tower shall process under the Subdivision and Land Development Regulation as a minor site development with a Full Site Plan. Prior to submission of the Full Site Plan, a Concept Plan is required, subject to a Public Workshop before the Planning Commission.

The Ordinance specifies that submittal and review of a Concept Plan for a tower shall follow the review process and timeline established in Sections 24.119 – 24.122, with certain exceptions.

Staff Determination of Application Sufficiency

Prior to scheduling a Concept Plan Public Workshop before the Planning Commission, staff must determine that the plan submitted by the applicant is “sufficient and complete” – i.e. meeting all relevant requirements of the Subdivision Regulations and Section 4B.7 of the Zoning Ordinance. Staff deemed the concept plan sufficient on05/05/2023.

Because telecommunication towers have unique characteristics that distinguish them from other types of development (such as height and visual impact), the Zoning Ordinance specifies additional submittal requirements for telecommunication towers that are required to be shown on a Concept Plan. These requirements are as follows:

Zoning Ordinance Required Item	Description	Comment
a. Dimensions, use, and setbacks	Outside dimensions, use, and setbacks of all existing and proposed buildings, structures, towers, antennas, utility lines, driveways, and parking areas.	Meets ordinance requirements. Fall radius area is completely within subject parcel.
b. Height	Height of the proposed tower measured from ground level at the center of the proposed structure, and height comparison to any nearby buildings or trees, or other	In the Rural zoning district, the permitted tower height is 100’, which is the proposed height.

	applicable structures and natural landforms part of the site's background and foreground landscape.	
c. Elevations and cross-section	Elevations and Cross-Section: Display topography with all proposed facilities including tower, equipment shelter and existing buildings.	Meets ordinance requirements.
d. Antenna features	Number, size and location of proposed and existing antennas; number of co-locations possible.	Proposed 100' tower will include 9 antennas mounted at 95' for Verizon Wireless; related concrete equipment pads; and enclosed in a 50' x 50' fenced compound area. Three future carrier spaces are provided at 85', 75', and 65'.
e. Method of camouflage	Method of camouflage (if any).	The proposed tower will have a galvanized finish and be screened by an 8' chain link fence, with dark green PVC strips, topped by 1' of barbed wire.
f. Historic structures	Locations of known historic structures.	The Concept Plan Narrative notes that the nearest Class II Historic Resource is 0.5 miles from the proposed monopole.
g. Development Schedule	A description of the anticipated construction and installation schedule.	The Concept Plan Narrative states construction is expected to be completed within 6 months after all jurisdictional approvals and building permits are obtained.
h. FCC Compliance	Documentation verifying compliance with applicable Federal Communications Commission (FCC) standards and requirements to provide the proposed services.	FCC license for Verizon Wireless, as Verizon Wireless is the d/b/a for Cellco Partnership was submitted.
i. Design criteria	Narrative addressing the design criteria of Section 4B.7.	Provided.
j. Balloon test information	Dates, address list, and notice for Balloon Test.	Provided.
k. Balloon test exhibits	Balloon Test exhibits as required in subsection G of Section 4B.7.	Balloon Test occurred on 4/15/23; photos provided.
l. Propagation maps	Propagation maps as required in subsection F of Section 4B.7.	Provided.
m. Additional information	Any other relevant information.	Narrative says N/A
n. Preferred Structures and Locations Policy	Additional application requirements of subsection H (Preferred Structures and Locations Policy)	Page 9 of Narrative.

Other required elements for a Wireless Telecommunications Tower Concept Plan are the same as for a site plan submittal as established in the Subdivision Regulations, Appendix A, Sec. 1.3A, with the exception of Subsections 1.3A.20-22, 24-29, 31-35.

External Agency Reviews

Most external agency reviews are not applicable, per Section 4B.7 of the Zoning Ordinance. As required by this section, Staff notified the Jefferson County Historic Landmarks Commission (JCHLC) of the application on 05/10/23.

Planning Commission Public Workshop Scope of Review

For a Wireless Telecommunications Tower, the Concept Plan Public Workshop is the only Planning Commission meeting during which the Planning Commission reviews the proposed plan. The scope of the Public Workshop includes the following:

1. A demonstration of need, as required by Article 4B;
2. Neighborhood compatibility;
3. Impact on cultural and historic resources;
4. Visual mitigation;
5. The submittal and design criteria of Article 4B;
6. The compatibility of the facility proposal with the Comprehensive Plan; and
7. Any relevant information presented by any person that addresses the purpose and intent of Article 4B.

The applicant addressed the above criteria on the first 10 pages of the Concept Plan Narrative and on the Concept Plan. Individual components have been noted as complete in the chart on pages 2 and 3 of this report.

1. **A demonstration of need as required by Article 4B**

   The purpose of the "demonstration of need" requirement is for the applicant to demonstrate that the proposed tower is necessary for coverage purposes, at the proposed height and at the proposed location. Implicit in this requirement is a demonstration that there are no other feasible alternatives to building a tower, such as co-location of antennas on an existing structure.

2. **Neighborhood compatibility**

   Adjacent land uses surrounding the site include numerous residential lots that are a part of a large development created in the mid 1960's and 1970's, known as the Shannondale Subdivision, which includes a 55 acre lake and related 5 ac +/- "club area" and beach across the lake from the proposed tower site. The Tower is proposed to be located on a portion of the 10 acre +/- section of the Shannondale Enterprises Inc property that includes the dam which impounds the lake. The entire area is zoned Rural. The Zoning Ordinance does not provide explicit standards for neighborhood compatibility for wireless facilities.

3. **Impact on cultural and historic resources**

   The only outside agency required by the Zoning Ordinance to be contacted for this Concept Plan is the Jefferson County Historic Landmarks Commission (JCHLC). The JCHLC was notified by the applicant during the Balloon Test and again by staff on 05/10/2023. No comments were received related to this project.

The site for the proposed tower is not located in the Harpers Ferry Overlay District or within 1 mile of the Appalachian Trail.

4. Visual mitigation

The proposed tower is designed as a 100' monopole tower with Verizon Wireless as the first provider with nine antennas at the 95' height. Space for co-location has been designated for three future carriers.

The applicant conducted the required balloon test for the Concept Plan. Exhibits depicting the required balloon test and photo simulations of the monopole tower from various locations and distances are attached. The monopole is proposed to be galvanized finish which is intended to minimize the visual impact.

The application does not show any landscaping around the outside of the leased compound area, which should be discussed as a part of the Workshop. Below is an excerpt from the Zoning Ordinance, addressing fencing requirements for new towers:

> 7. Fencing
>
> Towers, equipment enclosures and other improvements shall be enclosed within a security fence consisting of chain link fencing at least eight (8) feet in height. The Planning Commission may require as a condition of approval that the fencing be screened by a landscaped buffer of at least 10 feet in width planted along the entire exterior perimeter of the fence. Such a buffer must contain at least one row of native vegetation and form a continuous screen at least 6 feet in height at planting. All buffer yards shall be maintained by the property owner. It will be the responsibility of the property owner to maintain the buffer yard and to replace any trees or shrubs that die.
>
> The Planning Commission may waive or modify the fencing requirement upon a determination that doing so will enhance the overall appearance of the facility without any compromise in safety or security.

5. The submittal and design criteria of Article 4B

Article 4B of the Zoning Ordinance states that the required submittal elements for a Wireless Telecommunications Tower Concept Plan shall be the same as for a Site Plan as established in the Subdivision Regulations, Appendix A, Sec. 1.3A (with certain exceptions). In addition, other elements are required such as elevations and cross-section, locations of known historic structures, Balloon Test exhibits, and other information. Staff finds the application complete with regard to the required submittal elements.

Design criteria (height, color, fall zone, lighting and marking, fencing, and other elements) are established in Section 4B.7.J. Staff finds that the proposed tower design meets these criteria. The Zoning Ordinance requires that wireless telecommunication towers be set back from all property lines a distance to 110% of tower height, measured from the base of the structure to its highest point, and allows easements to be acquired on adjacent properties to meet the fall zone requirement. The required fall zone is provided completely within subject parcel.

6. The compatibility of the facility proposal with the Comprehensive Plan

a. Staff Analysis

The *Envision Jefferson 2035 Comprehensive Plan* includes some discussion of telecommunications facilities under the "Economic Development, Employment, and

Infrastructure Element". The Plan identifies improvements to the County's telecommunications network, particularly wireless technology and any advanced technologies, as one of the major public infrastructure projects needed to support the success of future economic growth.

The following recommendations are found under the Infrastructure and Technology Recommendations on pages 93-94 of the Plan:

"9. Collaborate with local economic development agencies and Information Technology (IT) providers to ensure that the current and future needs of small businesses within Jefferson County are met.

a. Ensure that all areas of Jefferson County are served by high speed wireline and/or wireless services and other advanced technologies.

b. Encourage private sector investment to improve wireless internet service availability in Jefferson County and the Eastern Panhandle.

c. Ensure that, as next-generation wireless and cellular services are implemented, Jefferson County collaborates with providers, including any necessary regulatory changes, to ensure that providers are able to provide these services at the same time as other communities in the Washington, D.C. and Baltimore, MD Metropolitan Areas."

Providing wireless telecommunication services to an area of the County that is currently underserved supports the recommendations of the Comprehensive Plan.

7. Any relevant information presented by any person that addresses the purpose and intent of Article 4B

To date, no agency comments have been submitted to our Office.

The Planning Commission may consider testimony at the Public Workshop regarding the purpose and intent of Article 4B of the Zoning Ordinance.

Staff Recommendation

The Planning and Zoning Staff finds the proposed Shannondale Lake Telecommunication Tower Concept Plan to be:

- Complete based on the information provided related to the required criteria outlined in the Subdivision Regulations and the Zoning Ordinance; and Consistent with the Comprehensive Plan.
- As provided for in Section 4B.7.B.2.J.7 of the Zoning Ordinance, the Planning Commission has the discretion to require that fencing be screened by a landscape buffer of at least 10 feet in width, planted along the entire exterior perimeter of the fence.

Planning Commission Direction

The Concept Plan Public Workshop allows for the Planning Commission and the general public to comment on the proposed plan. The Subdivision Regulations outline the procedure:

1. The applicant makes a short presentation.
2. Staff explains outside agency comments and whether the plan has met the standards of the Zoning Ordinance.

3. Public comment is solicited.

Following the applicant's presentation, staff's explanation, and the solicitation of public comment, the Planning Commission shall:

- Review the Concept Plan for compliance with the standards in Article 4B and, if applicable, provide direction in the form of conditions relevant to the scope of the public workshop and/or unique characteristics of the proposed development site, to be addressed in the Department's approval of the site plan; and
- Determine, by a majority vote, that the Concept Plan application complies with Article 4B of the Zoning Ordinance, and that the application is consistent with the Comprehensive Plan.

The Commission has the option of providing direction at the same meeting during which the Concept Plan Public Workshop takes place, or at a subsequent meeting that occurs within 14 days of the meeting, at which the Concept Plan Public Workshop is closed.

The Subdivision Regulations outline the direction to be provided to the applicant:

> "The Planning Commission shall direct the preparation of a site plan subject to conditions to be addressed in the site plan application. The purpose of this review is to guide the developer so that when the site plan application is formally reviewed by the staff, there should not be a whole range of issues being raised for the first time. The developer shall cite conditions and demonstrate that they have been met or otherwise addressed."

The direction provided to the applicant during the Concept Plan Public Workshop shall be applicable for a period of two years, with the provision that any amendments to the Subdivision Regulations or the Zoning Ordinance in the second year shall be applicable.

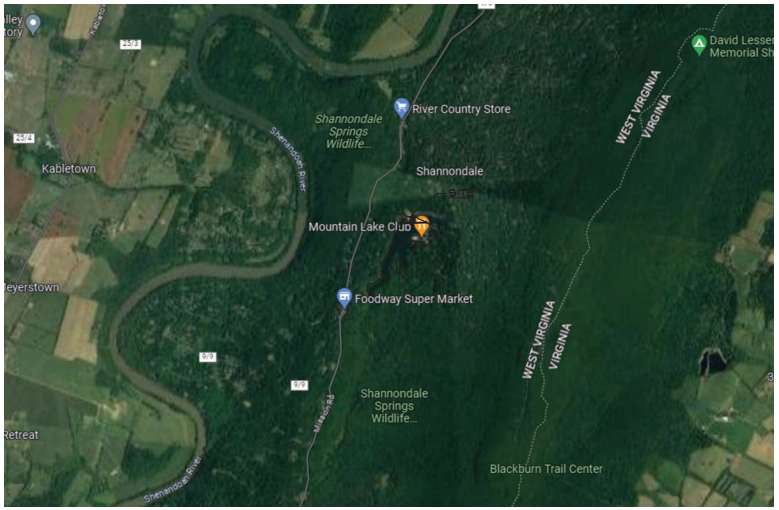
Should the Planning Commission vote to find the application consistent with the Comprehensive Plan, the applicant will submit a minor site plan to the Department of Engineering, Planning, & Zoning for administrative review and approval. The site plan shall address the conditions (if any) identified by the Planning Commission.

ATTACHMENTS:

- Concept Plan
- Concept Plan Narrative, including:
  - Exhibit B "Balloon Test and Monopole Photo Simulations"
  - Exhibit C "Propagation Maps" and Study Affidavit

SHANNONDALE MONOPOLE
CONCEPT PLAN (23-3-SP)
JEFFERSON COUNTY

1329 LAKESIDE DRIVE
HARPERS FERRY, WEST VIRGINIA 25425



GENERAL LOCATION MAP

2000 1000 0 2000 4000 FT
FULL SCALE 1"=2000'-0"

CONCEPT PLAN NOTES

1. ZONING DISTRICT WITHIN 500' OF THE SUBJECT PROPERTY IS RURAL.
2. A CONCEPT PLAN ON 24x36 WHITE PAPER CAN BE FOUND ON SHEETS C-1 AND C-2.
3. SEE SHEET C-2 FOR COMPOUND DETAILS, AND SHEET C-3 FOR MONOPOLE ELEVATION AND DETAILS.
4. SEE SHEET C-1 FOR SETBACKS.
5. FEMA FLOODPLAIN ON THE PROPERTY IS SHOWN ON SHEET C-1. THE PROPOSED SITE IS NOT WITHIN THE FLOODPLAIN AREA.
6. SEE SHEET C-1 FOR ADJOINING PROPERTY INFORMATION.
7. THE COMMUNICATION COMPOUND WILL BE UNMANNED, AND THE PROPOSED FACILITY DOES NOT ALLOW HUMAN HABITATION.
8. THERE WILL BE NO WATER OR SEWER CONNECTIONS REQUIRED, AS THE COMPOUND IS AN UNMANNED FACILITY.
9. PER THE ENVISION JEFFERSON 2035 COMPREHENSIVE PLAN THE NEAREST KEY INTERSECTION IS WV-115 AND MISSION ROAD (ROUTE 9/5). MISSION ROAD IS A MINOR COLLECTOR.
10. PER THE ENVISION JEFFERSON 2035 COMPREHENSIVE PLAN, THERE ARE NO HIGHWAY PROBLEM AREAS WITHIN A 1 MILE RADIUS OF THE PROPOSED PROJECT. THE NEAREST HIGHWAY PROBLEM AREA IS THE INTERSECTION OF WV-115 AND ROUTE 9/5 WHICH IS 3 MILES FROM THE PROPOSED PROJECT.

TRAFFIC IMPACT DATA:	
1. AVERAGE DAILY TRAFFIC (AADT) FOR LAKESIDE DRIVE:	90 VEHICLES
2. NEAREST KEY INTERSECTION:	WV-115 & ROUTE 9/5
3. HIGHWAY PROBLEM AREAS:	NONE
4. TRIP GENERATION:	2 VISITS PER YEAR

PROPERTY OWNER
SHANNONDALE ENTERPRISES, INC.
1329 LAKESIDE DRIVE
HARPERS FERRY, WV 25425

APPLICANT
VERTICAL BRIDGE VBTS, LLC
750 PARK OF COMMERCE DRIVE
BOCA RATON, FL 33487

PREPARED BY
MORRIS AND RITCHIE, ASSOCIATES, INC.
1220-B EAST JOPPA ROAD, SUITE 400K
TOWSON, MD 21286

INDEX OF DRAWINGS

CS-1	COVER SHEET
C-1	SITE PLAN
C-2	SITE DETAILS
C-3	ANTENNA DETAILS & ADDITIONAL INFORMATION

CONCEPT PLAN INFORMATION

SHANNONDALE MONOPOLE (23-3-SP)
JEFFERSON COUNTY, WEST VIRGINIA
TAX DISTRICT: KABLETOWN DISTRICT
TAX MAP: 06
PARCEL ID: 19-06-0006-0004-0000
DEED BOOK & PAGE: 1254 / 57
TRACT AREA: 68.2 ACRES
PROPERTY OWNER: SHANNONDALE ENTERPRISES, INC
1329 LAKESIDE DRIVE
HARPERS FERRY, WV 25245
304-963-5258
DEVELOPER NAME: VERTICAL BRIDGE VBTS, LLC
750 PARK OF COMMERCE DRIVE
BOCA RATON, FL 33487
703-705-2573
LAND USE: NONCONFORMING USE / MOUNTAIN LAKE CLUB
ZONING DISTRICT: RURAL

MORRIS & RITCHIE ASSOCIATES, INC.
(Civil/Structural Engineers)
1220-B East Joppa Rd, Suite 400K
Towson, Maryland 21286
410-821-7900
410-821-7920 Fax

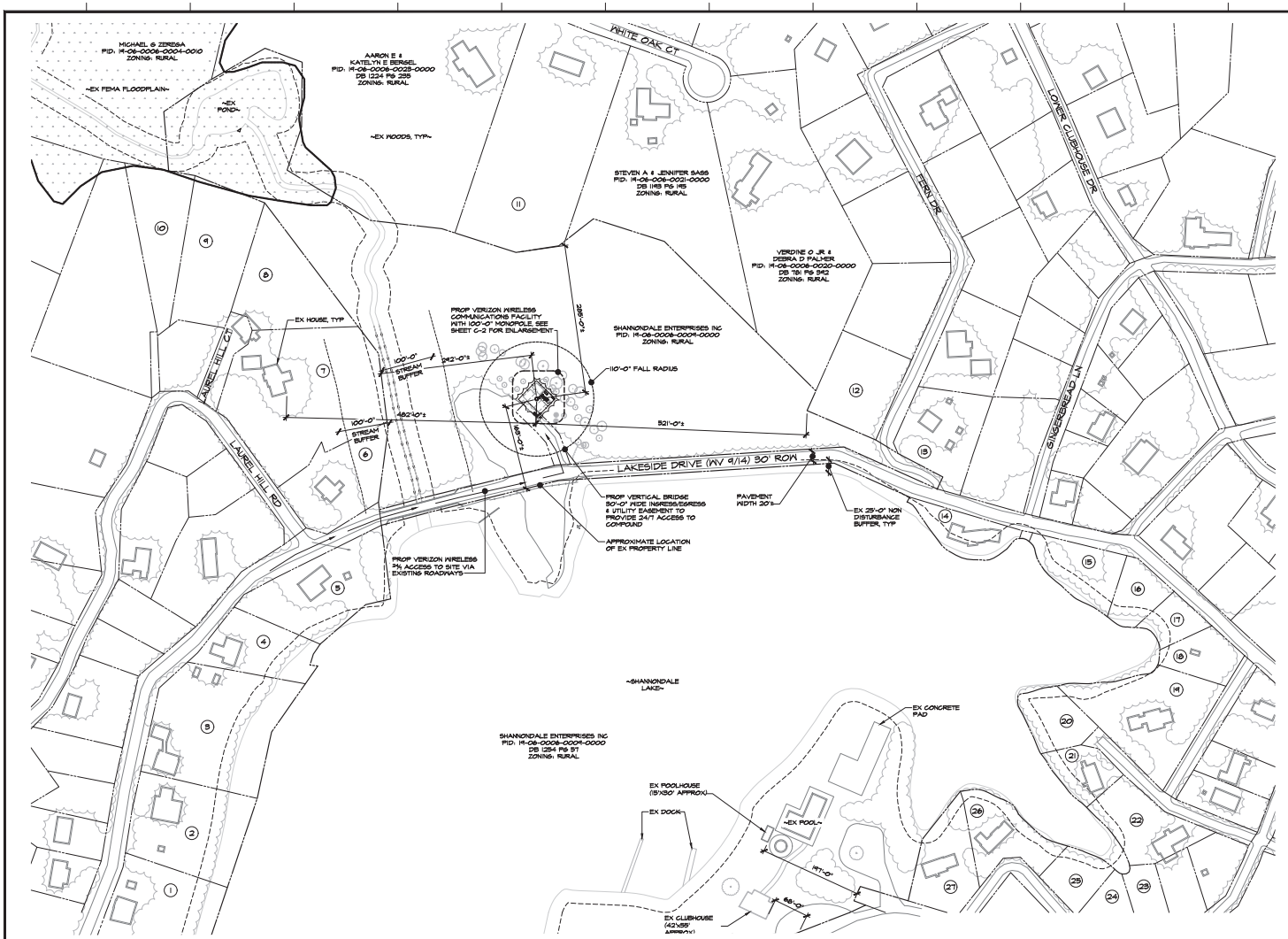
BRIAN E. SILVERLING 16545 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER 5/19/23

SHANNONDALE
US-WV-5095
1329 LAKESIDE DRIVE
HARPER'S FERRY, WV 25425 (JEFFERSON CO)

verticalbridge

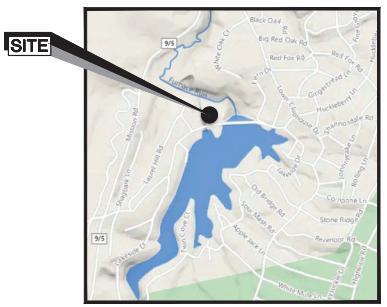
REVISIONS:		
NO.	DESCRIPTION	DATE
	CONCEPT PLAN DWGS - REV 2	5/19/23
	CONCEPT PLAN DWGS - REV 1	5/10/23
	CONCEPT PLAN DWGS	4/28/23

DESIGNED BY: BES
DRAWN BY: DNT/EO
PROJECT NO: 19847.007
DATE: 04/21/23
SCALE: AS NOTED
TITLE: Cover Sheet
SHEET: CS-1



SITE PLAN
SCALE: 1" = 100'-0"

100 50 0 100 200 FT
FULL SCALE 1"=100'-0"



VICINITY MAP
SCALE: 1" = 1000'

SITE NOTES:

1. APPLICANT: VERTICAL BRIDGE VBTS, LLC
750 PARK of COMMERCE DRIVE SUITE 200
BOCA RATON, FL 33487
(678)443-3166
2. PROPERTY OWNER: SHANNONDALE ENTERPRISES INC
1301 LAKESIDE DR
HARPERS FERRY, WV 25425
3. SITE DATA: DEED BOOK: 1254 PAGE: 57
PARCEL ID: 14-06-0008-0009-0000
TRACT AREA: 88.0 ACRES
TAX DISTRICT: 06 (KABLETOWN DISTRICT)
ADDRESS: 1301 LAKESIDE DR
HARPERS FERRY, WV 25425
LAND USE: NONCONFORMING USE / MOUNTAIN LAKE CLUB
4. ZONING DISTRICT: RURAL
5. HORIZONTAL AND VERTICAL CONTROL SHOWN HEREON IS BASED ON A GPS LATITUDE BY MORRIS & RITCHIE ASSOCIATES, INC., DATED MARCH 21, 2023.
LATITUDE: 39° 12' 45.80" (39.212589°) GROUND ELEVATION: 539.00' AMSL (NAVD.)
LONGITUDE: 77° 48' 55.66" (-77.815406°) PROPOSED STRUCTURE HEIGHT: 100.00' AGL
TOTAL ELEVATION (AMSL): 639.00' AMSL
6. TOTAL DISTURBED AREA = 1500 SF
7. THE PROPOSED FACILITIES WILL CONSIST OF ONE (1) 10' LONG x 5' WIDE CONCRETE EQUIPMENT PAD AND ONE (1) 7'-0" LONG x 5'-6" WIDE CONCRETE EQUIPMENT PAD WITHIN A 50'x50' FENCED COMPOUND. NINE (9) ANTENNAS SHALL BE MOUNTED ON A NEW 100'-0" MONOPOLE WITH A RAD CENTER AT AN ELEVATION OF 95'-0" ABOVE GRADE LEVEL FOR THE RECEPTION OF VERIZON WIRELESS TELECOMMUNICATIONS.
8. THE STRUCTURE WILL NOT SUPPORT LIGHTS OR SIGNS UNLESS REQUIRED FOR AIRCRAFT MARKING OR OTHER SAFETY RECORDS.
9. THE APPLICANT WILL PROVIDE A CERTIFICATION FROM A REGISTERED ENGINEER THAT THE STRUCTURE WILL MEET THE APPLICABLE DESIGN STANDARDS FOR WIND LOADS PER THE REQUIREMENTS OF THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION.
10. IF THE ANTENNAS ARE NO LONGER USED FOR TELECOMMUNICATIONS PURPOSES FOR A CONTINUOUS PERIOD OF ONE (1) YEAR, THEY SHALL BE REMOVED BY THE ANTENNA OWNER AT OWNER'S EXPENSE.
11. NO WATER OR SANITARY UTILITIES ARE REQUIRED FOR THE OPERATION OF THIS FACILITY.
12. STORMWATER MANAGEMENT NOTE: STORMWATER MANAGEMENT IS REQUIRED FOR THIS SITE.
13. BOUNDARY SHOWN PER COUNTY RECORDS.
14. THIS PLAN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT. PLAN IS SUBJECT TO EASEMENTS AND RESTRICTIONS OF RECORD.
15. ALL DETAILS SHOWN ARE "STANDARD" OR "TYPICAL" FOR REFERENCE ONLY. FOR ACTUAL DETAILS, SEE ARCHITECTURAL, STRUCTURAL, OR CONSTRUCTION PLANS BY OTHERS.
16. STRUCTURAL ANALYSIS/DESIGN TO BE PERFORMED BY OTHERS AT CLIENT AND/OR OWNER'S DISCRETION PRIOR TO COMMENCEMENT OF ANY WORK.
17. THE COMMUNICATION EQUIPMENT SHALL BE UNMANED, WITH APPROXIMENT VISITS (FOUR OR FEWER PER YEAR) BY MAINTENANCE PERSONNEL, AND WITH ACCESS AND PARKING FOR NO MORE THAN ONE VEHICLE. THE PROPOSED FACILITY IS NOT FOR HUMAN HABITATION AND THEREFORE HANDICAP ACCESS IS NOT REQUIRED.
18. THE PROPOSED COMMUNICATIONS EQUIPMENT, ANTENNAS AND RELATED MOUNTING DEVICES DO NOT EXCEED TWELVE (12) FEET IN TOTAL HEIGHT.

GENERAL NOTES

1. CONTRACTOR SHALL NOTIFY "MISS UTILITY" (811) 48 HOURS PRIOR TO DOING ANY EXCAVATION IN THIS AREA. CONTRACTOR SHALL CONTACT A SUBSURFACE UTILITY LOCATOR FOR LOCATION OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL VERIFY EXISTING UTILITY LOCATIONS BY TEST PIT AS NECESSARY. LOCATION OF UTILITIES SHOWN ON THIS PLAN ARE APPROXIMATE AND FOR PLANNING PURPOSES ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. DAMAGE TO UTILITIES OR PROPERTY OF OTHER BY THE CONTRACTOR DURING CONSTRUCTION SHALL BE REPAIRED TO PRECONSTRUCTION CONDITIONS BY THE CONTRACTOR.
2. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH ALL STATE AND LOCAL CODES AND ORDINANCES, THE LATEST EDITION THEREOF.
3. ANY PERMITS WHICH MUST BE OBTAINED SHALL BE THE CONTRACTOR'S RESPONSIBILITY. CONTRACTOR SHALL SECURE ALL NECESSARY PERMITS FOR THIS PROJECT FROM ALL APPLICABLE GOVERNMENTAL AGENCIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ABIDING BY ALL CONDITIONS AND REQUIREMENTS OF THE PERMITS.
4. CONTRACTOR SHALL COORDINATE ALL UTILITY CONNECTIONS WITH APPROPRIATE UTILITY OWNERS.
5. THESE PLANS ARE NOT FOR REGISTRATION OR CONVEYANCE.
6. EXISTING PAVEMENT AND OTHER SURFACES DISTURBED BY CONTRACTOR (WHICH ARE NOT TO BE REMOVED) SHALL BE REPAIRED TO PRECONSTRUCTION CONDITIONS BY THE CONTRACTOR.

811
Know what's **below.**
Call before you dig.
PROTECT YOURSELF, GIVE THREE WORKING DAYS NOTICE
THIS DRAWING DOES NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY. ALL CONSTRUCTION MUST BE DONE IN COMPLIANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 AND ALL RULES AND REGULATIONS THERE TO APPURTENANT.

DRAWING LEGEND
- EX TREELINE
- EX TREE
- FEMA FLOODPLAIN
- SUBJECT PROPERTY
- ADJACENT PROPERTY
- 25' NON-DISTURBANCE BUFFER

SETBACK CHART

	REQUIRED	PROVIDED
NORTH	110'-0"	285'-0"±
EAST	110'-0"	521'-0"±
SOUTH	110'-0"	185'-0"±
WEST	110'-0"	242'-0"±

PROPERTY OWNER CHART

#	OWNER NAME	PARCEL	DEED BOOK / PAGE	ADDRESS	ZONING
1	ADAM M MCDOWELL CHRISTY L ROBERTS	14-06-0005-0102-0000	1248 / 656	2175 LAKESIDE DR	RURAL
2	NANCY E VOORHEES	14-06-0005-0104-0000	1041 / 718	2155 LAKESIDE DR	RURAL
3	PATRICIA M BROWN	14-06-0005-0125-0000	1084 / 247	2114 LAKESIDE DR	RURAL
4	MARK W & JOANNE CURRAN	14-06-0005-0115-0000	1156 / 17	2075 LAKESIDE DR	RURAL
5	BRIAN C & ROSARIO L LEBLANC	14-06-0005-0116-0000	1260 / 249	2027 LAKESIDE DR	RURAL
6	RUTH GAYLE BOHLMAN	14-06-0005-0125-0000	1114 / 593	425 LAUREL HILL ROAD	RURAL
7	JON E & CHARYL L AVERY	14-06-0005-0124-0000	1225 / 598	357 LAUREL HILL ROAD	RURAL
8	SUSAN M CHARBONNEAU	14-06-0005-0133-0000	1121 / 264	34 LAUREL HILL CT	RURAL
9	ROBERT HOLMES & LAUREN CHARBONNEAU	14-06-0005-0062-0000	1148 / 76	34 LAUREL HILL CT	RURAL
10	ROBERT HOLMES & LAUREN CHARBONNEAU	14-06-0005-0061-0000	1148 / 74	34 LAUREL HILL CT	RURAL
11	DAVID M & KIM I BARRE	14-06-0006-0022-0000	1254 / 577	240 WHITE OAK CT	RURAL
12	VERDINE O JR & DEBRA D PALMER	14-06-0006-0510-0000	781 / 406	295 WHITE OAK CT	RURAL
13	THOMAS P JR & JOANN L ASH	14-06-0006-0249-0000	761 / 187	46 FERN DR	RURAL
14	MICHAEL & JULIET RAINES	14-06-0006-0216-0000	1230 / 388	1767 LAKESIDE DR	RURAL
15	CLIFFORD A & LAURIE E TELL	14-06-0006-0277-0000	1125 / 200	40 GINGERBREAD LN	RURAL
16	NEAL S KIRKPATRICK	14-06-0006-0218-0000	1168 / 118	LAKESIDE DR	RURAL
17	NEAL S KIRKPATRICK	14-06-0006-0249-0000	1168 / 118	E LAKESIDE DR	RURAL
18	NEAL S KIRKPATRICK	14-06-0006-0214-0000	1168 / 118	E LAKESIDE DR	RURAL
19	DAN C JR & FAY S ALEXANDER	14-06-0006-0246-0000	1026 / 157	11 SHORE LN	RURAL
20	WILLIAM C PALMER SR	14-06-0006-0245-0000	445 / 696	SHORE LN	RURAL
21	TIMOTHY P SULLIVAN	14-06-0006-0222-0000	1280 / 580	117 BERRY LN	RURAL
22	JOHN G III & CAROL M DUNMORE	14-06-0006-0220-0000	607 / 174	85 BERRY LN	RURAL
23	JOHN G & CAROL M DUNMORE	14-06-0006-0217-0000	747 / 464	85 BERRY LN	RURAL
24	JOHN G & CAROL M DUNMORE	14-06-0006-0218-0000	747 / 464	85 BERRY LN	RURAL
25	JASON P & KAROLINA SENGFIEHL	14-06-0006-0215-0000	1218 / 124	E LAKESIDE DR	RURAL
26	JASON P & KAROLINA SENGFIEHL	14-06-0006-0213-0000	1218 / 140	1447 LAKESIDE DR	RURAL
27	JASON & KAROLINA SENGFIEHL	14-06-0006-0212-0000	1041 / 514	1404 LAKESIDE DR	RURAL

MRA
MORRIS & RITCHIE ASSOCIATES, INC.
(Civil/Structural Engineers)
2220-D Black Rock Rd, Suite 4005
Hagerstown, Maryland 21740
410-821-7115
410-821-7282 Fax

BRIAN E. SILVERLING
16545
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
5/19/23

SHANNONDALE
US-WV-5095
1321 LAKESIDE DRIVE
HARPER'S FERRY, WV 25425 (JEFFERSON CO)

verticalbridge

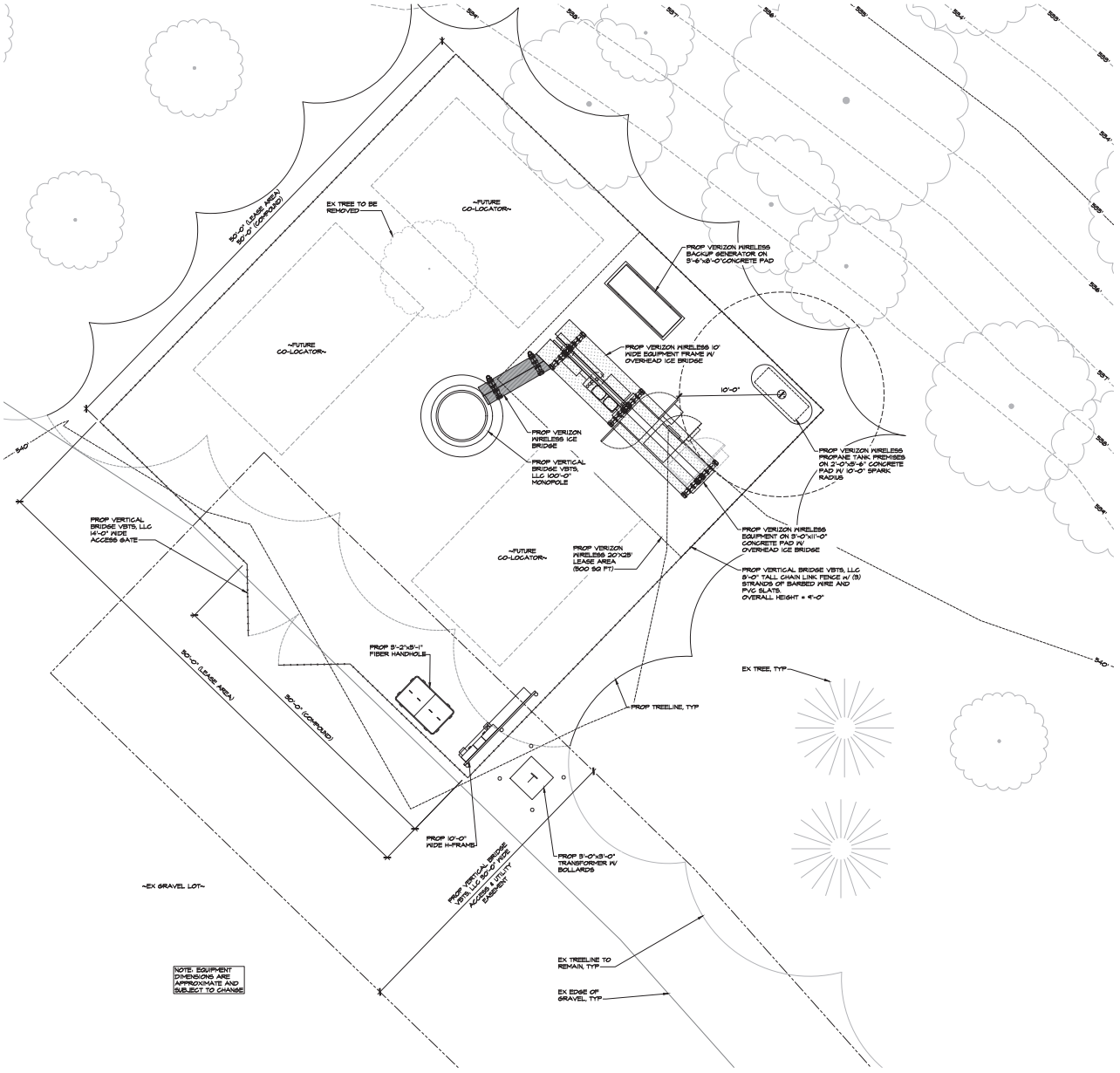
REVISIONS:

NO.	DESCRIPTION	DATE
	CONCEPT PLAN DWGS - REV 2	5/19/23
	CONCEPT PLAN DWGS - REV 1	5/10/23
	CONCEPT PLAN DWGS	4/26/23

DESIGNED BY: BES
DRAWN BY: DNT/EO
PROJECT NO: 19847.007
DATE: 04/21/23
SCALE: AS NOTED

TITLE: Site Plan

SHEET: C-1



ENLARGED COMPOUND LAYOUT

SCALE: 1" = 5'-0"

811

Know what's **below.**
Call before you dig.

PROTECT YOURSELF, GIVE THREE WORKING DAYS NOTICE

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MRA
MORRIS & RITCHIE ASSOCIATES, INC.
Civil/Structural Engineers
2220-D Rock Forge Rd, Suite 4000C
Timonium, Maryland 21093
410-821-7666
410-821-7667 Fax

BRIAN E. SILVERLING 16545 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
5/19/23

SHANNONDALE
US-WV-5095
1521 LAKESIDE DRIVE
HARPER'S FERRY, WV 25425 (JEFFERSON CO)

verticalbridge

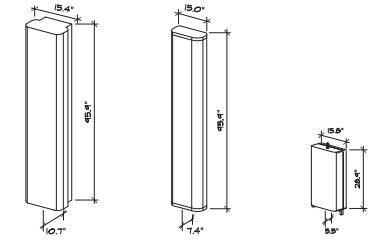
REVISIONS:

NO.	DESCRIPTION	DATE
	CONCEPT PLAN DWGS - REV 2	5/19/23
	CONCEPT PLAN DWGS - REV 1	5/10/23
	CONCEPT PLAN DWGS	4/26/23

DESIGNED BY: BES
DRAWN BY: DNT/EO
PROJECT NO: 19847.007
DATE: 04/21/23
SCALE: AS NOTED

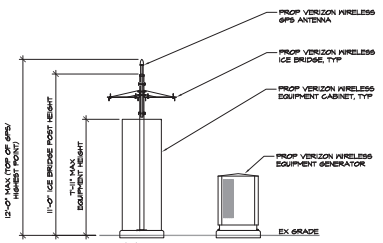
TITLE:
Site Details

SHEET:
C-2



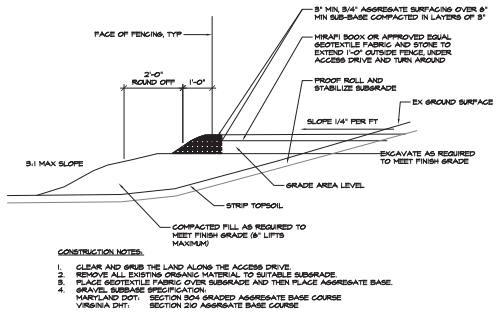
VERIZON WIRELESS ANTENNA DETAILS

NOT TO SCALE



CONCRETE PAD ELEVATION W/ GAS GENERATOR

SCALE: 1/4" = 1'-0"

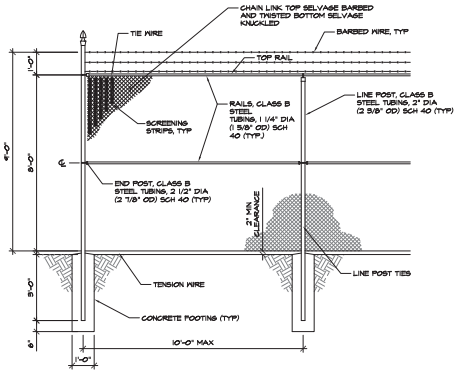


CONSTRUCTION NOTES:

1. CLEAR AND GRUB THE LAND ALONG THE ACCESS DRIVE.
2. REMOVE ALL EXISTING ORGANIC MATERIAL TO SUITABLE SUBGRADE.
3. PLACE GEOTEXTILE FABRIC OVER SUBGRADE AND THEN PLACE AGGREGATE BASE.
4. GRAVEL SUBBASE SPECIFICATION:
   MARYLAND DOT: SECTION 304 GRADED AGGREGATE BASE COURSE
   VIRGINIA DHT: SECTION 210 AGGREGATE BASE COURSE

LEASE AREA, ACCESS DRIVE & TURN AROUND AREA SURFACING

SCALE: ½" = 1'-0"

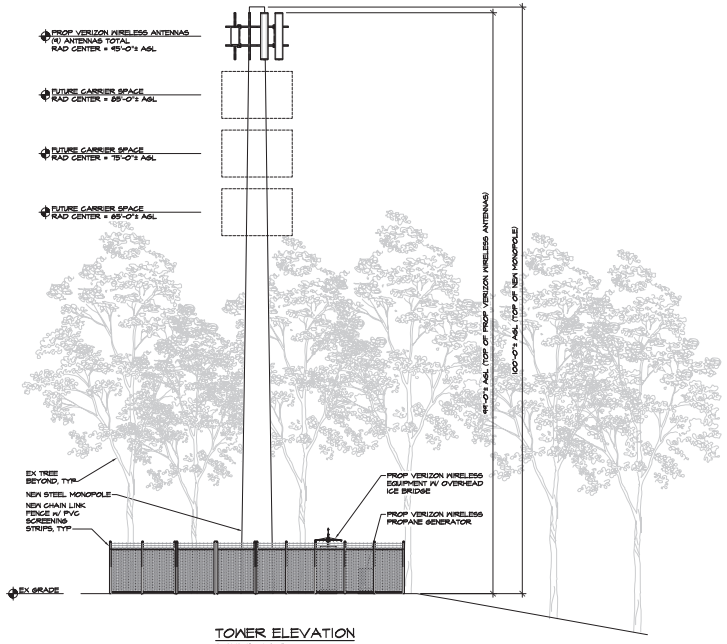


CHAIN LINK FENCE DETAIL

SCALE: ⅜" = 1'-0"

TYPICAL MOVEN WIRE FENCE NOTES

1. GATE POST, CORNER, TERMINAL OR PULL POST 2 1/2" DIA (2 7/8" OD) SCHEDULE 40 FOR GATE WIDTHS UP THRU 6 FEET OR (2 FEET FOR DOUBLE SWING GATE PER ASTM-F1083.
2. LINE POST: 2" DIA (2 3/8" OD) SCHEDULE 40 PIPE PER ASTM-F1083.
3. GATE FRAME: 1 1/4" DIA (1 5/8" OD) SCHEDULE 40 PIPE PER ASTM-F1083.
4. TOP RAIL & BRACE RAIL: 1 1/4" DIA (1 5/8" OD) SCHEDULE 40 PIPE PER ASTM-F1083.
5. FABRIC: 9 GA CORE WIRE SIZE, 2" MESH, CONFORMING TO ASTM-A392.
6. TIE WIRE: MINIMUM 11 GA GALVANIZED STEEL AT POSTS AND RAILS, A SINGLE WRAP OF FABRIC TIE AND AT TENSION WIRE BY HOG RINGS SPACED MAX 24" INTERVALS.
7. TENSION WIRE: 7 GA GALVANIZED STEEL.
8. BARBED WIRE: DOUBLE STRAND 12-2 1/2" OD TWISTED WIRE TO MATCH WITH FABRIC, 14 GA, 4 PT BARBS SPACED ON APPROXIMATELY 4" CENTERS.
9. GATE LATCH: 1-5/8" OD PLUNGER ROD WITH MUSHROOM TYPE CATCH AND LOCK, KEYED ALIKE FOR ALL SITES IN A GIVEN MTA.
10. LOCAL ORDINANCE OF BARBED WIRE PERMIT REQUIREMENT SHALL BE COMPLIED WITH, IF REQUIRED.
11. CHAIN-LINK FENCE SHALL INCLUDE VERITCAL PVC SCREENING SLATS, ALL SIDED. (COLOR: DARK GREEN OR BLACK)



TOWER ELEVATION

SCALE: 1" = 10'-0"

811

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MORRIS & RITCHIE ASSOCIATES, INC.
(Civil Structural Engineers)
1220-B East Joppa Rd, Suite 405E
Towson, Maryland 21286
410-821-7900
410-821-7920 Fax

BRIAN E. SAVERLING
10548
STATE OF VERMONT
PROFESSIONAL ENGINEER
5/19/23

SHANNONDALE
US-NV-5095
1324 LAKESIDE DRIVE
HARPER'S FERRY, WV 25425 (JEFFERSON CO)

verticalbridge

REVISIONS:

NO.	DESCRIPTION	DATE
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	CONCEPT PLAN DWGS - REV 1	5/10/23
	CONCEPT PLAN DWGS	4/26/23

DESIGNED BY: BES
DRAWN BY: DNT/EO
PROJECT NO: 19847.007
DATE: 04/21/23
SCALE: AS NOTED

TITLE:
Antenna Details & Additional Details

SHEET:
C-3

Concept Plan Narrative

Shannondale Monopole
US-WV-5095

1329 Lakeside Drive
Harpers Ferry, West Virginia 25425
Jefferson County

May 19, 2023
Revision 2

Prepared For:

Vertical Bridge VBTS, LLC
750 Park of Commerce Drive
Boca Raton , Florida 33487

MRA Project No.: 19847.007

1220-B East Joppa Road, Suite 400K, Towson, MD 21286 (410) 821-1690 Fax: (410) 821-1748 www.mragta.com

Abingdon, MD (410) 515-9000 ✦ Baltimore, MD (443) 490-7201 ✦ Laurel, MD (410) 792-9792 ✦ Towson, MD (410) 821-1690 ✦ Georgetown, DE (302) 855-5734 ✦ New Castle, DE (302) 326-2200 ✦ Leesburg, VA (703) 994-4047 ✦ Raleigh, NC (984) 200-2103

Contents

Contents 2
Introduction and Project Overview 3-4
Design Criteria (Per Article B.7J)……...……4-6
Concept Plan Elements (Per Article 4B.7.B & 4B.7.D-.F&.H)…...…… .……6-9
Alternative Sites……..9
Conclusion……..10
Exhibits
Exhibit A – Balloon Test Notification Information
Exhibit B – Balloon Test & Monopole Photo Simulations
Exhibit C – Propagation Maps
Exhibit D – FCC Licenses
Exhibit E – Proof of Eligibility (Lease Agreement)

Introduction and Project Overview

On behalf of Vertical Bridge VBTS, LLC (hereafter "the Applicant" or "Vertical Bridge"), Morris and Ritchie Associates, Inc (hereafter "MRA") submits this Wireless Telecommunications Tower Concept Plan Narrative as part of the application for a new monopole in accordance with Section 4B.7B of the Jefferson County Zoning and Land Development Ordinance.

Vertical Bridge is proposing a new 100' tall monopole that will support telecommunication antennas. The monopole will be placed within a 50'x50' fenced compound along with equipment at grade level. The proposed project shall be for the installation of antennas for one (1) wireless carrier and ground space for three (3) additional co-locations at grade level. The proposed monopole will be designed to support up to a total of four (4) tenants on the tower. Access to the site will be via an existing gravel lot and will not need to be extended to accommodate access. Additional information can be found in the Narrative below and in the included site plan documents.

The proposed Monopole site is located in southeast Jefferson County on a parcel in the Shannondale area of Harpers Ferry on the north side of Lakeside Drive.

Property Address: 1329 Lakeside Drive, Harpers Ferry, West Virginia 25425
Parcel ID: 16-06-6-0090-0000-0000
Property Owner: Shannondale Enterprises, Inc., (Address: 1329 Lakeside Drive, Harpers Ferry, West Virginia 25425)
Deed Reference: Book 1254 Page 57
Trace Area: 68.2 Acres
Zoning District: Rural

See Figure 1 below for a vicinity map showing the location of the property, and Figure 2 shows a more zoomed in aerial image of the proposed monopole location. Figure 3 shows the Zoning District map for the surrounding area.

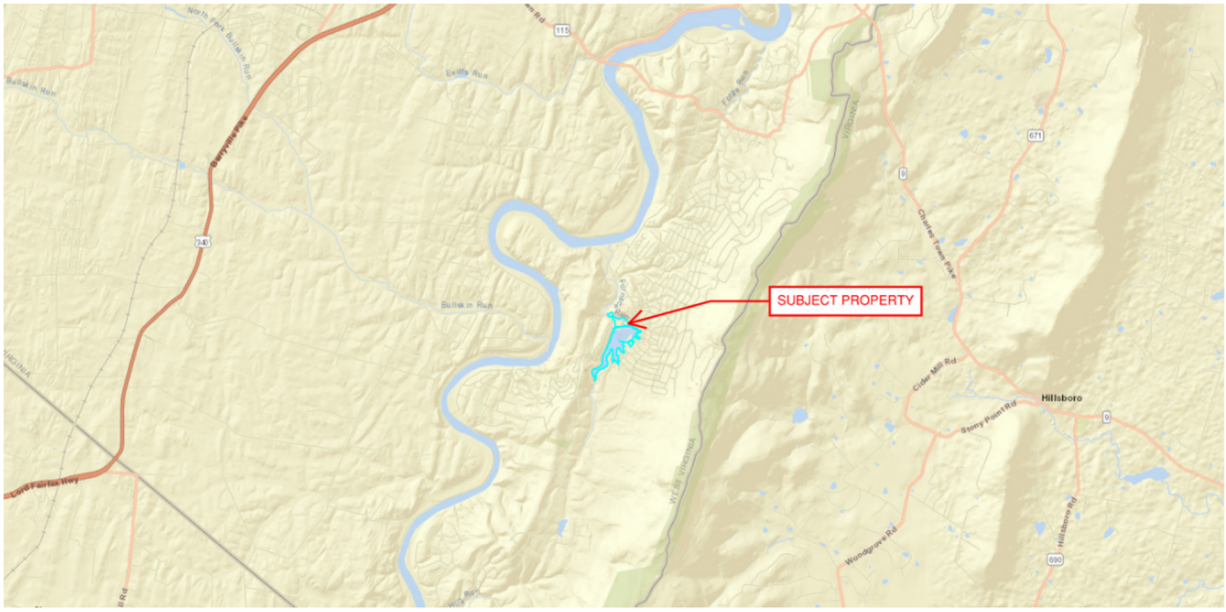


Figure 1 - Project Vicinity Map (jefferson.wvassessor.com)

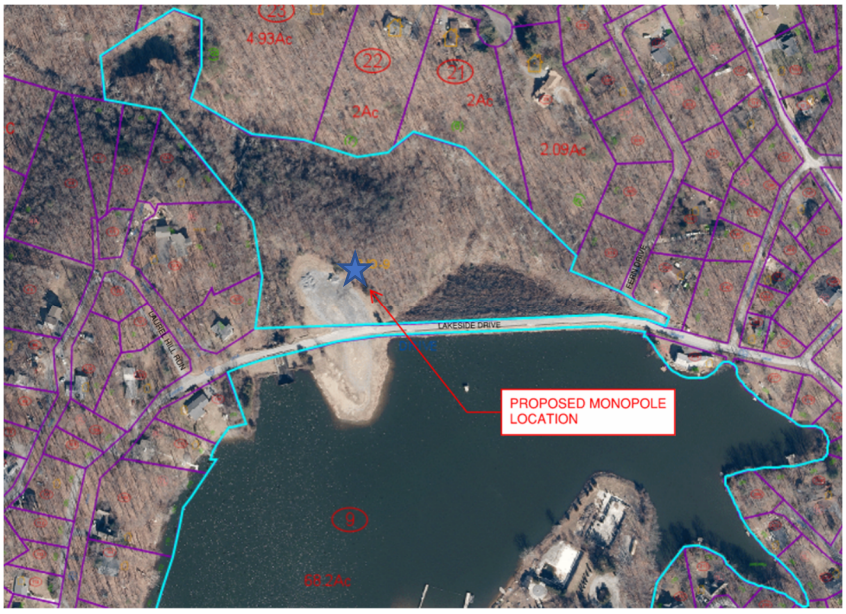


Figure 2 – Aerial Image of Monopole Location (jefferson.wvassessor.com)

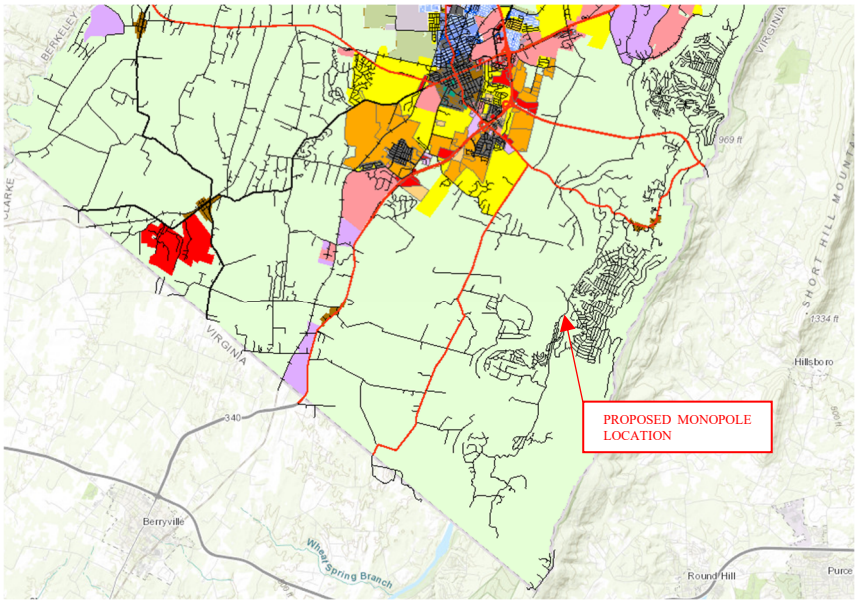


Figure 3 – Zoning District Map (maps.jeffersoncountywv.org)

Design Criteria (Per Article 4B.7J)

4B.7J.1 Antenna Mounting Preferences

MRA Response: The antennas installed on the proposed monopole shall be mounted on straight brackets that will extend from the monopole, complying with 4B.7J.1.b.

4B.7J.2 Height Restrictions

MRA Response: The proposed monopole shall be 100 feet tall as it is located within a Rural zoning district, complying with 4B.7J.2.a.

4B.7J.3 Fall Zone

MRA Response: The fall zone radius for the proposed monopole is 110'-0" (110% of the tower height from the base of the structure to its higher point.). The location of the monopole exceeds the Fall Zone requirements to adjacent property lines, as well as to the nearest existing structure (Refer to Fall Zone Chart below). Hence complying with 4B.7J.3.a and 4B.7J.3.b.

Fall Zone Chart		
Description	**Required**	**Provided**
North Property Line	110'-0"	285'-0"±
East Property Line	110'-0"	521'-0"±
South Property Line	110'-0"	163'-0"±
West Property Line	110'-0"	292'-0"±
Nearest Structure	110'-0"	482'-0"±

4B.7J.4 Signage

MRA Response: The Applicant shall only install ground signage as required by the FCC and FAA, complying with 7B.7J.4.

4B.7J.5 Lighting & Marking

MRA Response: The monopole shall not have lighting or marking unless required by the FCC or FAA, complying with 7B.7J.5.

4B.7J.6 Electrical Supply

MRA Response: The site shall have a dedicated incoming main electrical service. There will be a generator installed, however it will be a backup power source. The Applicant shall ensure that regularly scheduled testing and maintenance on the generator will only occur on weekdays between 8am and 7pm. Hence complying with 4B.7J.6

4B.7J.7 Fencing

MRA Response: The compound at grade level shall be enclosed with an 8' high chain link fence with three (3) strands of barbed wire at the top for security (9' tall overall), and a double gate for access. The fencing shall have dark green PVC strips to provide screening for the equipment within the compound. The compound shall be placed in an area with existing mature tree growth. Refer to Figure 4 below for a photo of the existing site conditions. The installation of chain link fence and placement of the monopole and compound within existing mature vegetation meets the intent of 4B.7J.7.

Figure 4 – Photo of Existing Site Conditions

4B.7J.8 Tower Color

MRA Response: The tower shall have a galvanized finish, complying with 4B.7J.8.

Concept Plan Elements (Per Article 4B.7.B & 4B.7.D-F)

The items below are referenced from Article 4B.7.B.2 of the Jefferson County Zoning and Land Development Code, last revision February 2, 2017.

From Article 4B.7.B:

2. The following additional elements must be submitted:

   a. Outside dimensions, use, and setbacks of all existing and proposed buildings, structures, towers, antennas, utility lines, driveways, and parking areas.

      MRA Response: Refer to the attached drawings C-1 Site Plan, C-2 Site Details, and C-3 Antenna Details & Additional Details.

   b. Height of the proposed tower measured from ground level at the center of the proposed structure, and height comparison to any nearby buildings or trees, or other applicable structures and natural landforms part of the site's background and foreground landscape.

      MRA Response: Refer to the detail labeled "Tower Elevation" on the attached C-3 drawing. This detail shows a to scale elevation view of the proposed monopole, proposed fencing, proposed equipment, and existing landscaping.

   c. Elevations and Cross-Section: Display topography with all proposed facilities including tower, equipment shelter and existing buildings.

      MRA Response: Refer to the detail labeled "Tower Elevation" on the attached C-3 drawing. This detail shows a to scale elevation view of the proposed monopole, proposed fencing, proposed equipment, and existing landscaping. The existing topography is also depicted in this detail. There are no existing structures within the immediate vicinity of the proposed monopole.

d. Number, size and location of proposed and existing antennas; number of co-locations possible.

MRA Response: Refer to the detail labeled "Verizon Wireless Antenna Details" and "Tower Elevation" on the attached C-3 drawing. The detail "Verizon Wireless Antenna Details" shown the dimensions of each proposed antenna. The detail "Tower Elevation" shows the number of antennas (three (3) sectors with three (3) antennas per sector), for a total of nine (9) antennas), the height of the antennas (95'-0" above grade level to the center), and the number of possible co-locations (three (3) co-locations, plus the initial installation for a total of four (4) carriers). Note, the top of the antennas shall be below the top of the monopole.

e. Method of camouflage (if any).

MRA Response: The proposed monopole will not be camouflaged. The monopole color shall be galvanized metal per Article 4B.7J.8.

f. Locations of known historic structures.

MRA Response: Refer to Figure 5 – Location of Historical Sites below. The nearest historical site is a Category II located approximately 0.5 miles from the proposed monopole.

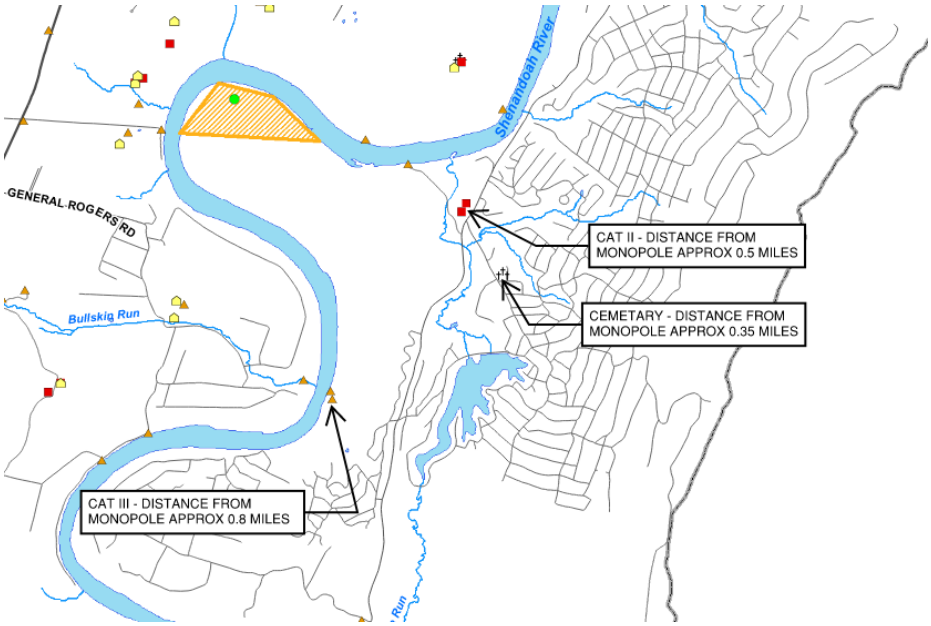


Figure 5 – Location of Historic Sites (Historic Resources in Unincorporated Jefferson County, WV)

g. A description of the anticipated construction and installation schedule.

MRA Response: The construction for the monopole and compound at grade will be a minimal disruption to the surrounding area. There will be minor clearing and grubbing, excavation and concrete work for the monopole foundation and equipment pads, and a crane to set the monopole. There will also antenna and ground equipment installation, electrical work, and fencing. After all jurisdictional approvals and building permits are obtained, the construction duration should be approximately 6 months.

h. Documentation verifying compliance with applicable Federal Communications Commission (FCC) standards and requirements to provide the proposed services.

MRA Response: Refer to Exhibit D for FCC Licenses. Note, Cellco Partnership is the legal entity that owns Verizon Wireless. Therefore, the FCC Licenses listed in Exhibit D are associated with Verizon Wireless. Vertical Bridge will own the tower and will lease the ground space from the property owner. Vertical Bridge does not control any FCC licenses or provide communication services.

i. Documentation Narrative addressing the design criteria of this section.

MRA Response: This section addresses each design criteria required.

j. Dates, address list, and notice for Balloon Test.

MRA Response: Refer to Exhibit A for Balloon Test notification information.

k. Balloon test exhibits as required in Subsection G of this Section.

MRA Response: Refer to Exhibit B for required Balloon Test results and photo simulations.

l. Propagation maps as required in Subsection F of this Section.

MRA Response: Refer to Exhibit C for required propagation maps and RF Engineer affidavits.

m. Any other relevant information.

MRA Response: The communication compound will be unmanned, and the proposed facility does not allow human habitation. Maintenance personnel will have infrequent visits and the site requires access by no more than one vehicle at a time, approximately 1-2 trips annually after the site is constructed. There will be no water or sewer connections required, as the compound is an unmanned facility.

n. Additional application requirements of Subsection H of this Section.

MRA Response: Refer to the section "Alternative Sites" in this report for additional information relating to Subsection H.

Article 4B.7.D – Applicant's Burden of Proof

MRA Response: The Concept Plan Narrative (including Exhibits) and the Concept Plan Documents submitted for the Shannondale Monopole meet the submittal and design criteria of the Jefferson County Zoning and Land Development Ordinance as it applies to this telecommunications project. The propagation maps included as Exhibit C depict a gap in existing coverage that is resolved with the installation of the Shannondale monopole site.

Article 4B.7.E – Proof of Eligibility

MRA Response: Refer to Exhibit D for FCC Licenses for Cellco Partnership d/b/a Verizon Wireless. Verizon Wireless shall be the anchor tenant for the site and shall be utilizing the monopole upon completion of construction. Refer to Exhibit E for the lease agreement between the property owner and Cellco Partnership.

Article 4B.7.F – Demonstration of Need

MRA Response: Refer to Exhibit C for existing and proposed propagation maps, as well as an affidavit from Verizon Wireless' RF Engineer. As noted above, there is a clear gap in coverage shown on the existing propagation map in the area surrounding the Shannondale monopole site. The proposed propagation map that depicts the coverage after the installation of the Shannondale monopole resolves that gap in coverage. Both maps note surrounding Verizon Wireless sites, and the affidavit from the RF Engineer provides additional technical data supporting the need for the Shannondale monopole site.

Article 4B.7.H – Preferred Structures and Locations Policy

MRA Response: There are not any existing electrical transmission towers or other appropriate structures with a height of 50' within one-quarter mile from the proposed monopole location. The surrounding area is a heavily wooded wildlife preserve to the west and south, and single-family residences to the north and east. Alternate sites for the monopole were considered by Vertical Bridge, refer to the "Alternative Sites" section of this narrative for additional information.

Alternative Sites

Five (5) alternative sites were investigated for a potential site location for the new monopole. The site addresses are listed below along with reasons why the locations are not viable. Refer to Figure 5 below for a location map showing the alternative sites.

1. Shannondale Storage (2309 Mission Rd Harpers Ferry, WV) No response from Property Owner
2. Riverside Country Store (2142 Mission Rd Harpers Ferry, WV) Not enough ground space available.
3. Red Bard Ranch (1395 Mt Hammond Lane, Harpers Ferry, WV) Property Owner declined.
4. Foodway Supermarket (3507 Mission Road, Harpers Ferry, WV) Property Owner declined.
5. Shannondale Springs Chapel Church (3868 Mission Road, Harpers Ferry, WV) No response from the Property Owner.

Figure 5 - Alternative Telecommunicates Site Location Map

Conclusion

The proposed use is in conformance with the Zoning and Land Development Ordinance, Subdivision Regulations, and meets all required design criteria and codes. Plans depicting the design features of the facility, and the equipment have been included as a separate attached along with this Concept Plan Submission.

In accordance with Section 4B.7.H.4.c, this new monopole is being proposed because there are no existing structures or electrical transmission tower within a quarter mile radius to allow a co-location. Refer to the "Alternative Sites" section in this narrative for a list of other locations that were investigated for the proposed monopole but were found to be not viable.

The communication facility has been located to meet the required setbacks from adjoining properties and to take advantage of existing vegetation and topography. The proposed monopole, while being one of the taller elements in the landscape, is strategically located within an existing tree line on the property. The communication facility will deliver a needed benefit to the community by connecting the gaps in existing service coverage in the area. Efficient telecommunications coverage is an essential part of life safety, prosperous economic growth and the ability to meet the needs of Jefferson County residents for high quality service. The proposed monopole seeks to improve telecommunication services while mitigating the impacts on its residents, and nearby land uses.

Brian E. Siverling, P.E.
Principal
Morris and Ritchie Associates, Inc.

EXHIBITS

EXHIBIT A

Balloon Test Notification Information

AFFIDAVIT OF BALLON TEST MAILING NOTICE

I, Sonya Hemphill, am above the age of majority and submit this affidavit pursuant to Jefferson County's balloon test policy:

1. I am a Real Estate Specialist III with Smartlink Group LLC, an agent for Verizon Wireless.
2. I am involved with the planning of telecommunications towers and facilities.
3. I am familiar with the zoning and other requirements in Jefferson County, West Virginia.
4. On March 24, 2023 as required by the Jefferson County Zoning and Land Development Ordinance, I hereby certify that the appropriate parties were notified of a balloon test to take place at 1329 Lakeside Drive Harper's Ferry WV 25425 on April 15, 2023 or the alternative date of April 16, 2023.

   I SOLEMNLY AFFIRM under penalties of perjury and upon personal knowledge that the content of the foregoing paper is true.

Sonya Hemphill
Real Estate Specialist III

4/20/23
Date

Veritcal Bridge VBTS, LLC
Shannondale Monopole
Balloon Test Notification Mailing List

Parcel ID	Name	Address	City	State	Zip Code
	Historic Landmarks Commission	P.O. Box 23	CHARLES TOWN	WV	25414
06 6E022600000000	ARROWSMITH JOHN M	1245 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F009100000000	REEVES LINDA JO REV TR	33 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F009800000000	REEVES LINDA JO REV TR	33 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6E024100000000	SHORES JEFFREY B & MATTHEW D BARAGER	1329 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6000900000000	SHANNONDALE ENTERPRISES INC	1329 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F010200000000	MCDOWELL ADAM W & CHRISTY L ROBERTS	2175 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F008900000000	LEWERENZ JULIE & KEYONA N WHITE	2176 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F008700000000	HIERGEIST JOHN E	2156 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6E021200000000	SENGPIEHL JASON & KAROLINA	PO BOX 591	ROUND HILL	VA	20142
06 6F011300000000	HIERGEIST JOHN E	2156 LAKESIDE DR	HARPERS FERRY	WV	254255034
06 6F010400000000	VOORHEES NANCY E	2135 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6E021300000000	SENGPIEHL JASON P & KAROLINA	PO BOX 591	ROUND HILL	VA	20142
06 6F008800000000	HIERGEIST JOHN E	2156 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F005200000000	MACHELL TIMOTHY R & LORI A	350 SHAGBARK LN	HARPERS FERRY	WV	25425
06 6F011200000000	HIERGEIST JOHN E	2156 LAKESIDE DR	HARPERS FERRY	WV	254255034
06 6E022200000000	SULLIVAN TIMOTHY P	117 BERRY LN	HARPERS FERRY	WV	25425
06 6F011100000000	LINZ PHILLIP B & GLENN M DUKE	248 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6C029600000000	ALEXANDER DAN C JR & FAY S	3440S JEFFERSON ST	FALLS CHURCH	VA	22041
06 6F004000000000	JBG HOMES LLC	4115 CHARLES TOWN RD	KEARNEYSVILLE	WV	25430
06 6F007100000000	SWAFFORD DIANA K & SCOTT W	251 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F005600000000	GIPPLE JESSE J & ANGELA M	424 SHAGBARK LN	HARPERS FERRY	WV	25425
06 6F010900000000	GRAF MICHAEL L	314 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F011500000000	CURRAN MARK W & JOANNE TR	2075 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F007000000000	SCHAFER DIANA K	251 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F003900000000	JBG HOMES LLC	4115 CHARLES TOWN RD	KEARNEYSVILLE	WV	25430
06 6F005800000000	GIPPLE JESSE J & ANGELA M	424 SHAGBARK LN	HARPERS FERRY	WV	25425
06 6F006900000000	OFFENSTEIN JOHN & PAULA	303 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F011600000000	LEBLANC BRIAN C & ROSARIO L	2027 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F003700000000	KISNER PENNY A	449 SHAGBARK LN	HARPERS FERRY	WV	25425
06 6F012400000000	GRAF MICHAEL L	314 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F006800000000	OFFENSTEIN JOHN E & PAULINE H	303 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6C015200000000	ENGLE SUSAN B & DENNIS	16 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6F012100000000	COMEAU PERRY A	9501 HALF DOLLAR CT	COLUMBIA	MD	210462071
06 6C015300000000	ENGLE SUSAN B & DENNIS	16 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6F012200000000	COMEAU PERRY A	9501 HALF DOLLAR CT	COLUMBIA	MD	210462071
06 6F003000000000	GRANT MICHAEL A JR	181 SHENANDOAH RIVER DR	HARPERS FERRY	WV	254254907
06 6F003200000000	KUSTERER DAVID J	125 SHENANDOAH RIVER DR	HARPERS FERRY	WV	254254907
06 6C014200000000	RAINES MICHAEL & JULIET	17114 SPATES HILL RD	POOLESVILLE	MD	20837
06 6C029900000000	ASH THOMAS P JR & JOANN L	46 FERN DR	HARPERS FERRY	WV	25425
06 6C014500000000	TELL CLIFFORD A & LAURIE E	40 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6F006300000000	CRUISE CLAUDIA A	PO BOX 25	OCCOQUAN	VA	22125
06 6C014600000000	TELL CLIFFORD A & LAURIE E	40 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6C014000000000	ASH THOMAS P JR & JOANN L	46 FERN DR	HARPERS FERRY	WV	25425
06 6C031000000000	PALMER VERDINE O JR & DEBRA D	293 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C030000000000	ASH THOMAS P JR & JOANN L	46 FERN DR	HARPERS FERRY	WV	25425
06 6C014700000000	LEE HARRY D	15376 CHARLES TOWN RD	CHARLES TOWN	WV	25414
06 6F003600000000	JENNINGS MORGAN A	278W MEADOWLAND LN	STERLING	VA	20164
06 6C030100000000	ASH THOMAS P JR	46 FERN DR	HARPERS FERRY	WV	25425
06 6F013300000000	CHARBONNEAU SUSAN M	3510 DEEP LANDING RD	HUNTINGTOWN	MD	20639
06 6F006200000000	HOLMES ROBERT & LAUREN CHARBONNEAU	34 LAUREL HILL CT	HARPERS FERRY	WV	25425
06 6C030800000000	PALMER VERDINE O JR & DEBRA D	293 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C013600000000	LEE J SCOTT	655 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6F000100000000	BOHON KEITH M & KATHERINE H	44 SHENANDOAH RIVER DR	HARPERS FERRY	WV	25425
06 6C013500000000	LEE JOHN SCOTT	232 MT DEW LN	HARPERS FERRY	WV	25425
06 6C013000000000	INGLERT KATHERINE	670 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6C030700000000	MAIN RUSSELL EDWARD	159 FERN DR	HARPERS FERRY	WV	254254763
06 6002000000000	PALMER VERDINE O JR & DEBRA D	293 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6002100000000	SASS STEVEN A & JENNIFER	262 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C030300000000	BREEDEN GEORGE A JR & DENA M	160 FERN DR	HARPERS FERRY	WV	25425
06 6002200000000	BARRIE DAVID M & KIM I	240 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C013200000000	COGLE LINDA C	688 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6C013300000000	BREEDEN GEORGE A JR & DENA M	160 FERN DR	HARPERS FERRY	WV	25425
06 6C030600000000	FREMAUX CHARLOTTE M	175 FERN DR	HARPERS FERRY	WV	25425
06 6C030500000000	CARTER SARAH L	189 FERN DR	HARPERS FERRY	WV	25425
06 6002300000000	BERGEL AARON E & KATELYN E	202 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6002400000000	PITCOCK RICKY S & TRACEY R	184 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C031100000000	CROWDER STEVAN D & SUZANNE	775 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6001900000000	CONTRINO MILDRED H	287 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6001800000000	SAMS EDSIL R ESTATE	261 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6001700000000	GINGELL ROBERT S - TR & HELEN E - TR	171 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6C031200000000	PENWELL ERIC L & BETH C DOWELL	857 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6002500000000	KRAPF KIMBERLY D & JOSEPH G THOMPSON	152 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6001600000000	HORSMAN MICHAEL	87 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6002600000000	MARZELL JEANNE K	98 WHITE OAK CT	HARPERS FERRY	WV	25425
06 6000400100000	ZEREGA MICHAEL G	PO BOX 801	CHARLES TOWN	WV	25414
06 6F010000000000	LEWIS MICHAEL A	170 LOCUST KNOLL DR	CHARLES TOWN	WV	25414

Veritcal Bridge VBTS, LLC
Shannondale Monopole
Balloon Test Notification Mailing List

Parcel ID	Name	Address	City	State	Zip Code
06 6F009000000000	SIGLER GEORGE H	245 UPPER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6F007600000000	BENDIT JOSHUA H & KRISTIN M LONG	175 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F011400000000	HIERGEIST JOHN E	2156 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6F007400000000	HENDRIX VICTOR & MELINDA	199 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F010800000000	GRAF MICHAEL L	314 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6C027800000000	KIRKPATRICK NEAL S	6446 JEFFERSON PIKE	FREDERICK	MD	21703
06 6C027700000000	TELL CLIFFORD A & LAURIE E	40 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6F002800000000	TUCKER KEVIN W & CARRIE A	195 SHENANDOAH RIVER DR #1244	HARPERS FERRY	WV	25425
06 6F012000000000	BRYANT BONNIE L & KEITH V BIRD - TR	2046 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6C027600000000	RAINES MICHAEL & JULIET	17114 SPATES HILL RD	POOLESVILLE	MD	20837
06 6C014400000000	TELL CLIFFORD A & LAURIE E	40 GINGERBREAD LN	HARPERS FERRY	WV	25425
06 6C013900000000	ASH THOMAS P JR & JO ANN	46 FERN DR	HARPERS FERRY	WV	25425
06 6C013800000000	ASH THOMAS P JR	46 FERN DR	HARPERS FERRY	WV	25425
06 6C013700000000	ASH THOMAS P JR	46 FERN DR	HARPERS FERRY	WV	25425
06 6F006100000000	HOLMES ROBERT & LAUREN CHARBONNEAU	34 LAUREL HILL CT	HARPERS FERRY	WV	25425
06 6F006000000000	CRIM LOWELL K	306 WITHERS LARUE RD	SUMMIT POINT	WV	25446
06 6C012100000000	BURSON DAVID K	636 LOWER CLUBHOUSE DR	HARPERS FERRY	WV	25425
06 6F010500000000	BROWN PATRICIA M ET AL	2119 LAKESIDE DR	HARPERS FERRY	WV	25425
06 6C029800000000	PALMER WILLIAM C SR	2816 FLORIDA AVE	BALTIMORE	MD	21227
06 6F005700000000	GIPPLE JESSE J & ANGELA M	424 SHAGBARK LN	HARPERS FERRY	WV	25425
06 6F003400000000	WILLIAMSON ANNE MARIE	21 EVERGREEN WAY	GARDINER	ME	4345
06 6C030900000000	UPWRIGHT LOUIS D	124 COLUMBIA ST	HARPERS FERRY	WV	25425
06 6000500000000	ARMSTRONG CINDRA	2605 MISSION RD	HARPERS FERRY	WV	25425
06 6C030200000000	BREEDEN GEORGE A JR	160 FERN DR	HARPERS FERRY	WV	25425
06 6C030400000000	MENKE MARY ANN - TR	31059 SCHOOLHOUSE RD	TRAPPE	MD	21673
06 6F003300000000	WILLIAMSON ANNE MARIE	PO BOX 2689	OCEAN SHORES	WA	98569
06 6000500010000	ARMSTRONG HARRY C ESTATE	2605 MISSION RD	HARPERS FERRY	WV	25425
06 6F012500000000	BOHLMAN RUTH GAYLE - TR	7337 YORKTOWNE DR	BALTIMORE	MD	21204
06 6C014800000000	LEE HARRY D & BELINDA L WEBER	15376 CHARLES TOWN RD	CHARLES TOWN	WV	25414
06 6C014900000000	RINKER DONALD S & LORA M DAVIS	3735 CHESTNUT HILL RD	HARPERS FERRY	WV	25425
06 6F012900000000	AVERY JON E & CHERYL L	387 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6F006500000000	WELLING BRODY W	345 LAUREL HILL RD	HARPERS FERRY	WV	25425
06 6E010400000000	ILA PROPERTIES INC	4115 CHARLES TOWN RD	KEARNEYSVILLE	WV	25430

March 22, 2023

RE: Notice of Visual Impact Survey on **April 15, 2023** regarding Verizon Wireless proposed wireless telecommunications facility on a portion of property at
1329 Lakeside Drive Harper's Ferry WV 25425
Parcel ID: 1906000600090000

Dear Resident or Interested Person:

Verizon Wireless has scheduled a visual impact survey for **April 15, 2023** between the hours of 10AM - 2PM at **1329 Lakeside Drive Harper's Ferry WV 25425** Verizon Wireless will erect a helium balloon to the proposed height of 100' (100' monopole) and survey the visibility of the helium balloon from various vantage points. Verizon Wireless will also take several photos of the helium balloon throughout the surrounding area. Verizon Wireless will use those photos to analyze and evaluate the visual impact from the proposed monopole. There will be an alternate date for possible inclement weather of **April 16, 2023.** The Jefferson County Office of Planning and Zoning has assigned the following file number to the proposed project: 23-3-SP.

We look forward to adding and improving non-emergency and emergency wireless services in the area. If you have any questions, want to provide feedback, or obtain information, please contact Sonya Hemphill by email at sonya.hemphill@smartlinkgroup.com

Thank you again and have a wonderful day.

Sincerely,

Sonya Hemphill

Sonya Hemphill
Real Estate Specialist III
Smartlink for Verizon Wireless
sonya.hempill@smartlinkgroup.com

Certificate of Publication

JEFFERSON PUBLISHING COMPANY, INC., Publisher

SPIRIT OF JEFFERSON ADVOCATE

Charles Town, W. Va. March 29 20 23

I hereby certify that the annexed Notice

in the case of Verizon Wireless proposes to construct a 100' tele-communications monopole ... PC file # 23-3-SP

has been published once a week for one successive weeks, in the Spirit of Jefferson Advocate, a newspaper published in Charles Town, Jefferson County, West Virginia, in the issues of March 29, 20 23,

as required by law.

x Tim Cook

Editor/Manager, Spirit of Jefferson Advocate

State of West Virginia
County of Jefferson

Personally appeared before me, Timcook, Editor/Manager of the Spirit of Jefferson Advocate, and made oath that the above certificate is true and correct.

Cara D. Young

Commission expires

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
CARA D. YOUNG
JEFFERSON PUBLISHING CO., INC.
PO. BOX 966
CHARLES TOWN, WV 25414
My Commission Expires January 27, 2024

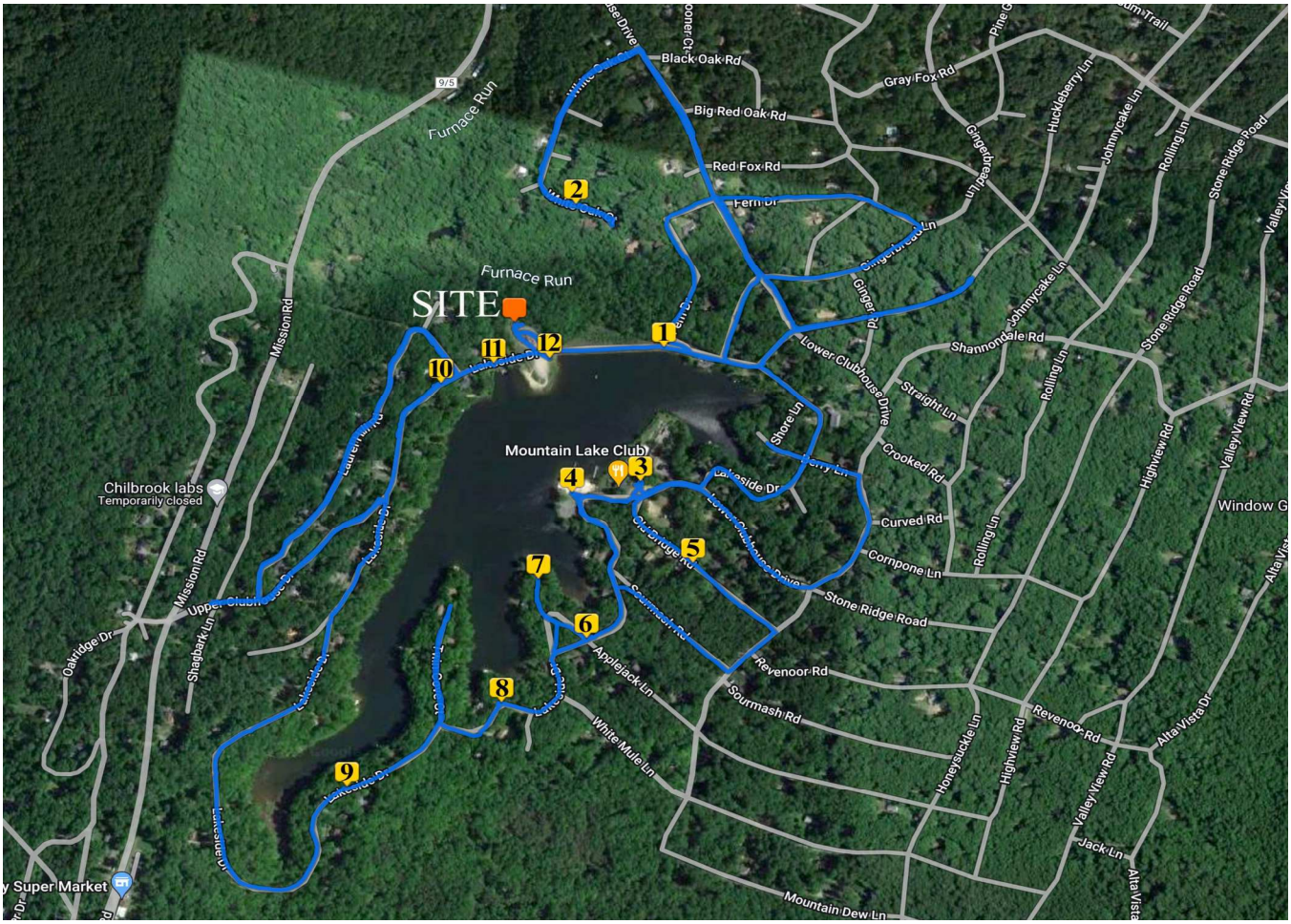
Notary Public

NOTICE

Verizon Wireless proposes to make application to Jefferson County's Planning Commission to construct a 100' telecommunications monopole and communications facility located at 1329 Lakeside Drive Harpers Ferry WV 25425 (PC file #23-3-SP). There will be a helium balloon test held on April 15, 2023 from 10am to 2pm at the location of the proposed tower. In case of inclement weather, the backup date is April 16, 023. If you have any questions please contact Sonya Hemphill at sonya.hemphill@smartlinkgroup

3/29/1t

EXHIBIT B
Balloon Test & Monopole
Photo Simulations



Balloon Test Location Map

LOCATION 1

Balloon Test Result

Photo Simulation Result

LOCATION 2

Balloon Test Result

Photo Simulation Result

LOCATION 4

Balloon Test Result

Photo Simulation Result

LOCATION 7

Balloon Test Result

Photo Simulation Result

LOCATION 8

Balloon Test Result

Photo Simulation Result

EXHIBIT C
PROPAGATION MAPS

Shannondale

Proposed Coverage

WBV Network Group
4/21/2023

verizon

Confidential and proprietery materials for Verizon personnel and outside agencies only. Use, disclosure or distribution of this material to any unauthorized persons or third parties except by written aggrement.

05/08/2022

Office of Planning and Zoning
Mason Building, 2nd Floor
116 East Washington Street
Charles Town, WV 25414

RE: Shannondale Site Plan

To Whom it May Concern:

The radio propagation studies were performed with Atoll software v3.4.1 using Verizon's tuned Aster model. The radio propagation model presented without the effects of the proposed monopole reflect propagations from Verizon's existing Rippon, Summit Point, Kabletown, Charles Town South and Mannings sites in Jefferson County, WV and Battletown and Acadia Farms in Clarke County, VA and Short Hill and Round Hill in Loudoun County, VA. The radio propagation model presented with the effects of the proposed Shannondale monopole uses NAD83 coordinates of 39.212567, -77.815258 and an antenna centerline height of 95 feet.

For both existing and proposed radio propagation maps, two studies are shown, one for low band (750 MHz) and one for mid band (2130 MHz). The proposed Shannondale predictions use JMA MX06FRO860-02 antennas with azimuths of 60°, 180° and 300°. For low band, a total ERP of 1,396 watts was used with 0° of mechanical and 2° of electrical down tilt. For mid-band band, a total ERP of 2,387 watts was used with 0° of mechanical and 2° of electrical down tilt.

If you have any additional questions or concerns, please contact your local Verizon resource below:

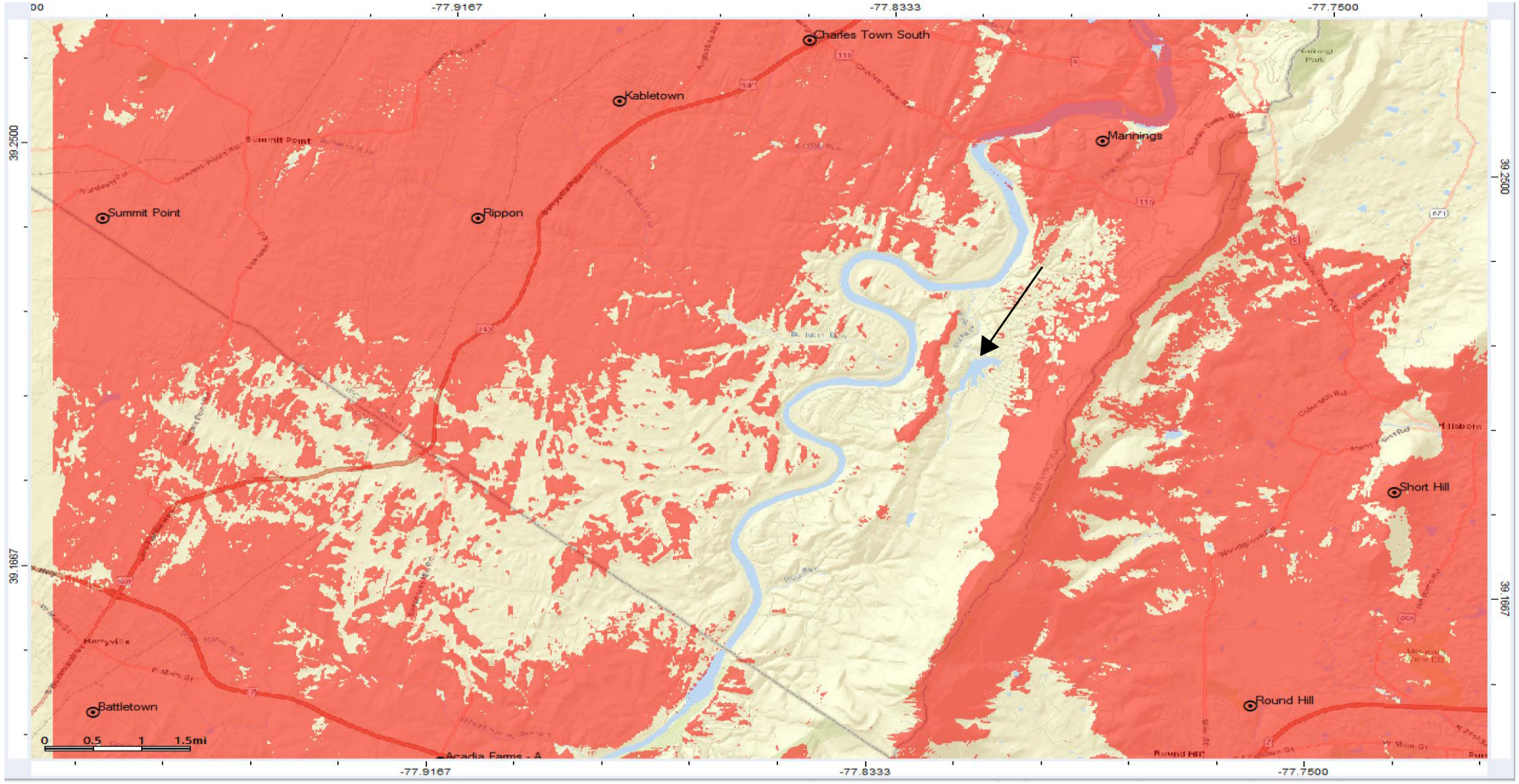
Contact Name	Contact Email	Contact Phone
Hamed Semati	Hamed.Semati@verizonwireless.com	301-807-8275

Sincerely,

Mark Stalnaker

Mark S. Stalnaker
Manager-RF System Design

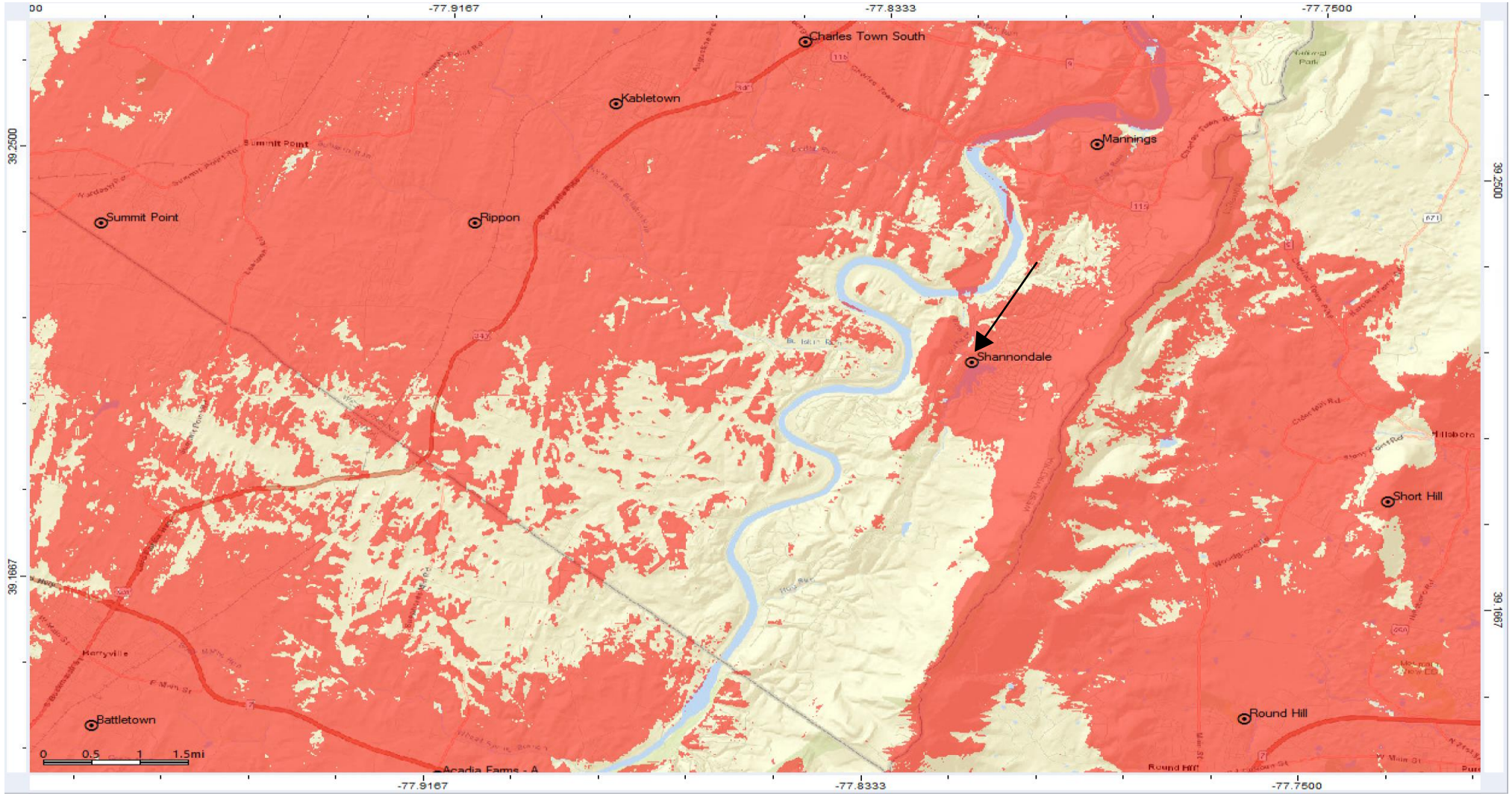
Existing 700 Coverage



✓

Confidential and proprietary materials for Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

Proposed 700 Coverage



✓

Confidential and proprietary materials for Verizon personnel and outside agencies only. Use, disclosure or distribution of this material is not permitted to any unauthorized persons or third parties except by written agreement.

EXHIBIT D
FCC Licenses

Federal Communications Commission
Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: AIRTOUCH CELLULAR

ATTN: REGULATORY
AIRTOUCH CELLULAR
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
KNLF652	
Radio Service CW - PCS Broadband	

FCC Registration Number (FRN): 0006146468

Grant Date	Effective Date	Expiration Date	Print Date
12-06-2016	12-06-2016	01-03-2027	

Market Number	Channel Block	Sub-Market Designator
BTA029	C	1

Market Name
Baltimore, MD

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
12-07-2003	01-03-2007		

Waivers/Conditions:

This authorization is subject to the condition that, in the event that systems using the same frequencies as granted herein are authorized in an adjacent foreign territory (Canada/United States), future coordination of any base station transmitters within 72 km (45 miles) of the United States/Canada border shall be required to eliminate any harmful interference to operations in the adjacent foreign territory and to ensure continuance of equal access to the frequencies by both countries.

Special Condition for AU/name change (6/4/2016): Grant of the request to update licensee name is conditioned on it not reflecting an assignment or transfer of control (see Rule 1.948); if an assignment or transfer occurred without proper notification or FCC approval, the grant is void and the station is licensed under the prior name.

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

This license may not authorize operation throughout the entire geographic area or spectrum identified on the hardcopy version. To view the specific geographic area and spectrum authorized by this license, refer to the Spectrum and Market Area information under the Market Tab of the license record in the Universal Licensing System (ULS). To view the license record, go to the ULS homepage at http://wireless.fcc.gov/uls/index.htm?job=home and select "License Search". Follow the instructions on how to search for license information.

Official Copy

FCC 601-MB
August 2021

Licensee Name: AIRTOUCH CELLULAR

Call Sign: KNLF652 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WPZY690	
Radio Service CW - PCS Broadband	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
12-06-2016	12-06-2016	01-03-2027	

Market Number	Channel Block	Sub-Market Designator
BTA461	C	2

Market Name
Washington, DC

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
12-07-2003	01-03-2007		

Waivers/Conditions:

This authorization is subject to the condition that, in the event that systems using the same frequencies as granted herein are authorized in an adjacent foreign territory (Canada/United States), future coordination of any base station transmitters within 72 km (45 miles) of the United States/Canada border shall be required to eliminate any harmful interference to operations in the adjacent foreign territory and to ensure continuance of equal access to the frequencies by both countries.

Pursuant to Order DA 03-617 (rel. March 3, 2003), the designated entity holding period for this license is extended by 703 days, or until the licensee meets its five-year construction requirement, whichever is sooner.

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

This license may not authorize operation throughout the entire geographic area or spectrum identified on the hardcopy version. To view the specific geographic area and spectrum authorized by this license, refer to the Spectrum and Market Area information under the Market Tab of the license record in the Universal Licensing System (ULS). To view the license record, go to the ULS homepage at http://wireless.fcc.gov/uls/index.htm?job=home and select "License Search". Follow the instructions on how to search for license information.

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Licensee Name: CELLCO PARTNERSHIP

Call Sign: WPZY690 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WQGA909	0009773354
Radio Service AW - AWS (1710-1755 MHz and 2110-2155 MHz)	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
12-21-2021	12-21-2021	11-29-2036	12-21-2021

Market Number	Channel Block	Sub-Market Designator
BEA013	B	13

Market Name
Washington-Baltimore, DC-MD-VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date

Waivers/Conditions:

This authorization is conditioned upon the licensee, prior to initiating operations from any base or fixed station, making reasonable efforts to coordinate frequency usage with known co-channel and adjacent channel incumbent federal users operating in the 1710-1755 MHz band whose facilities could be affected by the proposed operations. See, e.g., FCC and NTIA Coordination Procedures in the 1710-1755 MHz Band, Public Notice, FCC 06-50, WTB Docket No. 02-353, rel. April 20, 2006.

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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Official Copy

FCC 601-MB
August 2021

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WQGA909 **File Number:** 0009773354 **Print Date:** 12-21-2021

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WQJQ690	
Radio Service	
WU - 700 MHz Upper Band (Block C)	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
10-04-2019	03-12-2020	06-13-2029	

Market Number	Channel Block	Sub-Market Designator
REA002	C	0

Market Name
Southeast

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
06-13-2013	06-13-2019		

Waivers/Conditions:

If the facilities authorized herein are used to provide broadcast operations, whether exclusively or in combination with other services, the licensee must seek renewal of the license either within eight years from the commencement of the broadcast service or within the term of the license had the broadcast service not been provided, whichever period is shorter in length. See 47 CFR §27.13(b).

This authorization is conditioned upon compliance with section 27.16 of the Commission's rules

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

This license may not authorize operation throughout the entire geographic area or spectrum identified on the hardcopy version. To view the specific geographic area and spectrum authorized by this license, refer to the Spectrum and Market Area information under the Market Tab of the license record in the Universal Licensing System (ULS). To view the license record, go to the ULS homepage at http://wireless.fcc.gov/uls/index.htm?job=home and select "License Search". Follow the instructions on how to search for license information.

Official Copy

This authorization is subject to the condition that the station license limits the effective radiated power relative to a dipole (ERPd) antenna to 1238 watts per 10 MHz bandwidth at 333.7 degrees true azimuth bearing for all antennas associated with location no.1 (Lexington, VA) with coordinates of 37-47-19.5 N, 79-29-15.1 W. See Quiet Zone Notification authorized with grant of FN 0004834212.

This authorization is subject to the condition that the station license limits the effective radiated power to 196 watts per 10 MHz bandwidth at 7 degrees true azimuth bearing for all antennas associated with location no. 5 (Covington, VA) with coordinates of 37-47-35.1 N, 79-55-58.4 W. See Quiet Zone Notification authorized with grant of FN 0004880708.

This authorization is subject to the condition that the station license limits the effective radiated power to 856 watts per 10 MHz bandwidth at 320 degrees true azimuth bearing for all antennas associated with location no. 6 (Fairfield, VA) with coordinates of 37-53-48.4 N, 79-15-59.1 W. See Quiet Zone Notification authorized with grant of FN 0004880708.

This authorization is subject to the condition that the station license limits the effective radiated power to 9.8 watts per 10 MHz bandwidth at 359 degrees true azimuth bearing for all antennas associated with location no. 12 (Eagle Rock, VA) with coordinates of 37-37-55.8 N, 79-49-50.0 W. See Quiet Zone Notification authorized with grant of FN 0004880708.

This authorization is subject to the condition that the station license limits the effective radiated power relative to a dipole (ERPd) antenna to 918 watts per 10 MHz unit bandwidth at 29.6 degrees true azimuth bearing for all antennas associated with location no. 17 (White Sulphur Spring, WV) with coordinates of 37-47-19.6 N, 80-18-22.7 W. See Quiet Zone Notification authorized with grant of FN 0004880708.

This authorization is subject to the condition that the station license limits the effective radiated power relative to a dipole (ERPd) antenna to 264 watts per 10 MHz unit bandwidth at 352.4 degrees true azimuth bearing for all antennas associated with location no. 19 (Buchanan, VA) with coordinates of 37-33-45.0 N, 79-41-21.9 W. See Quiet Zone Notification authorized with grant of FN 0004908392.

This authorization is subject to the condition that the station license limits the effective radiated power relative to a dipole (ERPd) to 781 watts per 10 MHz unit bandwidth at 293.93 degrees true azimuth bearing for all antennas associated with location no. 21 (Waynesboro, VA) with coordinates of 38-06-55.6 N, 78-54-55.5 W. See Quiet Zone Notification authorized with grant of FN 0004970422.

This authorization is subject to the condition that the station license limits the effective radiated power to 20.23 dBW per 10 MHz bandwidth at 297.4 degrees true azimuth bearing for all antennas associated with location no. 24 (Waynesboro, VA) with coordinates of 38-02-29.4 N, 78-52-11.6 W. See Quiet Zone Notification authorized with grant of FN 0005104523.

This authorization is subject to the condition that the station license limits the effective radiated power (ERP) to 12.9 watts per 10 MHz bandwidth at 9.1 degrees true azimuth bearing for all antennas associated with location no. 31 (Covington, VA) withcoordinates of 37-51-51.4 N, 79-57-22.4 W. See Quiet Zone Notification authorized with grant of FN 0005178701.

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This authorization is subject to the condition that the station license limits the effective radiated power to 1327 watts per 10 MHz bandwidth at 291.8 degrees true azimuth bearing for all antennas associated with location no. 30 (Staunton, VA) with coordinates of 38-09-23.7 N, 78-57-02.9 W. See Quiet Zone Notification authorized with grant of FN 0005168812.

This authorization is subject to the condition that the station license limits the effective radiated power to 712 watts per 10 MHz bandwidth at 37.5 degrees true azimuth bearing for all antennas associated with location no. 28 (Lewisburg, WV) with coordinates of 37-48-42.7 N, 80-26-54.5 W. See Quiet Zone Notification authorized with grant of FN 0005223750.

This authorization is subject to the condition that the station license limits the effective radiated power to 877 watts per 10 MHz bandwidth at 296.22 degrees true azimuth bearing for all antennas associated with location no. 29 (Waynesboro, VA) with coordinates of 38-05-37.6 N, 78-57-05.3 W. See Quiet Zone Notification authorized with grant of FN 0005223750.

This authorization is subject to the condition that the station license limits the effective radiated power to 126 watts per 10 MHz bandwidth at 29.7 degrees true azimuth bearing for all antennas associated with location no. 53 (White Sulphur Spring, WV)with coordinates of 37-48-05.7 N, 80-17-54.5 W. See Quiet Zone Notification authorized with grant of FN 0005271165.

This authorization is subject to the condition that the station license limits the effective radiated power to 1129 watts per 10 MHz bandwidth at 35 degrees true azimuth bearing for all antennas associated with location no. 52 (Lewsiburg, WV) with coordinates of 37-48-47.3 N, 80-23-33.9 W. See Quiet Zone Notification authorized with grant of FN 0005272906.

This authorization is subject to the condition that the station license limits the effective radiated power to 763 watts per 10 MHz bandwidth at 36.99 degrees true azimuth bearing for all antennas associated with location no. 52 (Fairlea, WV) with coordinates of 37-47-03.0 N, 80-27-55.6 W. See Quiet Zone Notification authorized with grant of FN 0005287264.

This authorization is subject to the condition that the station license limits the effective radiated power to 83 watts per 10 MHz bandwidth at 27.85 degrees true azimuth bearing for all antennas associated with location no. 53 (White Suphur Springs, WV)with coordinates of 37-47-29.0 N, 80-16-23.30 W. See Quiet Zone Notification authorized with grant of FN 0005287264.

This authorization is subject to the condition that the station license limits the effective radiated power to 592 watts per 10 MHz bandwidth at 284.9 degrees true azimuth bearing for all antennas associated with location no. 62 (Mount Sidney, VA) with coordinates of 38-15-18.1 N, 78-58-22.3 W. See Quiet Zone Notification authorized with grant of FN 0005690131.

This authorization is subject to the condition that the station license limits the effective radiated power to 87 watts 700LTE at 298.03 degrees true azimuth bearing for all antennas associated with location no. 62 (Afton, VA) with coordinates of 38-01-43.5 N, 78-51-37.8 W. See Quiet Zone Notification authorized with grant of FN 0005669760.

.

Official Copy

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WQJQ690 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WQPG204	0009792679
Radio Service AW - AWS (1710-1755 MHz and 2110-2155 MHz)	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
02-16-2022	02-16-2022	11-29-2036	02-17-2022

Market Number	Channel Block	Sub-Market Designator
BEA013	C	8

Market Name
Washington-Baltimore, DC-MD-VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date

Waivers/Conditions:

This authorization is conditioned upon the licensee, prior to initiating operations from any base or fixed station, making reasonable efforts to coordinate frequency usage with known co-channel and adjacent channel incumbent federal users operating in the 1710-1755 MHz band whose facilities could be affected by the proposed operations. See, e.g., FCC and NTIA Coordination Procedures in the 1710-1755 MHz Band, Public Notice, FCC 06-50, WTB Docket No. 02-353, rel. April 20, 2006.

Special Condition for AU/name change (6/4/2016): Grant of the request to update licensee name is conditioned on it not reflecting an assignment or transfer of control (see Rule 1.948); if an assignment or transfer occurred without proper notification or FCC approval, the grant is void and the station is licensed under the prior name.

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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Commission approval of this application and the licenses contained therein are subject to the conditions set forth in the Memorandum Opinion and Order, adopted on December 29, 2006 and released on March 26, 2007, and revised in the Order on Reconsideration, adopted and released on March 26, 2007. See AT&T Inc. and BellSouth Corporation Application for Transfer of Control, WC Docket No. 06-74, Memorandum Opinion and Order, FCC 06-189 (rel. Mar. 26, 2007); AT&T Inc. and BellSouth Corporation, WC Docket No. 06-74, Order on Reconsideration, FCC 07-44 (rel. Mar. 26, 2007).

Official Copy

.

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WQPG204 **File Number:** 0009792679 **Print Date:** 02-17-2022

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WQQZ831	0009790965
Radio Service AW - AWS (1710-1755 MHz and 2110-2155 MHz)	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
02-17-2022	02-17-2022	11-29-2036	02-18-2022

Market Number	Channel Block	Sub-Market Designator
REA002	D	4

Market Name
Southeast

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date

Waivers/Conditions:

This authorization is conditioned upon the licensee, prior to initiating operations from any base or fixed station, making reasonable efforts to coordinate frequency usage with known co-channel and adjacent channel incumbent federal users operating in the 1710-1755 MHz band whose facilities could be affected by the proposed operations. See, e.g., FCC and NTIA Coordination Procedures in the 1710-1755 MHz Band, Public Notice, FCC 06-50, WTB Docket No. 02-353, rel. April 20, 2006.

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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The license is subject to compliance with the provisions of the January 12, 2001 Agreement between Deutsche Telekom AG, VoiceStream Wireless Corporation, VoiceStream Wireless Holding Corporation and the Department of Justice (DOJ) and the Federal Bureau of Investigation (FBI), which addresses national security, law enforcement, and public safety issues of the FBI and the DOJ regarding the authority granted by this license. Nothing in the Agreement is intended to limit any obligation imposed by Federal lawor regulation including, but not limited to, 47 U.S.C. Section 222(a) and (c)(1) and the FCC's implementing regulations. The Agreement is published at VoiceStream-DT Order, IB Docket No. 00-187, FCC 01-142, 16 FCC Rcd 9779, 9853 (2001).

Official Copy

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Licensee Name: CELLCO PARTNERSHIP

Call Sign: WQQZ831 **File Number:** 0009790965 **Print Date:** 02-18-2022

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WQVN933	
Radio Service AT - AWS-3 (1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz)	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
04-08-2015	11-01-2016	04-08-2027	

Market Number	Channel Block	Sub-Market Designator
BEA013	J	0

Market Name
Washington-Baltimore, DC-MD-VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
04-08-2021	04-08-2027		

Waivers/Conditions:

NONE

Conditions:

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

This license may not authorize operation throughout the entire geographic area or spectrum identified on the hardcopy version. To view the specific geographic area and spectrum authorized by this license, refer to the Spectrum and Market Area information under the Market Tab of the license record in the Universal Licensing System (ULS). To view the license record, go to the ULS homepage at http://wireless.fcc.gov/uls/index.htm?job=home and select "License Search". Follow the instructions on how to search for license information.

Official Copy

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WQVN933 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WRNF607	
Radio Service PM - 3.7 GHz Service	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
07-23-2021	07-23-2021	07-23-2036	

Market Number	Channel Block	Sub-Market Designator
PEA103	A1	0

Market Name
Winchester, VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
07-23-2029	07-23-2033		

Waivers/Conditions:

This final license provides authorization during the full 15-year license term. Operation under this final license may begin on the earlier of (1) 12/5/2025 or (2) the date that the certification for accelerated relocation for this PEA is validated by the FCC pursuant to 47 CFR § 27.1412(g).

License is conditioned on compliance with all applicable FCC rules and regulations, including licensee making payments required by 47 C.F.R. §§ 27.1401- 27.1424 as described in FCC 20-22. See FCC 20-22, paras. 178-331.

Conditions:
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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Official Copy

FCC 601-MB
August 2021

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WRNF607 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WRNF608	
Radio Service PM - 3.7 GHz Service	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
07-23-2021	07-23-2021	07-23-2036	

Market Number	Channel Block	Sub-Market Designator
PEA103	A2	0

Market Name
Winchester, VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
07-23-2029	07-23-2033		

Waivers/Conditions:

This final license provides authorization during the full 15-year license term. Operation under this final license may begin on the earlier of (1) 12/5/2025 or (2) the date that the certification for accelerated relocation for this PEA is validated by the FCC pursuant to 47 CFR § 27.1412(g).

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Official Copy

FCC 601-MB
August 2021

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WRNF608 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WRNF609	
Radio Service PM - 3.7 GHz Service	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
07-23-2021	07-23-2021	07-23-2036	

Market Number	Channel Block	Sub-Market Designator
PEA103	A3	0

Market Name
Winchester, VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
07-23-2029	07-23-2033		

Waivers/Conditions:

This final license provides authorization during the full 15-year license term. Operation under this final license may begin on the earlier of (1) 12/5/2025 or (2) the date that the certification for accelerated relocation for this PEA is validated by the FCC pursuant to 47 CFR § 27.1412(g).

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Official Copy

FCC 601-MB
August 2021

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WRNF609 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WRNF610	
Radio Service PM - 3.7 GHz Service	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
07-23-2021	07-23-2021	07-23-2036	

Market Number	Channel Block	Sub-Market Designator
PEA103	A4	0

Market Name
Winchester, VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
07-23-2029	07-23-2033		

Waivers/Conditions:

This final license provides authorization during the full 15-year license term. Operation under this final license may begin on the earlier of (1) 12/5/2025 or (2) the date that the certification for accelerated relocation for this PEA is validated by the FCC pursuant to 47 CFR § 27.1412(g).

License is conditioned on compliance with all applicable FCC rules and regulations, including licensee making payments required by 47 C.F.R. §§ 27.1401- 27.1424 as described in FCC 20-22. See FCC 20-22, paras. 178-331.

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Official Copy

FCC 601-MB
August 2021

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WRNF610 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

Federal Communications Commission

Wireless Telecommunications Bureau

RADIO STATION AUTHORIZATION

LICENSEE: CELLCO PARTNERSHIP

ATTN: REGULATORY
CELLCO PARTNERSHIP
5055 NORTH POINT PKWY, NP2NE NETWORK ENGINEERING
ALPHARETTA, GA 30022

Call Sign	File Number
WRNF611	
Radio Service PM - 3.7 GHz Service	

FCC Registration Number (FRN): 0003290673

Grant Date	Effective Date	Expiration Date	Print Date
07-23-2021	07-23-2021	07-23-2036	

Market Number	Channel Block	Sub-Market Designator
PEA103	A5	0

Market Name
Winchester, VA

1st Build-out Date	2nd Build-out Date	3rd Build-out Date	4th Build-out Date
07-23-2029	07-23-2033		

Waivers/Conditions:

This final license provides authorization during the full 15-year license term. Operation under this final license may begin on the earlier of (1) 12/5/2025 or (2) the date that the certification for accelerated relocation for this PEA is validated by the FCC pursuant to 47 CFR § 27.1412(g).

License is conditioned on compliance with all applicable FCC rules and regulations, including licensee making payments required by 47 C.F.R. §§ 27.1401- 27.1424 as described in FCC 20-22. See FCC 20-22, paras. 178-331.

Conditions:
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Official Copy

Licensee Name: CELLCO PARTNERSHIP

Call Sign: WRNF611 **File Number:** **Print Date:**

700 MHz Relicensed Area Information:

Market	Market Name	Buildout Deadline	Buildout Notification	Status

Official Copy

EXHIBIT E
LEASE AGREEMENT

Return To:

Site Name: Shannondale
MDG Location: 5000907556

MEMORANDUM OF LEASE AGREEMENT

THIS MEMORANDUM OF LEASE AGREEMENT is made effective this 29th day of March 2023, by and between **Shannondale Enterprises, Inc.**, a West Virginia corporation, with its principal offices located at 1329 Lakeside Drive, Harpers Ferry, WV 25425 (hereinafter "Lessor" or "Grantor"), and **Cellco Partnership d/b/a Verizon Wireless**, a Delaware general partnership ("Lessee" or "Grantee") with a mailing address of One Verizon Way, Mail Stop 4AW100, Basking Ridge, New Jersey 07920.

WHEREAS, Lessor and Lessee entered into a Land Lease Agreement ("Lease"), dated 29th March 23, whereby Lessor conveyed a Lease to Lessee, for a 50' x 50' portion (the "Leased Premises") of a 68.2 acre tract of property located at 1329 Lakeside Drive, Harpers Ferry, WV 25425, and also known as Tax Account No.: 00015695 (the "Property"), which Property is described in Exhibit "A" attached hereto; and,

NOW THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are acknowledged, Lessor and Lessee shall set forth basic terms of the Lease as follows:

1. The Initial Term of the Lease is for five (5) years commencing on the month in which Lessee commences construction, with options to renew for four (4) additional five (5) year terms unless terminated in accordance with the provisions of the Lease Agreement.

2. In consideration of the Rent set forth in the Lease, Lessor leases to Lessee a portion of the Property consisting of a 50' by 50' parcel of land containing 2500 square feet, together with the non-exclusive right for ingress and egress seven (7) days a week, twenty-four (24) hours a day for installation, maintenance and operation of communications facilities. A plat of the Leased Premises is attached hereto as Exhibit "B".

3. A copy of the Lease, as may be amended, is on file with the Lessor and Lessee.

4. The terms, covenants and provisions of the Lease, of which this is a Memorandum, shall extend to and be binding upon the respective executors, administrators, heirs, successors and assigns of Lessor and Lessee.

LESSOR:

Shannondale Enterprises, Inc.,

BY: _____
Name:
Title: President

STATE OF West Virginia :
: SS
COUNTY OF Jefferson :

ACKNOWLEDGMENT

On this 10 day of March, 2023, before me, the subscriber, a Notary Public, in and for the State of West Virginia, personally appeared Jeff Shore, and in due form of law acknowledged that he executed the above Memorandum of Lease Agreement as the act and deed of **Shannondale Enterprises, Inc.**, and desired the same might be recorded.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my seal in said County and State of the day and year last above written.

_____
Notary Public

My Commission Expires: 1/18/2028

NOTARY PUBLIC OFFICIAL SEAL
Renee Moore
State of West Virginia
My Commission Expires
January 18, 2028
RIVER COUNTRY STORE
2142 MISSION ROAD
HARPERS FERRY, WV 25425

LESSEE: **CELLCO PARTNERSHIP**
d/b/a Verizon Wireless

BY: _____
Michelle Chu
Director-Network Eng.

STATE / COMMONWEALTH OF Maryland :
: SS
COUNTY OF Anne Arundel :

CORPORATE ACKNOWLEDGMENT

On this 29th day of March, 2023, before me, the subscriber, a Notary Public, in and for the State / Commonwealth Maryland, personally appeared Michelle Chu (name), Director-Ntwk Eng (title) of **Cellco Partnership**, a Delaware general partnership, and in due form of law acknowledged that he/she is authorized on behalf of said Partnership to execute all documents pertaining hereto and acknowledged to me that he executed the same as his/her voluntary act and deed on behalf of said Partnership.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my seal in said County and State of the day and year last above written.

_____
Notary Public

My Commission Expires:

MELISSA FORD
Notary Public-Maryland
Anne Arundel County
My Commission Expires
February 10, 2024

MELISSA FORD NOTARY PUBLIC MD ANNE ARUNDEL COUNTY MY COMMISSION EXPIRES 02-10-2024

EXHIBIT "A"

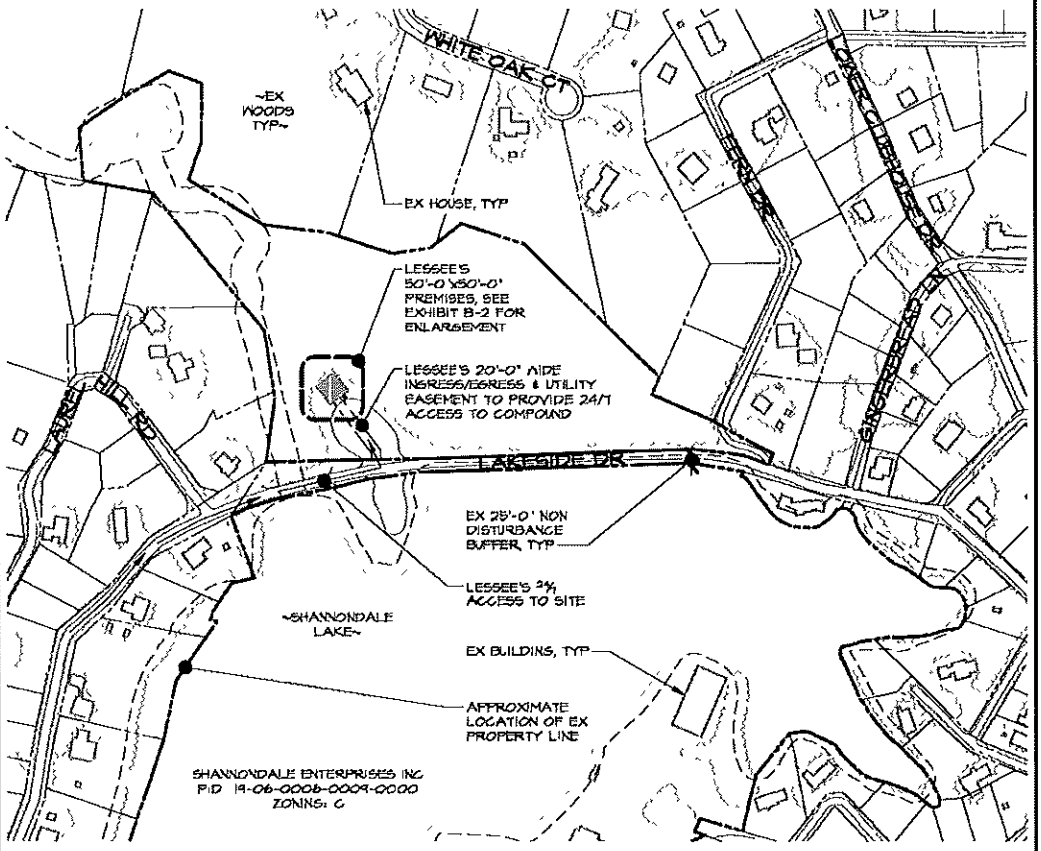
DESCRIPTION OF PROPERTY

All that certain parcel of real estate situate on the east side of the Shenandoah River in the Kabletown District, Jefferson County, West Virginia being more particularly bounded and described as follows:

Being all that 69.0184-acre parcel of real estate as the same is depicted on a plat entitled "Club House and Lake Area" made by Wallace R. Amos, dated August, 1978, said plat being recorded in the Office of the Clerk of the County Commission, Jefferson County, West Virginia in Plat Book 5, at Page 10 (the "Plat"), and which is more particularly described by metes and bounds in a Deed dated September 20, 1978 and recorded in the Office of the Clerk aforesaid in Deed Book No. 446, Page 147, from Shannondale, Incorporated to Shannondale Club, Limited.

Property also known as:
Tax Map 6 Parcel 9
Tax Account No.: 0015695
1329 Lakeside Drive
Harpers Ferry, Jefferson County, West Virginia

EXHIBIT B



SITE PLAN

SCALE: 1" = 300'

MORRIS & RITCHIE ASSOCIATES, INC.
ENGINEERS, PLANNERS, SURVEYORS AND LANDSCAPE ARCHITECTS
1220-B East Joppa Road, Suite 400K
Towson, Maryland 21286
(410) 821-1690
Fax (410) 821-1748

SHANNONDALE
1329 LAKESIDE DR
HARPERS FERRY, WV 25425
JEFFERSON COUNTY

SCALE	DATE	DRAWN BY	DESIGN BY	REVIEW BY	JOB NO
AS NOTED	12/08/22	AJL	BES	AJL	10427.3270

23-3-SP Shannondale Lake Cell Tower Public Comment

- Submitted 2023-05-29 by Corey Ash
- Submitted 2023-06-05 & 2023-06-06 by Amy Kostant
- Submitted 2023-06-05 by Daniel Kaseman
- Submitted 2023-06-05 by Dr. Diane B. Obenchain and Dennis D. Donahue
- Submitted 2023-06-05 by Adam Shub and Rachel Shub
- Submitted 2023-06-06 by Roberta Cohen
- Submitted 2023-06-06 by Alex Korovin, Adam McDowell, Peter and Harriet Getzels
- Submitted 2023-06-06 by Harriet and Peter Getzels
- Submitted 2023-06-06 by Linda Reeves
- Submitted 2023-06-07 by Coral Howe
- Submitted 2023-06-07 by Cheryl Wilfong

Planning Department

From: Corey Ash <ctash2@gmail.com>
Sent: Monday, May 29, 2023 10:20 PM
To: Planning Department
Subject: 5G Cell Tower in Shannondale
Attachments: CEASE AND DESIST RES.pdf; SAMPLE MUNICIPAL CODE.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or on clicking links from unknown senders.

To whom it may concern,

I am a concerned citizen who lives in Shannondale and am genuinely worried about the environmental and physical health effects these towers can have on the population and surrounding area. Unbeknownst to most people, there is quite a bit of evidence including several hundred medical studies that show a wide range of illnesses and complications that can be caused by 4G and 5G such as brain tumors, fertility issues, DNA damage, effects on implanted medical devices, and even effects on wildlife and plants. Below is a link to numerous studies mentioned above:
https://www.americansforresponsibletech.org/scientific-studies

Furthermore, I am also concerned from an EMS and Medevac standpoint. I would like to at least look into the FAA rules and regulations to see what issues emergency vehicles may have operating and landing next to a cell tower, especially since the proposed building site is the Medevac landing pad. One scenario would be if you have a mountain fire (which we have had before) that required EMS to occupy the dam side pad for filling tankers while the other side is needed for the Medevac. If the tower prevents the Medivac from landing there, then they are unable to provide urgent medical service which could lead to an unnecessary death.

Lastly, I have attached two documents, one a cease and desist letter template to use for Jefferson county until there is sufficient safety data in place for this technology. The other document is a sample code to modify the existing ordinance for wireless telecommunication. I hope we can investigate this issue in full and come to a conclusion that is good for the community as a whole. Thank you for your time.

Regards, Corey

A resolution calling upon all telecommunications companies and public utilities operating in (*name of village, town or city*), to cease the build-out of so-called “5G” wireless infrastructure until such technologies have been proven safe to human health and the environment through independent research and testing.

Whereas the telecommunications industry is engaged in a massive deployment of microwave and millimeter-wave "small cell" antennas across the county to facilitate the next generation of wireless communications known as 5G, and

Whereas this new technology uses existing wireless infrastructure and new types of radio-frequency (RF) microwave radiation to transmit large amounts of data, but requires significantly closer proximity to users, resulting in the dense deployment of antennas near residences, schools, and hospitals, and

Whereas the deployment of 5G-enabled small cell antennas in our neighborhoods raises serious questions regarding the potential health and environmental impacts of long-term exposure to untested RF microwave radiation frequencies, and

Whereas the Federal Communications Commission (FCC) has not conducted any long-term safety testing of new 5G wireless technologies, and has failed to update its human RF microwave radiation exposure guidelines since 1996, despite being advised to do so by the U.S. General Accounting Office (GAO), the American Academy of Pediatrics, and hundreds of medical and scientific experts from around the world, and

Whereas telecommunications industry leaders have publicly admitted that they have not conduced any safety tests to determine the possible adverse health and environmental effects from exposure to RF microwave radiation emitted by 5G-enabled small cell antennas, and

Whereas a significant body of published, peer-reviewed, independent science links exposure to RF microwave radiation with serious environmental and biological harm, including increased risk of cancer, reproductive problems and neurological impairments, and

Whereas populations especially at risk from this exposure include pregnant women, children, the elderly, and individuals with implanted medical devices, or cardiac or neurological problems, and

Whereas Swiss Re, the second-largest re-insurance company in the world, called 5G a "high impact" liability risk due to health risks in its 2019 SONAR emerging risks report, and

Whereas the theory that exposure to RF microwave radiation is harmless, which has been the underlying principle of all federal legislation and regulations regarding wireless technologies for more than twenty years, has now been proven false,

Now, therefore, be it

Resolved, that (*name of village, town or city*) calls upon all telecommunications companies and public utilities operating in (*name of village, town or city*) to cease and desist in the build-out of 5G-enabled small cell antennas until such technologies have been proven safe, beyond a reasonable doubt through independent research, and the public health and welfare can be assured.

MODEL WIRELESS TELECOMMUNICATIONS ORDINANCE
for Siting of "Small Cell" Telecommunication Infrastructure

*This document is intended for use by towns and villages that have existing code for wireless communications infrastructure developed and adopted **prior** to the introduction of "small cell" wireless equipment and its widespread deployment in public rights-of-way.*

***We strongly advise against the placement of 4G/5G small cell antennas in any residential areas due to the lack of safety testing**, and recommend that every effort be made by applicants to limit placement of antennas to the least populated areas, such as along highways or in large parking lots, and as far as possible from schools, daycare centers, playgrounds, parks and other area where children spend time. Locating antennas in or near residential areas increases issues regarding aesthetics and property values. These considerations are being used by some municipalities to challenge or deny permit applications.*

Moreover, as public resistance to 4G/5G antennas grows and technology improves, the need for locating any antennas in residential areas may decline. We note that some wireless carriers are using existing towers and lower-band frequencies formerly used for analog television signals to carry so-called "5G" signals, eliminating the need for small cells.

Municipal officials and local attorneys should be cognizant that rulings and orders of the Federal Communications Commission (FCC) are not laws, and do not have the force of law. They are merely the agency's interpretation of the law and of its own powers and authority. Recently, decisions of the FCC regarding the National Environmental Policy Act (NEPA) were overturned by the District Court in Washington, DC. Congress is currently threatening bipartisan legislation to curb the over-reach of the FCC, and a number of cities are challenging the authority of the agency to preempt local control over the siting of small cell antennas.

The wireless industry often threatens legal action against any municipality considering health effects in its deliberations, based on Section 704 of the 1996 Telecommunications Act which prohibits consideration of "environmental effects" in making siting decisions. However, that prohibition is conditional on the antenna meeting all FCC emission standards at all times during its operation, which is why many local municipalities are requiring annual random, independent testing of all antennas.

DISCLAIMER: This document is provided for informational purposes only, and is not intended to substitute for legal advice regarding zoning regulations or code compliance with local, state or federal law. Americans for Responsible Technology makes no assurances or guarantees regarding the applicability or suitability of this language for any municipality, and shall not be held responsible for any legal action arising from the use of language or concepts contained herein. Local municipalities should be aware that sample ordinances offered by wireless telecommunications companies, their subcontractors or the organizations they sponsor are generally not protective of the rights, welfare and property of local municipalities, their homeowners and other residents.

Section 1: FINDINGS

The Town of _____ hereby finds:

1.1 The wireless telecommunications industry has expressed interest in submitting applications to place antennas and associated equipment on new or existing structures in the Town's public rights-of-way for deployment of "small cell" wireless telecommunications facilities (hereinafter "small cell installations").

1.2 The deployment of small cell installations can have both positive and negative impacts on our community. Multiple small cell installations within the public right-of-way can impact property values; pose a threat to the public health, safety and welfare; create traffic and pedestrian safety hazards; impact trees where proximity conflicts may require trimming of branches or require removal of roots; create visual and aesthetic blights and potential safety risks from excessive size, height, weight, noise or lack of camouflaging which negatively impact the quality and character of the Town.

1.3 The Town currently regulates all wireless telecommunications facilities in the public right-of-way through a zoning and permit process. The Town's existing code has not been updated to reflect current telecommunications trends or necessary legal requirements. Further, the existing code provisions were not specifically designed to address the unique legal and practical issues that arise in connection with multiple small cell installations deployed in the public rights-of-way.

1.4 The Town recognizes its responsibilities under the federal Telecommunications Act of 1996 and state law, and believes that it is acting consistent with the current state of the law in ensuring that development activity does not endanger public health, safety, or welfare. The Town intends this Ordinance to ensure that the installation, augmentation and operation of small cell installations in the public rights-of-way are conducted in such a manner as to lawfully balance the legal rights of applicants under the federal Telecommunications Act and (*insert applicable State code*) with the rights, safety, privacy, property and security of residents of the Town.

1.5 This chapter is not intended to, nor shall it be interpreted or applied to: (1) prohibit or effectively prohibit any wireless telecommunications service provider's ability to provide reasonable and necessary wireless communications services; (2) prohibit or effectively prohibit any entity's ability to provide reasonable and necessary interstate or intrastate telecommunications service; (3) unreasonably discriminate among providers of functionally equivalent services; (4) deny any request for authorization to place, construct or modify wireless telecommunications service facilities solely on the basis of environmental effects of radio frequency emissions so long as such wireless facilities comply in every instance and regard with all FCC's regulations concerning such emissions; (5) prohibit any collocation or

modification that the Town may not deny under federal or state law; or (6) otherwise authorize the Town to preempt any applicable federal or state law.

1.6 Based on the foregoing, the Town (*Board, Selectmen or other governing body*) finds and determines that the preservation of public health, safety and welfare requires that this Ordinance be enacted and be effective immediately upon adoption.

NOW, THEREFORE, the Town of _____ does ordain as follows:

Section 2: DEFINITIONS

"Co-Located Small Cell Installation" means a single telecommunication tower, pole, mast, cable, wire or other structure supporting multiple antennas, dishes, transmitters, repeaters, or similar devices owned or used by more than one public or private entity.

"Exempted Telecommunications Facility" includes, but is not limited to, the following unless located within a recognized Historic District:

a. A single ground or building mounted receive-only radio or television antenna including any mast, for the sole use of the tenant occupying the residential parcel on which the radio or television antenna is located; with an antenna height not exceeding twenty-five feet;

b. A ground or building mounted citizens band radio antenna, including any mast, if the height (post and antenna) does not exceed thirty-five feet;

c. A ground, building, or tower mounted antenna operated by a federally licensed amateur radio operator as part of the Amateur Radio Service, if the height (post and antenna) does not exceed thirty-five feet;

d. A ground or building mounted receive-only radio or television satellite dish antenna, which does not exceed thirty-six inches in diameter, for the sole use of the resident occupying a residential parcel on which the satellite dish is located; provided the height of said dish does not exceed the height of the ridgeline of the primary structure on said parcel.

e. Mobile services providing public information coverage of news events of a temporary nature.

f. Hand-held devices such as cell phones, business-band mobile radios, walkie-talkies, cordless telephones, garage door openers and similar personal-use devices.

g. Government-owned and operated receive and/or transmit telemetry station antennas for supervisory control and data acquisition (SCADA) systems for water, flood alert, traffic

control devices and signals, storm water, pump stations and/or irrigation systems, with heights not exceeding thirty-five feet.

h. Town-owned and operated antennae used for emergency response services, public utilities, operations and maintenance if the height does not exceed seventy feet.

i. Telecommunication facilities less than fifty feet in height, in compliance with the applicable sections of this chapter, located on a parcel owned by the Town and utilized for public and/or quasi-public uses where it is found by the Town Board to be compatible with the existing uses of the property and serving the public interest.

j. Telecommunication facilities, including multiple antennas, in compliance with the applicable sections of this chapter, located on an industrial parcel and utilized for the sole use and purpose of a research and development tenant of said parcel, where it is found by the planning director to be aesthetically compatible with the existing and surrounding structures.

"Major Telecommunications Facility" means telecommunication towers, poles or similar structures greater than 60 feet in height, including accessory equipment such as transmitters, repeaters, microwave dishes, horns, and other types of equipment for the transmission or receipt of such signals, as well as support structures, equipment buildings and parking areas.

"NEPA" is the National Environmental Policy Act.

“Public Right of Way” means the area on, below, or above property that has been designated for use as or is used for a public roadway, highway, street, sidewalk, alley or similar purpose, and for purposes of this Chapter shall include Public Utility Easements, but only to the extent the Town has the authority to permit use of the area for this purpose. The term does not include a federal interstate highway or other areas that are not within the legal jurisdiction, ownership or control of the Town.

"Related Third Parties" shall include any entity contracting with applicant for the design, construction, maintenance, use or operation of the proposed small cell installation, including such entity's officers, employees, contractors, subcontractors, volunteers and agents or any subsidiaries, affiliates, successors in interest or legal assigns.

"Small Cell Installation" means all equipment required for the operation and maintenance of so-called "small cell" wireless communications systems that transmit and/or receive signals but are not "Major Telecommunications Facilities," including antennas, microwave dishes, power supplies, transformers, electronics, and other types of equipment required for the transmission or receipt of such signals.

Section 3: PERMITTING PROCESS

3.1 Permit Required. No small cell installation shall be constructed, erected, modified, mounted, attached, operated or maintained within the Town on or within any public right-of-way without the issuance of a permit. No approval granted under this chapter shall confer any exclusive right, privilege, license or franchise to occupy or use the public right-of-way of the Town for delivery of telecommunications services or any other purpose.

3.2 Application Content. All permit applications must include:

A. Detailed site and engineering plans for each proposed small cell installation, including full address, GIS coordinates, a list of all associated equipment necessary for its operation, as well as a proposed schedule for the completion of each small cell installation covered by the application;

B. A master plan showing the geographic service area for the proposed small cell installation(s), and all of applicant's existing, proposed and anticipated installations in the Town;

C. Certification that the proposed small cell installation(s) addresses an existing and significant gap in coverage in the service area, such certification to include a detailed map of the "gap areas" and documentation of such gaps causing an inability for a user to connect with the land-based national telephone network or maintain a connection capable of supporting a reasonably uninterrupted communication.

D. Photographs of proposed facility equipment;

E. Visual impact analyses with photo simulations including both "before" and "after" appearances, including simulations of the appearance of the equipment from the perspective of any property owner within 250 feet.

F. Certification by an independent certified radio-frequency (RF) engineer that the small cell installation will be in compliance with all FCC standards for RF emissions as they relate to the general public, including aggregate emissions for all co-located equipment;

G. Certification that the applicant has a right under state law to install wireless telecommunications facilities in the public right-of-way;

H. Documentation demonstrating significant effort to locate the small cell installation in non-residential areas and in accordance with all other provisions of this chapter;

I. Documentation that owners of all properties within 500 feet of the proposed small cell installation have been notified in writing via certified mail of the proposed installation, including its exact location;

J. A disclosure of all related third parties on whose behalf the applicant is acting, including contracting parties and co-locaters.

K. An executed indemnification agreement as set forth in section 3.6 hereof, and documentation that applicant and any third party on whose behalf the small cell facility is being constructed and any co-locator is in possession of General Liability Insurance without a pollution exclusion.

L. All required documentation to demonstrate full compliance with NEPA requirements as set forth by the FCC, unless exemption is claimed. If exempt, applicant must state the basis is for such exemption and provide proof, including all supporting documents, that each and every exempt installation meets prescribed requirements;

M. If the small cell installation is proposed to be attached to an existing utility pole or wireless support structure owned by an entity other than the Town, sufficient evidence of the consent of the owner of such pole or wireless support structure to the proposed colocation;

N. Performance specifications and data that identify the maximum and minimum amount or level of radio-frequency emissions that are produced by the equipment when it is in full operating mode, and a monitoring plan for the Applicant's equipment capable of tracking and recording the daily amounts or levels of radio-frequency emissions that are produced by the equipment in order to verify that the average and peak emissions do not exceed the applicable FCC regulations.

3.3 Application Fee. The Town shall assess a per-installation fee of _____*(See Note 1*) to cover the Town's costs of processing, reviewing, evaluating, conducting a public hearing, and other activities involved in consideration of the application, and conducting oversight of the construction of the small cell installation to ensure compliance with zoning requirements.

3.4 Consultant Fee. The Town shall have the right to retain an independent technical consultant to assist the Town in its review of the application. The reasonable cost of the review shall be paid by the Applicant.

3.5 Compliance Bond. Upon approval of the application, the Permittee shall be required to post a bond in the amount of $50,000 (fifty thousand dollars) for each small cell installation, such bond to be held and maintained during the entire period of Permittee's operation of each small cell installation in the Town as a guarantee that no such installation, including any co-located equipment, exceeds or will exceed the allowable FCC limits for radio frequency radiation exposure to the general public as determined by a qualified independent radio frequency engineer under Section 3.7.2 hereof.

3.6 Indemnification. Permittee shall provide an executed agreement in the form provided by the Town, pursuant to which Permittee and any related third parties agree to defend, hold harmless and fully indemnify the Town, its officers, employees, agents, attorneys, and volunteers, from (i) any claim, action or proceeding brought against the Town or its officers, employees, agents, or attorneys to attack, set aside, void, or annul any such approval of the Town or (ii) a successful legal action brought against the Town for loss of property value or other harm caused by the placement or operation of a small cell installation. Such indemnification shall include damages, judgments, settlements, penalties, fines, defensive costs or expenses, including, but not limited to, interest, attorneys' fees and expert witness fees, or liability of any kind related to or arising from such claim, action, or proceeding whether incurred by the Permittee, the Town and/or the parties initiating or bringing such proceeding. The agreement shall also include a provision obligating the Permittee to indemnify the Town for all of the Town's costs, fees and damages which the Town incurs in enforcing the indemnification provisions of this Section.

3.7 Annual Recertification.

3.7.1 Each year, commencing on the first anniversary of the issuance of the permit, the Permittee shall submit to the Town an affidavit which shall list all active small cell wireless installations it owns within the Town by location, certifying that (1) each active small cell installation is covered by liability insurance in the amount of $2,000,000 per installation, naming the Town as additional insured; and (2) each active installation has been inspected for safety and found to be in sound working condition and in compliance with all federal regulations concerning radio frequency exposure limits.

3.7.2 The Town shall have the right to employ a qualified independent radio frequency engineer to conduct an annual random and unannounced test of the Permittee's small cell wireless installations located within the Town to certify their compliance with all FCC radio-frequency emission limits as they pertain to exposure to the general public. The reasonable cost of such tests shall be paid by the Permittee.

3.7.3 In the event that such independent tests reveal that any small cell installation or installations owned or operated by Permittee or its Lessees, singularly or in the aggregate, is emitting RF radiation in excess of FCC exposure guidelines as they pertain to the general public, the Town shall notify the Permittee and all residents living within 1500 feet of the small cell installation(s) of the violation, and the Permittee shall have forty-eight (48) hours to bring the small cell installation(s) into compliance. Failure to bring the small cell installation(s) into compliance and maintain them in compliance throughout the period of the lease shall result in the forfeiture of all or part of the Compliance Bond, and the Town shall have the right to require the removal of such installation(s), as the Town in its sole discretion may determine is in the public interest.

3.7.4 Any small cell wireless installation which is no longer in use shall be removed by the Permittee within 30 days of being taken out of use.

3.7.5 Any small cell wireless installation which is not removed within 30 days after being listed as no longer in use in the annual recertification affidavit shall be subject to a fine of $100/day until such installation is removed.

3.7.6 Where such annual recertification has not been properly or timely submitted, or equipment no longer in use has not been removed within the required 30-day period, no further applications for small cell wireless installations will be accepted by the Town until such time as the annual re-certification has been submitted and all fees and fines paid.

3.8 Non-Permitted Installations. Any small cell installation constructed, erected, modified or enhanced prior to the issuance of a site-specific permit from the Town shall be removed prior to the submission of any other application. No application for a small cell installation shall be considered, and no so-called "shot clock" for approval shall commence, while such unauthorized installations remain.

3.9 Notice of Permit Filing. Notice of the filing of any permit submitted pursuant to this ordinance shall be sent to all property owners within 500 feet of each and every proposed small cell installation within five (5) days of such filing, such notice to be sent by certified mail at the expense of the Permittee.

3.10 Public Availability of Permit Applications. All permit applications submitted pursuant to this ordinance, including all related documents, shall be made available for viewing and/or copying by any member of the public during normal business hours at the relevant office of the Town. Any charge for copies shall be limited to the Town's actual cost. No additional charges may be assessed against any member of the public for access to the entire permit and all of its related documents.

Section 4: LOCATION AND CONFIGURATION PREFERENCES

4.1 Siting Guidelines. The purpose of this section is to provide guidelines to applicants and the reviewing authority regarding the preferred locations and configurations for small cell installations in the Town, provided that nothing in this section shall be construed to permit a small cell installation in any location that is otherwise prohibited by this ordinance or any other section of the Town code.

4.2 Order of preference - Location. The order of preference for the location of small cell installations in the Town, from most preferred to least preferred, is:

1. Industrial zone
2. Commercial zone
3. Mixed commercial and residential zone

4. Residential zone

(*See Note 2*)

Section 5: INSTALLATION SPECIFICATIONS

5.1 The Permittee must construct, install and operate the small cell installation in strict compliance with the plans and specifications included in the application.

5.2 Where feasible, as new technology becomes available, the Permittee shall replace larger, more visually intrusive facilities with smaller, less visually intrusive facilities, after receiving all necessary permits and approval required by the Town.

5.3 The Permittee shall submit and maintain current at all times basic contact and site information on a form to be supplied by the Town. The Permittee shall notify the Town of any changes to the information submitted within seven days of any change, including the name or legal status of the owner or operator.

5.4 At all times, all required notices and signs shall be posted on the site as required by the FCC and state law, and as approved by the Town. The location and dimensions of a sign bearing the emergency contact name and telephone numbers shall be posted pursuant to the approved plans.

5.5 The Permittee shall maintain current at all times liability and property insurance for each small cell installation in the Public Right of Way in the amount of $2,000,000 (two million dollars) naming the Town as additional insureds.

5.6 The proposed small cell installation shall have an adequate fall zone to minimize the possibility of damage or injury resulting from pole collapse or failure, ice fall or debris fall, and to avoid or minimize all other impacts upon adjoining properties.

5.7 Every effort shall be made to locate small cell installations no less than 1500 feet away from the Permittee's or any Lessee's nearest other small cell installation, or within _____ feet of any permanent residential dwelling. (*See Note 3*)

5.8 Single or co-located small cell installations must be mounted on an existing structure such as a utility or lighting pole that can support its weight and the weight of any existing co-located equipment. All new wires needed to service the small cell installation must be located within the width of the existing structure so as to not exceed the diameter and height of the existing utility pole.

5.9 All equipment not to be installed on or inside the pole must be located underground, flush to the ground, within three (3) feet of the utility pole. Each installation is to have its own dedicated power source to be installed and metered separately.

5.10 If a Permittee proposes to replace a pole in order to accommodate a small cell installation, the pole shall match the appearance of the original pole to the extent feasible, unless another design better accomplishes the objectives of this section. Such replacement pole shall not exceed the height of the pole it is replacing by more than seven feet.

5.11 Each small cell installation facility shall be designed to be resistant to, and minimize opportunities for, unauthorized access, climbing, vandalism, graffiti and other conditions that would result in hazardous situations, visual blight, or attractive nuisances. The Town may require the provision of warning signs, fencing, anti-climbing devices, or other techniques to prevent unauthorized access and vandalism when, because of their location or accessibility, a small cell installation has the potential to become an attractive nuisance.

5.12 The Permittee shall repair, at its sole cost and expense, any damage including, but not limited to, subsidence, cracking, erosion, collapse, weakening, or loss of lateral support to Town streets, sidewalks, walks, curbs, gutters, trees, parkways, street lights, traffic signals, improvements of any kind or nature, or utility lines and systems, underground utility line and systems, or sewer systems and sewer lines that result from any activities performed in connection with the installation or maintenance of a small cell installation in the public right-of-way. The Permittee shall restore such areas, structures and systems to the condition in which they existed prior to the installation or maintenance that necessitated the repairs. In the event the Permittee fails to complete such repair within the number of days stated on a written notice by the permitting authority, the permitting authority shall cause such repair to be completed at Permittee's sole cost and expense.

5.13 Prior to issuance of a building permit, the applicant shall obtain the permitting authority's approval of a tree protection plan prepared by a certified arborist if the small cell installation will be located within the canopy of a street tree, or a protected tree on private property, or within a 10-foot radius of the base of such a tree. Depending on site specific criteria (e.g., location of tree, size, and type of tree, etc.), a radius greater than 10 feet may be required by the permitting authority.

5.14 Applicant shall abide by all local, state and federal laws regarding design, construction and operation of the small cell installation, including all state and federal Occupational Safety and Health Administration (OSHA) requirements for worker safety in, around and above power lines.

Section 6: APPLICABILITY

This chapter shall apply to all small cell installations and co-located small cell installations in the Town, and shall not apply to any Exempted Telecommunications Facility or Major Telecommunications Facility.

* * *

Note 1: In its *Declaratory Ruling and Third Report and Order* issued in September, 2018, the FCC suggests that application fees be no more than $500 per application, which can include up to five small cell installations, with an additional $100 per installation after five. The FCC also suggests a fee limitation of $270 per year for each small cell installation to cover any recurring fees, including rights-of-way. However, municipalities may charge their actual costs for processing such applications.

Note 2: The town may also wish to include preference for the *configuration* of small cell installations, from most-preferred to least-preferred. Configuration preferences might be:

(1) Co-located with existing wireless facilities,
(2) Mounted on existing utility poles,
(3) Mounted on new poles or towers.

Considerations include the structural integrity of existing utility poles, the fact that mandating co-located equipment could result in an unfair esthetic burden on some residents or neighborhoods, and the possibility that new poles might be bigger, heavier and more obtrusive than existing poles.

Note 3: Every possible effort should be made to prevent the placement of small cell installations in close proximity to residences. Viable and legally defendable setbacks will vary based on zoning.

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Version 10.1.1 June, 2020

Planning Department

From: Amy Kostant <amy@sciencecom.org>
Sent: Monday, June 5, 2023 1:03 PM
To: Planning Department
Subject: Shannondale lake Telecommunications Tower (file: 23-3-SP)
Attachments: Balmori Cell Tower Radiation Research Review 2022.pdf; 5G-4G Cell Tower Abstract Compilation Final 2023.pdf; The Effect of Continuous Low-Intensity Exposure to Electromagnetic Fields from Radio Base Stations to Cancer Mortality in Brazil.pdf

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To the planning committee:

I'm concerned about the siting of a cell tower on Shannondale Lake where many families live, children play, and many people swim and fish. Health concerns associated with continuous exposure to low level RF radiation – for humans and for wildlife, are currently being debated within the scientific community. Until there is general consensus that this is safe – which to date there is not, it makes sense to put the tower elsewhere, away from a residential neighborhood.

People are certainly going to use wireless devices -- we appreciate high speed internet, but there are safer ways to provide this service than by putting a tower in a residential community. Please take a look at the tremendous amount of peer-reviewed research and consider what we've learned from researchers from the Yale School of Medicine, the National Toxicology Program, and University of California at Berkeley – to name just a few.

I urge you to consider the information presented by CBS news here https://ehtrust.org/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/, along with the attached studies, which are just a few of many. If you'd like more resources, I'll be happy to provide them.

While the jury is out on exactly which effects are how harmful and to whom, it is not a good idea to put this tower in a residential community. Once the tower goes in, it will be very difficult to remove.

Thank you.
Amy Kostant
5 Twin Cove Court
Harpers Ferry, WV 25425

From: Amy Kostant
To: Planning Department
Subject: RE: RF report for cell tower at Shannondale Lake
Date: Tuesday, June 6, 2023 2:13:44 PM

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Hi Jennilee,

Thanks for this.

I understand your point that an RF report is not strictly required, however, given this exceptional situation, wouldn't it be prudent to request one since the proposed monopole tower is going to affect so many residents who live nearby? It's difficult to evaluate the need and the possible health effects for local residents without that type of information.

Can you please include this question in the Planning Commission packet?

Thanks,
Amy Kostant

From: Planning Department <PlanningDepartment@jeffersoncountywv.org>
Sent: Friday, June 2, 2023 2:04 PM
To: Amy Kostant <amy@sciencecom.org>
Subject: RE: RF report for cell tower at Shannondale Lake

Good afternoon Amy,

A Radio Frequency (RF) Report is not required as part of the Concept Plan process. The Concept Plan and Narrative for this project have been posted to the County's website. Please feel free to review the materials submitted by the applicant and let us know if you have any follow up questions.

Please note that the tower will be required to comply with all Federal Communication Commission (FCC) rules and regulations.

If you would like to submit written comments for inclusion in the June 13, 2023 Planning Commission packet, please do so by June 6, 2023. The Planning Commission packet will be posted to the County's Website no later than June 9, 2023.

Thank you and have a nice day.

Jennilee Hartman, Zoning Clerk
Office of Planning and Zoning
304-728-3228

From: Amy Kostant <amy@sciencecom.org>
Sent: Friday, June 2, 2023 11:53 AM
To: Planning Department <PlanningDepartment@jeffersoncountywv.org>
Subject: RF report for cell tower at Shannondale Lake

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or on clicking links from unknown senders.
Hello,

If you have it, would you please send me a copy of the Radio Frequency (RF) report for the proposed cell tower on Shannondale Lake?

Thanks very much,
Amy Kostant
202-255-6665

Environmental Research 214 (2022) 113851

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journal homepage: www.elsevier.com/locate/envres

Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer

A. Balmori [1]

C/ Rigoberto Cortejoso, 14 47014, Valladolid, Spain

ARTICLE INFO

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Microwave syndrome
Radar
Radio antennas

ABSTRACT

The objective of this work was to perform a complete review of the existing scientific literature to update the knowledge on the effects of base station antennas on humans. Studies performed in real urban conditions, with mobile phone base stations situated close to apartments, were selected. Overall results of this review show three types of effects by base station antennas on the health of people: radiofrequency sickness (RS), cancer (C) and changes in biochemical parameters (CBP). Considering all the studies reviewed globally (n = 38), 73.6% (28/38) showed effects: 73.9% (17/23) for radiofrequency sickness, 76.9% (10/13) for cancer and 75.0% (6/8) for changes in biochemical parameters. Furthermore, studies that did not meet the strict conditions to be included in this review provided important supplementary evidence. The existence of similar effects from studies by different sources (but with RF of similar characteristics), such as radar, radio and television antennas, wireless smart meters and laboratory studies, reinforce the conclusions of this review. Of special importance are the studies performed on animals or trees near base station antennas that cannot be aware of their proximity and to which psychosomatic effects can never be attributed.

1. Introduction

During the last few decades, hundreds of thousands of mobile phone base stations and other types of wireless communications antennas have been installed around the world, in cities and in nature, including protected natural areas, in addition to pre-existing antennas (television, radio broadcasting, radar, etc.). Only the aesthetic aspects or urban regulations have been generally considered in this deployment, while the biological, environmental and health impacts of the associated non-ionizing electromagnetic radiation emissions have not been assessed so far. Therefore, the effects on humans living around these anthropogenic electromagnetic field sources (antennas) have not been considered.

In France, there is a significant contribution of mobile phone base stations in the exposure to radiofrequency electromagnetic fields (RF-EMF) of urban citizens living nearby (De Giudici et al., 2021). Some studies from India indicate that more than 15% of people have levels of EMF strength above 12 V/m due to their proximity to antennas (Premlal and Eldhose, 2017). Exposure estimates have shown that RF-EMF from mobile telephone systems is stronger in urban than in rural areas. For instance, in Sweden the levels of RF radiation have increased considerably in recent years, both outdoor and indoor, due to new telecommunication technologies, and the median power density measured for RF fields between 30 MHz and 3 GHz was 16 $\mu W/m^2$ in rural areas, 270 $\mu W/m^2$ in urban areas and 2400 $\mu W/m^2$ in city areas (Hardell et al., 2018). Total exposure varies not only between urban and rural areas but also, depending on residential characteristics, between different floors of a building, with a tendency for building exposure to increase at higher floors (Breckenkamp et al., 2012).

Over the past five decades, and more intensively since the beginning of this century, many studies and several reviews have been published on the effects of anthropogenic electromagnetic radiation on humans living around the antennas. The first studies were carried out with radio and television antennas, investigating increases in cancer and leukaemia (Milham, 1988; Maskarinec et al., 1994; Hocking et al., 1996; Dolk et al., 1997a, 1997b; Michelozzi et al., 1998; Altpeter et al., 2000), as well as around radars (Kolodynski and Kolodynska, 1996; Goldsmith, 1997).

Regarding base station antennas, there are scientific discrepancies in their effects: some studies concluded that there are no health-related effects (e.g. Augner and Hacker, 2009; Blettner et al., 2009; Röösli et al., 2010; Baliatsas et al., 2016) whereas others found increases in cancer and other health problems in humans living around antennas (e.g. Santini et al., 2002; Navarro et al., 2003; Bortkiewicz et al., 2004;

E-mail address: abalmorimartinez@gmail.com.
[1] Independent researcher

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Eger et al., 2004; Wolf and Wolf, 2004; Abdel-Rassoul et al., 2007; Khurana et al., 2010; Dode et al., 2011; Shinjyo and Shinjyo, 2014; Gandhi et al., 2015; López et al., 2021; Rodrigues et al., 2021). There is a specific symptomatology linked to radar and RF exposure at low levels, characterized by functional disturbances of the central nervous system (headache, sleep disturbance, discomfort, irritability, depression, memory loss, dizziness, fatigue, nausea, appetite loss, difficulty in concentration, dizziness, etc.), that has been termed 'RF sickness' (Lilienfeld et al., 1978; Johnson Lyakouris, 1998; Navarro et al., 2003).

The objective of this study was to perform a complete review of the existing scientific literature to update the knowledge on the effects of base stations on humans living around the antennas.

2. Methods

A search was performed in the EMF portal, Google Scholar and PubMed databases with the words: "mobile phone base station and health" or "cell tower and health".

Only studies performed in real urban conditions, with mobile phone base stations situated close to apartments, were selected. Studies conducted in larger regions with numerous antennas, based on surveys and geographic data, were also included.

On the contrary, studies were excluded that considered different sources of electromagnetic radiation, such as mobile phone base stations together with broadcast transmitters (TV and radio), radar, mobile phones, cordless phones, Wi-Fi or wireless smart meters. Also excluded were those that included antennas and powerlines jointly. Studies that only performed measurements or modelling of radiation levels in the environment of the antennas or in the body, but did not deal with health effects, were excluded, as were surveys on risk perception and the nocebo effect, modelled radiofrequency electromagnetic field exposure from mobile-phone base stations or perceived exposure. All experimental laboratory studies, experiments in an exposure chamber or adapted room were also excluded. Finally, the comments or criticism of previously published studies were also excluded. However, due to their importance the conclusions of some of the excluded studies will be discussed in the corresponding section.

3. Results

The studies that met the selected criteria are presented in chronological order in Table 1, catalogued as Y/N depending on whether or not they found effects. The selected studies cover three types of effects: radiofrequency sickness (RS) (according to Lilienfeld et al., 1978; Johnson Lyakouris, 1998), cancer (C) and changes in biochemical parameters (CBP). Table 1 also includes the authors, year and country, antenna type, study design, diseases and symptoms found/not found and the main conclusions of each study.

Considering all the selected studies (n = 38), 73.6% (28/38) showed effects: 73.9% (17/23) for radiofrequency sickness, 76.9% (10/13) for cancer and 75.0% (6/8) for changes in biochemical parameters (Fig. 1). Therefore, most of the studies carried by research groups from twenty different countries reach the same conclusions.

For the reasons previously explained, the following studies (n = 85) were not considered in this review, even though the conclusions of some of these studies will be discussed later due to their importance regarding the similarities of the electromagnetic radiation types involved and the health effects found in many cases. Several studies only performed measurements or modelling of radiation levels in the environment of the antennas or in the body, but did not deal with the effects on health (e.g. Aniołczyk, 1999; Henderson and Bangay, 2006; Keow and Radiman, 2006; Neitzke et al., 2007; Bürgi et al., 2008; Augner et al., 2009; Chen and Chuang, 2009; Schmiedel et al., 2009; Viel et al., 2009; Hansson et al., 2011; Alhekail et al., 2012; Breckenkamp et al., 2012; Beekhuizen et al., 2013; Bürgi et al., 2014; Lyare et al., 2019; Urbinello et al., 2014; Lemaire et al., 2016; Admawi, 2021; De Giudici et al., 2021; Kazaure et al., 2021; Yetiş and Kayili, 2021). Some were surveys on risk perception and the nocebo effect, modelled RF-EMF exposure from mobile-phone base stations or perceived exposure (Wiedemann et al., 2006; Dohle et al., 2012; Kowall et al., 2012; Freudenstein et al., 2015; Dieudonné, 2016; Klaps et al., 2016; Martens et al., 2017; Koh et al., 2020). Others jointly considered various sources of electromagnetic fields such as telephone antennas, mobile phones, cordless phones, Wi-Fi, powerlines or wireless smart meters (Seitz et al., 2005; Baliatsas et al., 2011; Atzmon et al., 2012; Eskander et al., 2012; Frei et al., 2012; Lamech, 2014; Singh and Pati, 2016; Boehmert et al., 2020; Akkam et al., 2020). Some studied the effects of radio or television antennas (Milham, 1988; Maskarinec et al., 1994; Hocking et al., 1996; Dolk et al., 1997a, 1997b; McKenzie et al., 1998; Michelozzi et al., 1998; Altpeter et al., 2000; Hocking and Gordon, 2000; Boscolo et al., 2001; Cooper et al., 2001; Michelozzi et al., 2002; Hallberg and Johansson, 2002; Elwood, 2003; Ha et al., 2003; Park et al., 2004; Abelin et al., 2005; Altpeter et al., 2006; Ha et al., 2007; Satta et al., 2018). Others were radar studies (Kolodynski and Kolodynska, 1996; Goldsmith, 1997; Szmigielski et al., 2001; Yakymenko et al., 2011; Schoeni et al., 2016; Martens et al., 2018). Some studies performed experiments in a laboratory, exposure chamber or adapted room, with simulated or real electromagnetic radiation from base station antennas (e.g. Zwamborn et al., 2003; Hinrichs et al., 2005; Regel et al., 2006, 2007; Eltiti et al., 2007; Leitgeb et al., 2008; Riddervold et al., 2008; Augner et al., 2009; Augner et al., 2010; Wallace et al., 2010; Danker-Hopfe et al., 2010; Falcioni et al., 2018; Azimzadeh and Jelodar, 2019; Smith-Roe et al., 2020). Some reports were comments or criticisms of previously published studies (e.g. Coggon, 2006; Röösli and Huss, 2008; Bithell, 2010; Dode and Leão, 2012; Foster and Trottier, 2012; Mortazavi, 2014, 2017).

4. Discussion

The results of this review show three types of effects by base station antennas on the health of humans: radiofrequency sickness, cancer and changes in biochemical parameters (Fig. 1). From among all these studies, most of them found effects (73.6%). Thus, despite some limitations and differences in study design, statistical measures, risk estimates and exposure categories (Khurana et al., 2010), together they provide a consistent view of the effects on the health of people living in the vicinity of base station antennas.

Studies conducted in large regions with numerous antennas, based on surveys and geographic data (e.g. Augner and Hacker, 2009; Dode et al., 2011; Baliatsas et al., 2016; Martens et al., 2017; Dode et al. al., 2021), have the limitation that there may be many factors other than the base station antennas affecting the health of the population (environmental and occupational determinants of diseases and symptoms, individual characteristics such as food and life habits, activity level, smoking, self-medication, individual pathologies or genetic factors) that can act as confounding factors. It is important to mention here that the meters used for power density measurements in research papers should have more high quality equipment and better measurement methods.

On the other hand, some studies did not meet the strict conditions to be considered in this review, but due to their importance regarding the similarities of the electromagnetic radiation types involved and the effects found in many cases, they provide important supplementary evidence, as we will see in the next paragraphs.

For example, mobile phone users had an increased risk of headache (one of the typical symptoms for RF sickness near base station antennas) compared with non-users, and the risk of headache was also increased in those who had a longer daily call duration and higher daily call frequency (Wang et al., 2017). The same was also seen with cancer (Hardell et al., 2007). On the other hand, the symptoms caused by wireless smart meters were similar to those reported by people exposed to RF fields emitted by mobile phones (Lamech, 2014).

Table 1
Studies that met the selected criteria.

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
1 Y RS	Santini et al. (2002), 2003a and 2003b France	Base station antennas GSM 900 and 1800 MHz	Questionnaire survey in 530 people	Effects found on: -tiredness -headache -sleep disturbance -discomfort -irritability -depression -memory loss -dizziness -libido decrease -visual perturbations	Effects occur up to a distance of 300 m from the antenna. Older subjects are more sensitive. Also, hat the facing location is the worst position for some symptoms s tudied, especially for distances till 100 m from base stations. The frequency of reported complaints is significantly higher for women in comparison with men
2 Y RS	Gómez-Perretta et al., 2013 Spain	Base station antennas GSM 900 and 1800 MHz	Questionnaire survey in 101 people and electric field measurements	Effects found on: -fatigue -irritability -headache -nausea -appetite loss -discomfort -sleep disturbance -depression -difficulty in concentration -dizziness	Significant correlation between the declared severity of the symptoms and the measured power density. The separation of respondents into two different exposure groups also showed an increase of the declared severity in the group with the higher exposure. The incidence of most of the symptoms was related to exposure levels, independently of the demographic variables and some possible risk factors. Health changes related with GSM exposure seem to occur in a manner unrelated with those fears
3 Y RS	Bortkiewicz et al. (2004) Poland	Base station antennas	Review of previous publications	Effects found on: -circulatory system -sleep disturbances -irritability depression -blurred vision -concentration -difficulties nausea -lack of appetite -headache -vertigo	Relationship between the incidence of individual symptoms, the level of exposure, and the distance. This association was observed in both groups of persons, those who linked their complaints with the presence of the base station and those who did not notice such a relation.
4 Y C	Eger et al. (2004) Germany	2 Base station antennas	Number of cancer cases in the selected population (1045 resident) in Naila to compare results an inner area (within a distance of 400 m from the base station antennas) and outer area (beyond 400 m).	The number of newly developed cancer cases in the inner area is more than the expected number taken from the cáncer register, which represents the total population being irradiated. The group who had lived during the past five years within a distance of 400 m from the Base station antennas have a two times higher risk of developing cancer than that of the average population. The relative risk of getting cancer in the inner área compared with the Saarland cancer register is 1.7.	The risk of newly developing cancer was three times higher among those patients who had lived during past ten years (1994–2004), within a distance of 400 m From the cellular transmitter, in comparison to those who had lived further away.
5 Y C	Wolf and Wolf (2004) Israel	1 Base station antenna	A cancer incidence study to investigate the incidence of cancer cases of individuals (the cohort included 622 people) exposed to a Base station antenna, in comparison to those of a nearby clinic out of that area, to the national incidence rates of the whole country and to the incidence rates in the whole town of Netanya	There were 4.15 times more cases of cáncer in area A (breast carcinoma, ovary carcinoma, lung carcinoma, Hodgkin's disease, osteoid osteoma, and hypernephroma) than in the entire population.	The study indicates an association between an increased incidence of cancer and living in proximity to a Base station antenna.
6 Y RS	Hutter et al. (2006) Austria	10 Base station antennas in the 900 MHz band	Questionnaire survey in 365 subjects and exposure measurements	Effects found on: -headache -difficulties to concéntrate -Cold hands or feet No effects found on: -vertigo -palpitations -tremor -hot flushes -sweating -loss of apetite -loss of energy, -exhaustion -tiredness	Self-reported symptoms like headache and difficulties in concentrating show an association with microwave exposure from base stations, not attributable to subjects' fear of health effects from these sources. Other symptoms, like sleeping problems, seem to be more due to fear of adverse health effects than actual exposure.

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
				-feeling strained -sleep	
7 Y RS	Abdel-Rassoul et al. (2007) Egypt	Base station antennas (GSM)	Questionnaire survey on 85 exposed persons and 80 controls	Effects found on: -headache -memory changes -dizziness -tremors -depressive symptoms -sleep disturbance No effects found on: -Blurred visión -Irritability -Lack of concentration	The prevalence of neuropsychiatric complaints were significantly higher among exposed inhabitants than controls. Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition.
8 N CBP	Augner and Hacker (2009) Austria	Base station antennas	Questionnaire survey on fifty-seven participants and saliva samples	Self-declared base station neighbors (≤100 m) had significantly higher concentrations of alpha-amylase in their saliva, higher rates in symptoms, somatization, obsessive-compulsive, anxiety, phobic anxiety. There were no differences in EMF-related health concern scales.	Self-declared base station neighbors are more strained than others. EMF-related health concerns cannot explain these findings.
9 N RS	Blettner et al. (2009) Berg-Beckhoff et al. (2009) Germany	Base station antennas (GMS 900 and 1800 and UMTS 2170)	Questionnaire survey on 30,047 participants and geo-coding information on the residence distance (less or more than 500 m) to the nearest mobile phone base station. In a second phase RF measurements were conducted for a sub-sample in the households of 1500 persons	The mailed questionnaire included a list of 38 symptoms that have been reported in previous studies to be possibly associated with RF-EMF exposure	Participants who were concerned about or attributed adverse health effects to mobile phone base stations and those living in the vicinity of a mobile phone base station (500 m), reported slightly more health complaints tan others. The observed slightly higher prevalence of health complaints near base stations cannot be explained by attributions or concerns alone. The worries and health complaints of people living close to mobile phone base stations need to be taken seriously. Measured RF-EMFs emitted from mobile phone base stations were not associated with health disturbances. However, the study shows that sleep disturbances and health complaints are related to the attribution of adverse health effects to mobile phone base stations.
10 Y RS C	Kundi and Hutter (2009) Austria	Base station antennas	Review of previous publications	Effects found on: Adverse neurobehavioral symptoms or cancer	There are indications from epidemiology that such exposures affect wellbeing and health weakly supported by human provocation studies and an inconclusive body of evidence from animal and in vitro studies. Cross-sectional investigations of subjective health as a function of distance or measured field strength, despite differences in methods and robustness of study design, found indications for an effect of exposure that is likely independent of concerns and attributions. Two ecological studies of cancer in the vicinity of base stations report both a strong increase of incidence within a radius of 350 and 400 m respectively. Due to the limitations inherent in this design no firm conclusions can be drawn, but the results underline the urgent need for a comprehensive investigation of this issue
11 Y C	Eger and Jahn (2010) Germany	Base station antennas	Questionnaire survey on 255 persons	Effects found on: -sleep problems -depression -headaches -cerebral affections -concentration difficulties -joint problems -infections -skin problems	A significant relationship between mean exposure levels of the study participants and reported health symptoms. Within the 400-m radius around the transmitter, a higher symptom rate could be documented for 14 out of 19 symptom groups in the highest exposure groups compared to groups

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
				-dizziness -cardiovascular problems -disturbance of equilibrium -visual problems -nosebleed -gastrointestinal problems No effects found on: -toothaches -hormonal imbalances -weight gain -weight loss	further away from the transmitter and the difference is statistically significant. Decreasing symptom scores in relation to decreasing mean exposure levels caused by cell phone transmitter emissions
12 N C	Elliott et al. (2010) Great Britain	Base station antennas	Data on all registered cases of cancer in children aged 0–4 in Great Britain and data on mobile phone base stations to investigate the risk of early childhood cancer associated with the mother's exposure to radiofrequency from and proximity to mobile phone base stations during pregnancy.	Of the 1397 cases, there were 251 brain and central nervous system cancers and 527 cases of leukaemia and non-Hodgkin's lymphoma. The study found no association between mobile phone base stations and risk of cáncer.	In this systematic national investigation the authors found no association between risk of cancer in young children and estimated exposures to radiofrequency from mobile phone base stations during pregnancy. However there is a research paper limitation on page 5: "our models did not include information on other sources of radiofrequency exposure, such as from microcells or picocells" and the city centers (especially) are full of these kind of antennas.
13 Y RS C	Khurana et al. (2010) international	Base station antennas	Review of previous publications	Effects found on: Adverse neurobehavioral symptoms or cancer	The authors identified a total of 10 epidemiological studies that assessed for putative health effects of mobile pone base stations. Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. The authors found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances <500 m from base stations.
14 N RS	Röösli et al. (2010) Switzerland	Base station antennas (GMS 900 and 1800 and UMTS 2170)	Systematic review	There are no adverse effects	Not indication of an association between any health outcome and RF-EMF exposure from mobile phone base stations at levels typically found in our everyday environment. There is also no evidence that EHS individuals are more susceptible to base station radiation than the rest of the population. The evidence for the absence of long-term effects is limited.
15 N CBP C	Yildirim et al. (2010) Turkey	Base station antennas	Blood samples to analise the micronucleus (MN) frequency and chromosomal aberrations on blood in people living around mobile phone base stations and healthy controls.	There was not a significant difference of MN frequency and chromosomal aberrations between the two study groups.	Mobile phones and their base stations do not produce important carcinogenic changes.
16 Y RS	Alazawi, 2011 Iran	8 Base station antennas	Questionnaire survey on 375 subjects. Not measurements	Effects found on: -headaches -sleep disturbances -irritability -depressive -tendencies -feeling of discomfort, -difficulties in concentration -memory loss -lowering of libido	This study shows that inhabitants living nearby mobile phone base stations are at risk for developing non specific health symptoms, the facing position appears to be the worst one for distances from cellular phone base stations <100 m. It is advisable that cellular phone base stations should not be sited closer than 300 m to populations, as a precautionary measure, sitting of base stations should be such as to minimize exposure of neighbors.
17 Y C	Dode et al. (2011) Brazil	Base station antennas	This research was conducted in a broad environmental context, aiming to verify if there is a spatial correlation between the Base station antennas and the cases of death by neoplasia during the period between 1996 and 2006 in Belo Horizonte municipality (Brazil).	The mortality rates and the relative risk were higher for the residents inside a radius of 500 m from the Base station antennas, compared to the average mortality rate of the entire city, and a decreased dose– response gradient was observed for residents who lived farther away from these base stations.	The research showed the existence of a spatial correlation between cases of death by neoplasia and the locations of the Base station antennas, in the Belo Horizonte municipality from 1996 to 2006.

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
18 Y C	Li et al. (2012) Taiwan	Base station antennas	Population-based case–control study in Taiwan considerering incident cases aged 15 years or less and admitted in 2003–2007 for all neoplasm (n = 3481 children). Exposure of each study subject to radio frequency (RF) was indicated by the averaged annual power density within 5 years prior to the neoplasm diagnosis. Controls were randomly selected.	Taiwanese children with higher-than median exposure of RF potentially emitted from Base station antennas were at significantly increased risk of all neoplasms combined. Although there were also positive associations between RF power density and risks of brain neoplasm and leukaemia in children, such associations did not reach statistical significance.	This study noted a significantly increased risk of all neoplasms in children with higher-than-median RF exposure to Base station antennas. The slightly elevated risk was seen for leukaemia and brain neoplasm, but was not statistically significant.
19 N C	Stewart et al. (2012) Great Britain	1 Base station antennas (GMS 1800)	Data on cancer incidence and mortality accessing the medical information of near residents	The study cannot conclude that the base station is responsible for the incidence of cancer in the local residents	Although the age range for local residents with cancer in the suspected cluster was younger than might be generally expected, there was no evidence that their cancer incidence is associated with the mobile phone base station. 10 cancers were registered after installation of the base station. However, the collection of cancers does not fulfil the criteria for a cancer cluster; the cases are a mixed variety of relatively common cancers. No single type of cancer was dominant, all but one were common types of cancer and none were seen in a group not usually affected by that cancer. Data from primary and secondary care also provide evidence that lifestyle and family history factors could have contributed to some individual cases.
20 N RS	Islam and Mohammed (2014) Bangladesh	Base station antennas	Questionnaire survey on 220 adults living near a Base station antenna for at least one year in two selected areas	Half of the respondents experienced problems in sleeping patterns, recent episodes of headache or dizziness and mood change, anxiety, or depression. 11 respondents experienced some generalized burning sensation and 4 reported episodes of shaking or fits. 48 respondents mentioned one or more other health effects, such as mood changes/problem, buzzing in the head, hopelessness, palpitation, tachycardia, heaviness of chest, anorexia, diarrhoea, and skin diseases.	From the results of the study cannot conclude that the health effects are direct results of the base station antennas. However, the complaints were similar to those of other studies, which shows the importance of conducting further research to determine the effects of electromagnetic radiarion from base station antennas on human health and should be considered as a public health concern.
21 Y RS	Pachuau and Pachuau (2014) India	Base station antennas (GSM 900)	Questionnaire survey conducted on 64 adults (31 female, 33 male) and electric field measurements. Health symptoms of RF exposure faced by the inhabitants within 50 m and outside 50 m from the tower were analysed and compared.	Effects found on: -Muscle pain -Fatigue -Sleep disorder -Nausea -Skin problema -Dizziness -Feeling of discomfort -Difficulty in concentration -Memory loss -Visual disruption	Inhabitants living within 50 m had more health complaints than those living outside 50 m. It was also found that females had more complaints than males
22 Y RS	Shinjyo and Shinjyo (2014) Japan	2 base station antennas (CDMA 800 MHz and 2 GHz)	Medical examinations and health questionnaires comparing the health of 107 residents during the base station's operation and after its removal. Measurement of the power density	Effects found on: -fatigue -eye problems -sleep disturbances -dizziness -headache -tinnitus -nasal bleeding No effects found on: -tachycardia -tumours -skin problems -rhinitis -angina pectoris -hearing loss	A total of 34 residents suffered from health problems after installation of the 800 MHz antennas. Three months after their removal this number decreased to 13. There were 41 residents who had health problems after installation of the 2 GHz antennas, and this number decreased to 15 after removal of the 2 GHz antennas. In total 49 residents suffered from health problems during operation of both the 800 MHz and the 2 GHz antennas. However, this number decreased to 25 after removal of both sets of antennas.The residents had no prior knowledge about possible adverse health effects of RF-EMFs. Health problems of the residents were associated with the operation of the

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
					mobile phone base station and these problems improved after its removal.
23 Y CBP	Gandhi et al. (2015) India	Base station antennas	Questionnaire survey and blood simples from 91 individuals, with 70% (63) residing in a populated area with a mobile phone base station (the sample group) and 30% (28) in a sparsely-populated zone without any nearby base stations (the control group). Radiofrequency field measurements	Effects found on: Genetic damage parameters of DNA migration length, damage frequency (DF) and damage index	Genetic damage was significantly increased in the sample group compared to that in the controls. The 2.5–4.5-fold increase in DNA damage in peripheral blood lymphocytes of persons staying near a mobile phone base station is of acute concern given that all neoplasia initiate via unrepaired DNA damage. In the light of the above observations and the statistically significant genetic damage observed in those residing within 300 m of a mobile phone base station in this study, it implies that the effects of radiations from mobile phone base stations cannot be overlooked, as unrepaired DNA damage can lead to cancer, precocious ageing and age-related effects.
24 Y CBP	Meo et al. (2015) Saudi Arabia	2 Base station antennas (925 MHz) near two schools	RF-EMF measurements and blood sample collection	Effects found on: -chronic hyperglycemia -increased HbA1c -diabetes mellitus	Students who were exposed to high EMFR generated by MPBS had significantly higher HbA1c and prevalence of pre diabetes mellitus compared to the students who exposed to low EMFR. EMFR appears to be another risk factor contributing to high levels of HbA1c and risk of type 2 diabetes mellitus.
25 Y RS	Pachuau et al. (2015) India	Base station antennas (GSM 900)	Questionnaire survey from 50 exposed and 50 control individuals. Power density measurements	Effects found on: -fatigue -sleep disruption -headache -dizziness -muscle pain -cramp No effects found on: -nausea -discomfort -difficulty in concentration -memory los -skin problems -visual disruption -hearing problem	Inhabitants living near mobile tower are having more health complaints than those inhabitants living in the area where there is no mobile tower
26 Y CBP	Al-Quzwini et al. (2016) Iraq	Base station antennas	Questionnaire survey. Two hundred couples (one hundred subfertile couples as a study group, and one hundred fertile couples as a control group. Semen analysis	Twenty-nine percentage of subfertile couples had exposure to environmental hazards (communication's tower beside their house-within 50 m), and 71% non-hazard. The duration of the exposure to the environmental factor ranged from 2 to 7 years.	The exposure to environmental hazards shows significant difference between the subfertile and the fertile men; as higher percentage of exposure to mobile phone tower among subfertile group, 29% versus 12% for the fertile group,
27 N RS	Baliatsas et al. (2016) The Netherlands	Base station antennas (GSM and UMTS)	Health records from 1069 adult participants, All participants were living within 500 m from the nearest bases station. A propagation model combined with a questionnaire was used to assess indoor exposure to RF-EMF from MPBS at T1. Estimation of exposure at T0 was based on number of antennas at T0 relative to T1.	Compared to the baseline period, there was a higher prevalence of symptoms theoretically relevant to EMF at T1. A significant increase was observed in the prevalence of ear symptoms and a two-fold (but not significant) increase in the prevalence of skin symptoms. Overall, the total prevalence was slightly lower at T1. A consistent association between UMTS exposure and different clusters of GP-registered symptoms, for the self-declared mobile phone base stations-sensitive group.	This before-after study found no evidence that RF-EMF exposure from mobile phone base stations is associated with the development of non-specific symptoms in the general population, corroborating recent observational studies. Subgroup analyses among people with self-reported sensitivity to base stations showed a higher prevalence for most symptoms at T1 compared to baseline and there was some indication for a higher risk of non-specific symptoms for the mobile phone base stations-sensitive group, in relation to exposure.
28 N RS	Klaps et al. (2016) Austria	Base station antennas	Meta-analysis based on the results of 17 studies	The effects of mobile phone base stations seem to be rather unlikely. However, nocebo effects occur.	It is unclear whether electromagnetic fields emitted by mobile phone base stations affect well-being in adults. The existing studies on this topic are highly inconsistent.
29 Y	Singh et al. (2016) India	4 Base station antennas		Effects found: -sleep disturbances	A majority of the subjects who were residing near the mobile base station

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
RS CBP			Questionnaire survey and salivary analysis in 20 individuals (case group) and 20 (control group)	-headache -dizziness -irritability -concentration difficulties -hypertension	had various complaints. A majority of the study subjects had significantly lesser stimulated salivary secretion as compared to the control subjects. The effects of prolonged exposure to EMRs from mobile phone base stations on the health and well-being of the general population cannot be ruled out.
30 Y RS	Premlal and Eldhose, 2017 India	14 Base station antennas	Questionnaire survey (229 persons) and power density measurements	Joint pain, sleep disorders, migraine related headaches and digestive problems	For 32 different diseases, only 4 were found to have obvious relation to the cell tower radiation. Females are more prone to the bad effects of cell tower radiation. The current Indian standard for cell tower exposure is inadequate for the safe living.
31 Y CBP	Taheri et al. (2017) Iran	Base station antennas	45 healthy individuals with their home near BTS antenna (exposed group) and 45 healthy subjects who were away from the antenna	In the exposed group, the whole number of white blood cells, the level of hematocrit, percent of monocytes, eosinophils and basophils were significantly lower than the control group. The number of red blood cells, their average volume and the mean concentration of hemoglobin were notably higher than the controls. There was not observed a significant difference between the two groups in hemoglobin, its mean concentration, platelet count, percent of lymphocytes and neutrophils as well as serum levels of cytokines IL-4, IL-10 and interferon γ.	The radiation of base station antennas influenced the blood and immune systems.
32 Y RS C	Vijay and Choudhary (2017) India	40 Base station antennas (900–1800 MHz)	Questionnaire survey	Effects found: - headache - depression - sleep disturbance - nausea - fatigue - asthma - cancer - Alzheimer's disease - multiple sclerosis - brain tumor.	The questionnaires show that people have some kind of physical or mental illness after the installation of mobile towers.
33 Y CBP	Zothansiama et al. (2017) India	6 Base station antennas (900–1800 MHz)	Questionnaire survey. Blood sample collection and lymphocyte culture. Power density measurement. Exposed group (n = 40) Control group (n = 40) The study was envisaged to evaluate the effect of RFR on the DNA damage and antioxidant status in cultured human peripheral blood lymphocytes of individuals residing in the vicinity of mobile phone base stations and comparing it with healthy controls.	Effects found: -higher frequency of micronuclei -decreased antioxidants	The analyses of data from the exposed group residing within a perimeter of 80 m of mobile base stations, showed significantly higher frequency of micronuclei when compared to the control group, residing 300 m away from themobile base station. The analysis of various antioxidants in the plasma of exposed individuals revealed a significant attrition in glutathione concentration, activities of catalase and superoxide dismutase and rise in lipid peroxidation when compared to controls. Multiple linear regression analyses revealed a significant association among decreased antioxidants and elevated miconuclei frequency with increasing RF power density. The persistence of DNA unrepaired damage leads to genomic instability which may lead to several health disorders including the induction of cancer.
34 Y RS	Meo et al. (2019) Saudi Arabia	Two different schools both situated nearby base station antennas (925 MHz)	Cognitive function, motor screening task and spatial working memory were tested, and also RF measurements were made.	There was a statistically significant impairment in the motor screening task and spatial working memory among students who were exposed to high RF generated by base station antennas (School 2: 10.021 μW/cm^2) compared to students who were exposed to lower levels of RF (School 1: 2.010 μW/cm^2).	High exposure to RF-EMF produced by base station antennas is associated with a decrease in fine and gross motor skills and spatial working memory and attention in school adolescents compared to students who had been exposed to low RF-EMF.

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Table 1 (*continued*)

N°	Reference and country	Antenna type	Study design	Diseases and symptoms found/not found	Main conclusions
35 Y RS	Ali et al. (2021) Iraq	Base station antennas (900–1800 MHz)	Questionnaire survey comparing two groups. The first group (n = 79) was located in a town with three cell phone towers with less than a hundred meters apart. The second study group (n = 79) was limited to the area almost empty from cell phone towers. Electric field measurements were made.	There was a significant association between health problems (skin problem, hair loss issues, sleeping difficulties, and fertility issues) and distance to towers (less distance, more problems: P-value < 0.05). In regards to health problems (abnormalities, blood pressure issues, tumours cases, and memory and concentration difficulties), the obtained results were not statistically significant.	The results showed an increase in both short- and long-term health problems near base stations antennas in general.
36 Y RS C	López et al., 2021 Spain	9 Base station antennas	Questionnaire survey on 268 persons, 174 in exposed área and 94 in control área, and EMF measurements	Effects found on -headache -dizziness -instability -tachycardias -nightmares No effects found on: -fainting	People who are exposed to higher radiation values present more severe headaches, dizziness and nightmares. 5.6% cancer cases in the study population, a percentage 10 times higher tan that of the total Spanish population.
37 N RS	Martin et al. (2021) France	Base station antennas	Questionnaire survey in 354 residents from buildings located at a distance of 250 m or less from the base station antennas in the main transmit beam of the antennas and home exposure measurements	No significant association between RF-EMF exposure and the overall symptoms score, nor between RF-EMF exposure from MPBSs and insomnia-like symptoms. There was a significant association between RF-EMF exposure and insomnia-like symptoms only for participants who attributed their symptoms to radiofrequencies.	The findings of the study do not support the hypothesis of an association between RF-EMF exposure and health outcomes, such as self-reported non-specific or insomnia-like symptoms in the general population. However, they may suggest a possible association between such exposure and insomnia-like symptoms among people reporting environmental concerns.
38 Y C	Rodrigues et al. (2021) Brazil	Base station antennas	This is an ecological study using capitals as the unit of analysis. The authors collected information on the number of deaths by cancer, gender, age group, gross domestic product per capita, death year, and the amount of exposure over a lifetime and investigated all cancer types and some specific types (breast, cervix, lung, and esophagus cancers).	For all cancers and for the specific types investigated (breast, cervix, lung, and esophagus cancers), the higher the exposure to RBS radiofrequency, the higher the median of mortality rate.	The results indicates that the exposure to radiofrequency electromagnetic fields from an RBS increases the rate of mortality by all cancers and specifically by breast, cervix, lung, and esophageal cancers. These conclusions are based on the fact that the findings of the study indicate that, the higher the RBS radiofrequency exposure, the higher the cancer mortality rate, especially for cervix cancer. The spatial analysis showed that the highest radiofrequency exposure was observed in a city located in the southern region of Brazil, which also showed the highest mortality rate for all types of cancer and specifically for lung and breast cancers.

4.1. Investigations with radar and radio/television antennas

In studies carried out in the last century, occupational exposure of people to microwave radiation (RF) related to military, industrial and radio uses, as well as radio waves, showed several types of effects: an increase in spontaneous abortions, changes in red and white blood cell counts and an increase in childhood, testicular and other cancers. These findings suggest that RF exposures are potentially carcinogenic and have other health effects; the author recommends precautionary measures to avoid unnecessary exposure (Goldsmith, 1997). An analysis of particular locations of diagnosed neoplasms indicates significantly higher morbidity rates in the military exposed to RF for alimentary tract cancers, skin tumours, neoplasms and cerebral and haematological/lymphatic malignancies. For haematological/lymphatic malignancies, the difference in morbidity between exposed and unexposed military was the largest. This may suggest that spontaneous neoplasms develop faster in the exposed group, with a shorter latency period than in those not exposed. In fact, in exposed subjects, the disease occurs 5–10 years earlier (Szmigielski et al., 2001). On the other hand, children exposed to radar electromagnetic radiation had less developed memory and attention, their reaction time was slower and their neuromuscular apparatus endurance was decreased (Kolodynski and Kolodynska, 1996).

In several studies performed around radio and television antennas, there was a significant decrease in the risk of cancer and leukaemia with increasing distance to the antennas (Maskarinec et al., 1994; Dolk et al., 1997a, 1997b; Hocking and Gordon, 2000; Michelozzi et al., 2002; Park et al., 2004). People exposed to a radio antenna shortwave broadcasting station in Schwarzenburg (Switzerland) had sleep disturbances, which were more frequent in exposed than in unexposed subjects (Altpeter et al., 2000).

Thus, the coincidences of similar effects from studies with different sources of electromagnetic radiation (but with similar pulsed, polarized and modulated radiation), such as radar or radio/television antennas, reinforce the conclusions of this review. Non-ionizing EMF are among the fastest growing forms of environmental pollution, its increase around the world in recent years has been exponential (Bandara and Carpenter, 2018) and symptoms reported today may be classic microwave/RF sickness (Levitt and Lai, 2010).

4.2. RF exposure incidents among diplomats (Havanna syndrome)

From late 2016 through August 2017, US government personnel on a diplomatic mission in Havana, Cuba, reported neurological symptoms, including cognitive, balance, visual and hearing disturbances, sleep

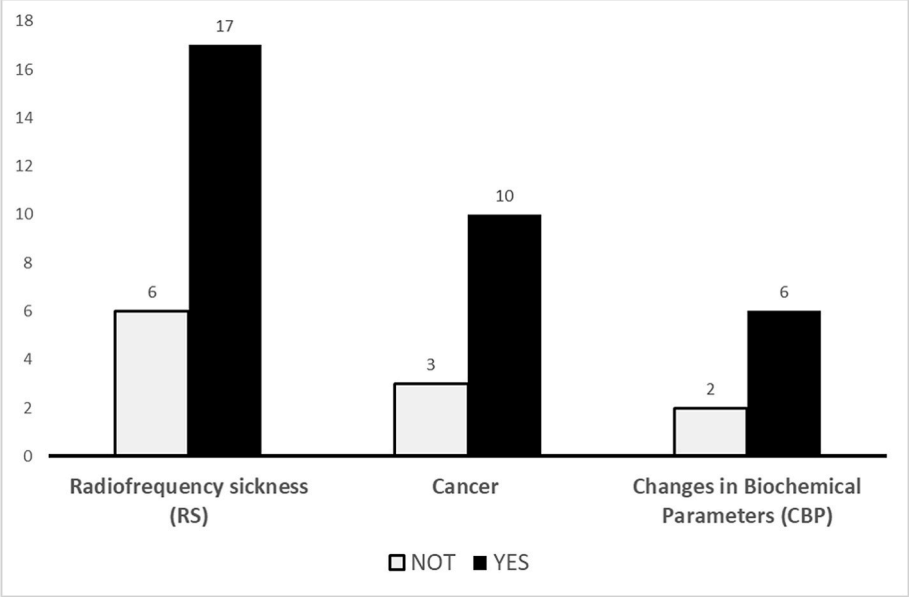

Fig. 1. Results on effects according to the study type considered.

disturbances and headaches. These individuals appeared to have sustained injuries to generalized brain networks with no associated history of head trauma (Swanson et al., 2018). They complained of cognitive decline, fatigue and headache, especially after cognitive exertion, and in some cases tinnitus, nausea and balance problems (Dyer, 2018). This mysterious disease that affected US and Canadian diplomats in Cuba (and later also in China) has confused the FBI, the State Department and US intelligence agencies.

The reported facts seem consistent with pulsed RF/microwave as the source of injuries to the affected diplomats (Golomb, 2018). The same conclusion was later reached by the National Academy of National Academies of Sciences (2020), who reported that many of the chronic or non-specific symptoms were consistent with known effects of RF, such as dizziness, headache, fatigue, nausea, anxiety, cognitive deficits and memory loss. In general, directed pulsed RF energy appears to be the most plausible mechanism to explain these cases. Such symptoms had already been described much earlier at the Moscow embassy (Lilienfeld et al., 1978; Johnson Lyakouris, 1998).

There are objective pathophysiological changes and health effects induced by EMF exposure that can biologically damage the organism and are noxious agents in healthy people (Belpomme and Irigaray, 2022).

4.3. Important laboratory studies

The United States National Toxicology Program (NTP) tested the two main modulation types used for mobile phones worldwide for GSM (2G) and UMTS (3G/4G), in a two-year rodent cancer bioassay under near-field exposure conditions; the experiments included additional assays for genotoxicity endpoints (Smith-Roe et al., 2020). They found clear evidence of carcinogenic activity, and more specifically malignant schwannomas of the heart, malignant gliomas of the brain and benign, malignant or complex pheochromocytomas (combined) of the adrenal medulla. They also found increased DNA damage (measured by the comet assay) in the frontal cortex of male mice, in the leukocytes of female mice and in the hippocampus of male rats, indicating that mobile phone EMF could cause DNA damage and consequent carcinogenesis. In a similar large carcinogenicity study by the Ramazzini Institute, Falcioni et al. (2018) examined far-field exposure to GSM 1800 MHz EMF and reported very similar results to the NTP study. Specifically, they also found increased incidence of tumours of the brain and heart in the mobile phone EMF-exposed Sprague-Dawley rats. Furthermore, these tumours are of the same histotype as those observed in some epidemiological studies on mobile phone users (Hardell et al., 2007).

Kostoff et al. (2020) emphasizes that most of the laboratory experiments conducted to date were not designed to identify the more severe adverse effects reflective of the real-life operating environment in which wireless radiation systems operate, as many experiments do not include pulsing and modulation of the carrier signal and the majority do not account for synergistic adverse effects of other toxic stimuli.

4.4. Importance of studies with biological parameters and those performed on animals and plants

Despite the scientific evidence shown in the studies carried out in many countries by different teams of researchers that we have reviewed, several studies conclude that no effects are found and blame it on risk perception and the nocebo effect (Wiedemann et al., 2006; Kowall et al., 2012; Freudenstein et al., 2015; Dieudonné, 2016; Klaps et al., 2016; Koh et al., 2020). However, the nocebo effect is not supported by objective data (Belpomme and Irigaray, 2022), by the results of cancer studies (Eger et al., 2004; Wolf and Wolf, 2004; Dode et al., 2011; Li et al., 2012; Rodrigues et al., 2021), by studies on changes in haematological parameters (Gandhi et al., 2015; Meo et al., 2015; Taheri et al., 2017; Zothansiama et al., 2017), by hormonal changes after long-term exposure (Eskander et al., 2012), by salivary secretion (Singh et al., 2016) and by effects on fertility (Al-Quzwini et al., 2016). Many reviews on the health effects of mobile phones have reached the same conclusions regarding their effects on male infertility (El-Hamd and Aboeldahab, 2018). Unfortunately, the studies that allude to the nocebo effect seem to be the ones taken into account by the World Health Organization (World Health Organization, 2015).

On the other hand, studies performed on animals or trees near base station antennas are especially important, because animals and plants cannot be aware of their proximity and therefore nocebo or psychosomatic effects cannot be attributed (Balmori, 2005, 2010; Balmori and Hallberg, 2007; Hässig et al., 2012; Lázaro et al., 2016; Waldmann-Selsam et al., 2016; Levitt et al., 2021). In fact, a similar result of this study for humans was found in a review on the significant ecological effects of RF EMF in 65% of the studies on vertebrates, birds and plants (Cucurachi et al., 2013).

Moreover, for these effects, perfectly plausible mechanisms of action

have already been proposed. Plasma membrane calcium channels and other voltage-gated ion channels are irregularly activated/inactivated by man-made EMF in both animals and plants, increasing intracellular [Ca^{2+}] and altering intracellular ion concentrations (Panagopoulos et al., 2002, 2021; Pall, 2016).

Under the influence of non-thermal intensities of microwave radiation, often there are important signals of some hazardous changes in cell metabolism. A significant increase of reactive oxygen species and nitrogen oxide generation in cells under non-thermal intensities has been detected both in vivo and in vitro (Yakymenko et al., 2011; Belpomme and Irigaray, 2022). Thus, the different findings clearly argue for a causal role of EMF in inducing free radical species, including overproduction of reactive oxygen and nitrogen species or suppression of antioxidant defence in cells (Belpomme and Irigaray, 2022). Furthermore, this exposure can result in DNA damage through oxidative stress with reactive oxygen species/free radical overproduction (Yakymenko et al., 2011; Kıvrak et al., 2017; Panagopoulos et al., 2021).

5. The Precautionary Principle

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is a private organization that issues exposure guidelines that are then adopted by governments, but it has been accused of having conflicts of interest (Hardell and Carlberg, 2020; Hardell et al., 2021). The ICNIRP (2010, 2020) limits are thousands of times above the levels where effects are recorded for both extremely low frequency and RF man-made EMF and account only for thermal effects, whereas the vast majority of recorded effects are non-thermal. These existing guidelines for public health protection only consider the effects of acute intense (thermal) exposures and do not protect from lower level long-term exposures (Israel et al., 2011; Yakymenko et al., 2011; Blank et al., 2015; Starkey, 2016; Belpomme and Irigaray, 2022). The exposure duration is crucial to assess the induced effects.

The Precautionary Principle is one of the fundamental principles of the European Union, governing policies related to the environment, health and food safety (Harremoes et al., 2013). This principle enables decision-makers to adopt precautionary measures when the scientific evidence regarding an environmental or human health factor is not certain regarding its safety. Therefore, despite the existing ample and rapidly increasing scientific evidence, no significant progress has been made over all these years, at least at the level of guidelines issued by the responsible authorities and official regulatory bodies. Some authors have pointed out that the source of funding correlates with study findings, and many systematic reviews and meta-analyses in this field have failed to correct for this source of funding bias, which has likely underestimated the evidence for causation (Carpenter, 2019). A growing number of scientists have been calling internationally on governments to raise their safety standards for RF-EMF (Blank et al., 2015; Hardell and Nyberg, 2020; Frank, 2021). Thus, there is an urgent need to adopt the Precautionary Principle and impose more restrictive levels (Zinelis, 2010; Yakymenko et al., 2011; Blank et al., 2015; Starkey, 2016).

6. Conclusion

In the current circumstances, it seems that the scientific experts in the field are very clear about the serious problems we are facing and have expressed this through important appeals (Blank et al., 2015; Hardell and Nyberg, 2020). However, the media, the responsible organizations (World Health Organization, 2015) and the governments are not transmitting this crucial information to the population, who remain uninformed. For these reasons, the current situation will probably end in a crisis not only for health but also for this technology itself, as it is unsustainable and harmful to the environment and the people.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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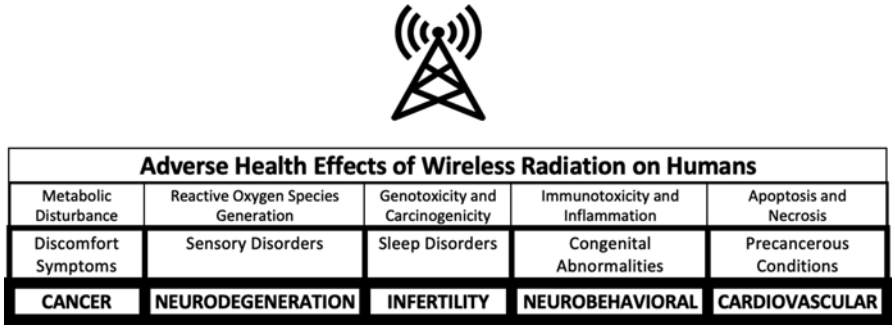
Adverse health effects of 5G mobile networking technology under real-life conditions

Ronald N. Kostoff[a,*], Paul Heroux[b], Michael Aschner[c], Aristides Tsatsakis[d,e]

[a] Research Affiliate, School of Public Policy, Georgia Institute of Technology, Georgia, United States
[b] Toxicology and Health Effects of Electromagnetism, McGill University, Canada
[c] Molecular Pharmacology, Einstein Center of Toxicology, Albert Einstein College of Medicine, United States
[d] Laboratory of Toxicology, Medical School, University of Crete, Voutes, 71409 Heraklion, Crete, Greece
[e] Department of Analytical, Toxicology, Pharmaceutical Chemistry and Pharmacognosy, Sechenov University, 119991 Moscow, Russia

GRAPHICAL ABSTRACT



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ABSTRACT

This article identifies adverse effects of non-ionizing non-visible radiation (hereafter called wireless radiation) reported in the premier biomedical literature. It emphasizes that most of the laboratory experiments conducted to date are not designed to identify the more severe adverse effects reflective of the real-life operating environment in which wireless radiation systems operate. Many experiments do not include pulsing and modulation of the carrier signal. The vast majority do not account for synergistic adverse effects of other toxic stimuli (such as chemical and biological) acting in concert with the wireless radiation. This article also presents evidence that the nascent 5G mobile networking technology will affect not only the skin and eyes, as commonly believed, but will have adverse systemic effects as well.

1. Introduction

Wireless communications have been expanding globally at an exponential rate. The latest imbedded version of mobile networking technology is called 4G (fourth generation), and the next version (called 5G- fifth generation) is in the early implementation stage. Neither 4G

* Corresponding author.
E-mail addresses: rkostoff@gmail.com (R.N. Kostoff), toxlab.uoc@gmail.com (A. Tsatsakis).

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Main Regularities and Health Risks from Exposure to Non-Thermal Microwaves of Mobile Communication

Igor Belyaev

Abstract — **Various responses to non-thermal microwaves (MW) from mobile communication including adverse health effects related to electrohypersensitivity, cancer risks, neurological effects, and reproductive impacts have been reported while some studies reported no such effects. This presentation provides an overview of the complex dependence of the MW effects on various physical and biological variables, which account for, at least partially, an apparent inconsistence in the published data. Among other variables, dependencies on carrier frequency, polarization, modulation, intermittence, electromagnetic stray fields, genotype, physiological traits, and cell density during exposure were reported. Nowadays, biological and health effects of 5G communication, which will use microwaves of extremely high frequencies (millimeter waves MMW, wavelength 1- 10 mm), are of significant public concern. It follows from available studies that MMW, under specific conditions of exposure at very low intensities below the ICNIRP guidelines, can affect biological systems and human health. Both positive and negative effects were observed in dependence on exposure parameters. In particular, MMW inhibited repair of DNA damage induced by ionizing radiation at specific frequencies and polarizations. To what extend the 5G technology and the Internet of Things will affect the biota and human health is definitely not known. However, based on possible fundamental role of MMW in regulation of homeostasis and almost complete absence of MMW in atmosphere due to effective absorption, which suggests the lack of adaptation to this type of radiation, the health effects of chronic MMW exposures may be more significant than for any other frequency range.**

Keywords — **Thermal and non-thermal effects of microwaves, Millimeter waves, 5G mobile communication, Health risks, Cancer, Physical mechanisms.**

I. Thermal versus Non-Thermal Microwave Effects, Their Main Regularities

Exposures to microwaves (MW, 300 MHz-300 GHz) vary in many parameters: incident power density (PD), specific absorption rate (SAR), frequency/wavelength, polarization (linear, ellipsoidal, circular, unpolarized), continuous wave (CW) and pulsed fields, modulation (amplitude, frequency, phase, complex), far field/near field, static magnetic field (SMF) and stray electromagnetic fields (EMF) of extremely low frequency (ELF, 3-300 Hz) at the location of exposure, overall duration and intermittence of exposure (interrupted, continuous), short-term acute and prolonged chronic exposures. With increased SAR, so-called thermal effects of MW are usually observed that result in significant MW-induced heating. SAR is a main determinate of thermal MW effects. The SAR based safety limits, which intend to protect from the thermal MW effects, were developed based on computer simulation of the MW energy absorption in standardized male phantoms. Thus, they do not take into account individual variability in voxel SAR distribution, which may be observed in dependence on polarization, frequency, age, sex, and pregnancy status [1-8]. In addition, the mobile phone SAR values are usually obtained when the phone is positioned about 2 cm from the standard male phantom head, a condition, which is not usually maintained during mobile phone calls. Other aforementioned physical variables of MW exposure have been linked to occurrence of so-called non-thermal (NT) biological effects, which are induced by MW at intensities well below measurable heating [9-21] [22]. The classification of MW effects into thermal and non-thermal is not based on physics of interaction between MW and biological tissues but rather reflects experimental observation of heating induced by MW exposure, which at SAR levels higher than 2 W/kg may result in thermal injury. Of note, slight temperature increase is also observed in the head tissues during exposure to mobile handset radiation, but this increase is too weak to produce thermal injury [23] and even to be sensed by the exposed subjects [24] while some mobile phone users reported sensation of warmth around the ear [25].

Vilenskaya and co-authors [26] and Devyatkov [27] have reported pioneering data on the NT effects of millimeter waves (MMW, 30-300 GHz, wavelength 1-10 mm in vacuum, to be used in 5G mobile communication) upon exposure of various biological objects. Webb was the first to establish the highly resonant effects of ultra-weak MMW on the induction of λ-phage in lysogenic bacterial E. coli cells [28]. These findings were subsequently corroborated by independent research groups [29, 30]. In these and subsequent studies the observed spectra of MMW action were found to have the following regularities: (1) strong dependence on frequency (frequency windows of resonance type), (2) there was a specific PD threshold below which no effect was observed, and above which the effects of exposure depended only weakly on power over several orders of magnitude (so-called

Igor Belyaev is with the Cancer Research Institute, Biomedical Research Center, University Science Park for Biomedicine, Slovak Academy of Sciences, Dubravska cesta 9, 845 05 Bratislava, Slovak Republic (e-mail: Igor.Beliaev@savba.sk).

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Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer

A. Balmori [1]

C/ Rigoberto Cortejoso, 14 47014, Valladolid, Spain

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ABSTRACT

The objective of this work was to perform a complete review of the existing scientific literature to update the knowledge on the effects of base station antennas on humans. Studies performed in real urban conditions, with mobile phone base stations situated close to apartments, were selected. Overall results of this review show three types of effects by base station antennas on the health of people: radiofrequency sickness (RS), cancer (C) and changes in biochemical parameters (CBP). Considering all the studies reviewed globally (n = 38), 73.6% (28/38) showed effects: 73.9% (17/23) for radiofrequency sickness, 76.9% (10/13) for cancer and 75.0% (6/8) for changes in biochemical parameters. Furthermore, studies that did not meet the strict conditions to be included in this review provided important supplementary evidence. The existence of similar effects from studies by different sources (but with RF of similar characteristics), such as radar, radio and television antennas, wireless smart meters and laboratory studies, reinforce the conclusions of this review. Of special importance are the studies performed on animals or trees near base station antennas that cannot be aware of their proximity and to which psychosomatic effects can never be attributed.

1. Introduction

During the last few decades, hundreds of thousands of mobile phone base stations and other types of wireless communications antennas have been installed around the world, in cities and in nature, including protected natural areas, in addition to pre-existing antennas (television, radio broadcasting, radar, etc.). Only the aesthetic aspects or urban regulations have been generally considered in this deployment, while the biological, environmental and health impacts of the associated non-ionizing electromagnetic radiation emissions have not been assessed so far. Therefore, the effects on humans living around these anthropogenic electromagnetic field sources (antennas) have not been considered.

In France, there is a significant contribution of mobile phone base stations in the exposure to radiofrequency electromagnetic fields (RF-EMF) of urban citizens living nearby (De Giudici et al., 2021). Some studies from India indicate that more than 15% of people have levels of EMF strength above 12 V/m due to their proximity to antennas (Premlal and Eldhose, 2017). Exposure estimates have shown that RF-EMF from mobile telephone systems is stronger in urban than in rural areas. For instance, in Sweden the levels of RF radiation have increased considerably in recent years, both outdoor and indoor, due to new telecommunication technologies, and the median power density measured for RF fields between 30 MHz and 3 GHz was 16 $\mu W/m^2$ in rural areas, 270 $\mu W/m^2$ in urban areas and 2400 $\mu W/m^2$ in city areas (Hardell et al., 2018). Total exposure varies not only between urban and rural areas but also, depending on residential characteristics, between different floors of a building, with a tendency for building exposure to increase at higher floors (Breckenkamp et al., 2012).

Over the past five decades, and more intensively since the beginning of this century, many studies and several reviews have been published on the effects of anthropogenic electromagnetic radiation on humans living around the antennas. The first studies were carried out with radio and television antennas, investigating increases in cancer and leukaemia (Milham, 1988; Maskarinec et al., 1994; Hocking et al., 1996; Dolk et al., 1997a, 1997b; Michelozzi et al., 1998; Altpeter et al., 2000), as well as around radars (Kolodynski and Kolodynska, 1996; Goldsmith, 1997).

Regarding base station antennas, there are scientific discrepancies in their effects: some studies concluded that there are no health-related effects (e.g. Augner and Hacker, 2009; Blettner et al., 2009; Röösli et al., 2010; Baliatsas et al., 2016) whereas others found increases in cancer and other health problems in humans living around antennas (e.g. Santini et al., 2002; Navarro et al., 2003; Bortkiewicz et al., 2004;

E-mail address: abalmorimartinez@gmail.com.
[1] Independent researcher

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Article

The Effect of Continuous Low-Intensity Exposure to Electromagnetic Fields from Radio Base Stations to Cancer Mortality in Brazil

Nádia Cristina Pinheiro Rodrigues [1,2,*], Adilza Condessa Dode [3], Mônica Kramer de Noronha Andrade [1], Gisele O'Dwyer [1], Denise Leite Maia Monteiro [4], Inês Nascimento Carvalho Reis [1], Roberto Pinheiro Rodrigues [5,6], Vera Cecília Frossard [1] and Valéria Teresa Saraiva Lino [1]

1 Sérgio Arouca National School of Public Health, Oswaldo Cruz Foundation, Rio de Janeiro 21041-210, Brazil; monicakra@gmail.com (M.K.d.N.A.); odwyer@ensp.fiocruz.br (G.O.); inesreis@ensp.fiocruz.br (I.N.C.R.); verafrossard@gmail.com (V.C.F.); valeriaslino@gmail.com (V.T.S.L.)
2 Institute of Social Medicine, Rio de Janeiro State University, Rio de Janeiro 20550-900, Brazil
3 Instituto Metodista Izabela Hendrix, Belo Horizonte, Minas Gerais 30160-012, Brazil; mreengenharia@mreengenharia.com.br
4 Medical Sciences College, Rio de Janeiro State University, Rio de Janeiro 20550-170, Brazil; denimonteiro2@yahoo.com.br
5 Federal Center for Technological Education Celso Suckow da Fonseca, Rio de Janeiro 20271-110, Brazil; roberto.88rpr@gmail.com
6 Petrobras, Rio de Janeiro 20031-912, Brazil
* Correspondence: nadiacristinapr@gmail.com

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Abstract: Background: this study aims to estimate the rate of death by cancer as a result of Radio Base Station (RBS) radiofrequency exposure, especially for breast, cervix, lung, and esophagus cancers. Methods: we collected information on the number of deaths by cancer, gender, age group, gross domestic product per capita, death year, and the amount of exposure over a lifetime. We investigated all cancer types and some specific types (breast, cervix, lung, and esophagus cancers). Results: in capitals where RBS radiofrequency exposure was higher than 2000/antennas-year, the average mortality rate was 112/100,000 for all cancers. The adjusted analysis showed that, the higher the exposure to RBS radiofrequency, the higher cancer mortality was. The highest adjusted risk was observed for cervix cancer (rate ratio = 2.18). The spatial analysis showed that the highest RBS radiofrequency exposure was observed in a city in southern Brazil that also showed the highest mortality rate for all types of cancer and specifically for lung and breast cancer. Conclusion: the balance of our results indicates that exposure to radiofrequency electromagnetic fields from RBS increases the rate of death for all types of cancer.

Keywords: cancer; mortality; electromagnetic fields; breast neoplasms; lung neoplasms; esophageal neoplasms; uterine cervical neoplasms

1. Background

Mobile phones have become extremely common in modern times. Wireless technology has a large number of Radio Base Stations (RBSs), which transmit information through radiofrequency signals. In 2006, there were already more than 1.4 million RBSs in the world [1]. In the Brazilian capitals, RBSs were implemented in 1992 in Brasília (the capital of Brazil), and in 2017, there were 27,145 RBSs indexed in the capitals [2].

The effect of electromagnetic fields emanating from RBS on health is not very well known. The World Health Organization (WHO) reported, in 2006, that scientific knowledge indicates that RBS radiofrequency exposure is within the international standards and, therefore, does not pose a risk to human health [1]. However, in 2014, the WHO recognized the need to promote research to investigate the effect of the radiofrequency field on human

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Letter

Transcriptomic and Long-Term Behavioral Deficits Associated with Developmental 3.5 GHz Radiofrequency Radiation Exposures in Zebrafish

Subham Dasgupta, Connor Leong, Michael T. Simonich, Lisa Truong, Huaping Liu, and Robyn L. Tanguay*

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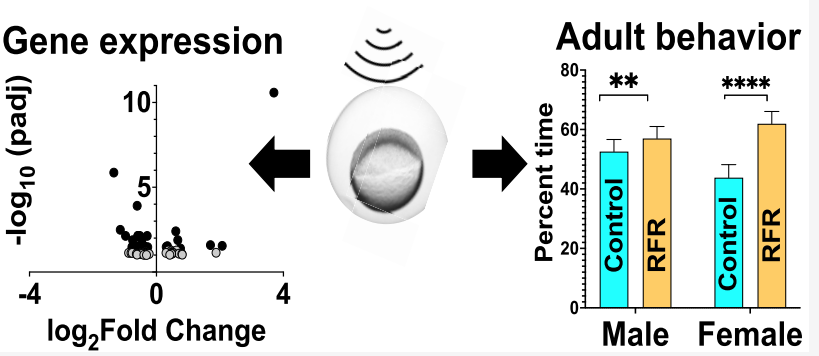

ABSTRACT: The rapid deployment of the fifth-generation (5G) spectrum by the telecommunication industry is intended to promote better connectivity and data integration among various industries. However, concerns among the public about the safety and health effects of radiofrequency radiations (RFRs) emitted from the newer-generation cell phone frequencies remain, partly due to the lack of robust scientific data. Previously, we used developmental zebrafish to model the bioactivity of 3.5 GHz RFR, a frequency used by 5G-enabled cell phones, in a novel RFR exposure chamber. With RFR exposures from 6 h post-fertilization (hpf) to 48 hpf, we observed that, despite no teratogenic effects, embryos showed subtle hypoactivity in a startle response behavior assay, suggesting abnormal sensorimotor behavior. This study builds upon the previous one by investigating the transcriptomic basis of RFR-associated behavior effects and their persistence into adulthood. Using mRNA sequencing, we found a modest transcriptomic disruption at 48 hpf, with 28 differentially expressed genes. KEGG pathway analysis showed that biochemical pathways related to metabolism were significantly perturbed. Embryos were grown to adulthood, and then a battery of behavioral assays suggested subtle but significant abnormal responses in RFR-exposed fish across the different assays evaluated that suggest potential long-term behavioral effects. Overall, our study suggests the impacts of RFRs on the developing brain, behavior, and the metabolome should be further explored.

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INTRODUCTION

The gradual rollout of fifth-generation (5G) frequencies has spurred increased scrutiny of their potential health effects over the past several years. Radiofrequency radiations (RFRs) emitted from these signals are non-ionizing, but skepticism about their safety remains, partly due to the lack of robust scientific data. This knowledge gap has contributed to valid public concerns about fully understanding 5G cell signal safety but has also been misappropriated to fuel baseless and dangerous conspiracy theories; e.g., a fabricated causal link between 5G and COVID-19 occurrence has led to violence against telecommunication engineers in Britain.[1,2] Our hope is that robust studies of the health effects of 5G RFRs will provide scientific facts to dampen the unscientific noise.

Several studies, including a recent one conducted by the National Institute of Health National Toxicology Program, have addressed specific health effects of pre-5G RFR frequencies and have shown that exposure to these frequencies can lead to oxidative stress, neurological outcomes, and, in rare cases, carcinogenesis.[3−6] 5G frequencies penetrate less through the skin and, therefore, should be less capable of impacting biology than lower-frequency (pre-5G) RFR. Because higher-

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Changes in rat spatial learning and memory as well as serum exosome proteins after simultaneous exposure to 1.5 GHz and 4.3 GHz microwaves

Hui Wang [a,1], Yu Liu [a,b,1], Yunbo Sun [a,1], Li Zhao [a], Ji Dong [a], Xinping Xu [a], Haoyu Wang [a], Jing Zhang [a], Binwei Yao [a], Xuelong Zhao [a], Shuchen Liu [a,*], Ke Zhang [b,*], Ruiyun Peng [a,*]

[a] Beijing Institute of Radiation Medicine, Beijing 100850, China
[b] College of Education, Hebei University, No. 180 of Wusi East Road, Baoding, China

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ABSTRACT

This study aimed to elucidate the effects and biological targets sensitive to simultaneous 1.5 and 4.3 GHz microwave exposure in rats. A total of 120 male Wistar rats were divided randomly into four groups: the sham (S group), 1.5 GHz microwave exposure (L group), 4.3 GHz microwave exposure (C group) and simultaneous 1.5 and 4.3 GHz microwave exposure (LC group) groups. Spatial learning and memory, cortical electrical activity, and hippocampal ultrastructure were assessed by the Morris Water Maze, electroencephalography, and transmission electron microscopy, respectively. Additionally, serum exosomes were isolated by ultracentrifugation and assessed by Western blotting, nanoparticle tracking and transmission electron microscopy. The serum exosome protein content was assessed by label-free quantitative proteomics. Impaired spatial learning and memory decreased cortical excitability, and damage to the hippocampal ultrastructure were observed in groups exposed to microwaves, especially the L and LC groups. A total of 54, 145 and 296 exosomal proteins were differentially expressed between the S group and the L, C and LC groups, respectively. These differentially expressed proteins were involved in the synaptic vesicle cycle and SNARE interactions during vesicular transport. Additionally, VAMP8, Syn7 and VMAT are potential serum markers of simultaneous microwave exposure. Thus, exposure to 1.5 and 4.3 GHz microwaves induced impairments in spatial learning and memory, and simultaneous microwave exposure had the most severe effects.

1. Introduction

With the rapid development of communication networks, scientists have begun to examine the health hazards of increasing use of microwave communication equipment (Hardell and Nyberg, 2020; Liu et al., 2021). According to the literature, the central nervous system (CNS) is one of the most vulnerable systems to microwave exposure (Chauhan et al., 2017; Kesari et al., 2013; Maaroufi et al., 2014; Narayanan et al., 2018; Suhhova et al., 2013). In addition, studies have examined the effects of single-frequency microwave exposure, indicating that the degree of harm was largely related to microwave frequency (Fragopoulou et al., 2018; Zhang et al., 2017). However, although multiple microwave frequencies are used in daily life, few studies have evaluated the effects of simultaneous exposure to multiple frequencies of microwaves.

Learning and memory, two of the most important brain functions, as well as their associated brain region (the hippocampus) (Zola-Morgan and Squire, 1993) are of particular interest and have attracted substantial attention in studies of the effects of microwave exposure. Chauhan's team found damaged cortical and hippocampal pyramidal neurons in the brains of rats exposed to 2.45 GHz microwave radiation for 2 h/d at 0.2 mW/cm^2 over 35 d (Chauhan et al., 2017). Li et al. (2015) reported impaired performance on the Morris Water Maze (MWM) in rats exposed to 2.856 GHz microwave radiation for 6 weeks at different intensities administered three times a week for 6 min each (Li et al., 2015). Nayaranan et al. found that rats exposed to 900 MHz microwave radiation for 1 h/day over 28 d showed impaired performance in the MWM as well as structural damage to hippocampal neurons (Narayanan et al., 2015).

However, previous studies have mainly focused on changes in neurons, synaptic plasticity, and related receptors (Wang et al., 2017a; Zhao et al., 2012). Recent studies have shown that interneuronal communication (consisting of neurons and other cells in the brain, especially glial

* Corresponding authors.
E-mail addresses: liusc118@163.com (S. Liu), zhangkecompany_1@sina.com (K. Zhang), ruiyunpeng18@126.com (R. Peng).
[1] Hui Wang, Yu Liu and Yunbo Sun contributed equally to this work and are co-first authors

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Article

Immune Responses to Multi-Frequencies of 1.5 GHz and 4.3 GHz Microwave Exposure in Rats: Transcriptomic and Proteomic Analysis

Li Zhao †, Chuanfu Yao †, Hui Wang, Ji Dong, Jing Zhang, Xinping Xu, Haoyu Wang, Binwei Yao, Ke Ren, Liu Sun and Ruiyun Peng *

Beijing Institute of Radiation Medicine, Beijing 100850, China; lillyliz@163.com (L.Z.); yaomax2010@126.com (C.Y.); wanghui597bj@163.com (H.W.); djtjwj@163.com (J.D.); zhang115614@163.com (J.Z.); xxpbjhd@163.com (X.X.); smart106@126.com (H.W.); ybwcsq@163.com (B.Y.); okayke1@163.com (K.R.); 13103249606@163.com (L.S.)

* Correspondence: ruiyunpeng18@126.com

† These authors contributed equally to this work.

Abstract: With the rapidly increasing application of microwave technologies, the anxiety and speculation about microwave induced potential health hazards has been attracting more and more attention. In our daily life, people are exposed to complex environments with multi-frequency microwaves, especially L band and C band microwaves, which are commonly used in communications. In this study, we exposed rats to 1.5 GHz (L10), 4.3 GHz (C10) or multi-frequency (LC10) microwaves at an average power density of 10 mW/cm^2. Both single and multi-frequency microwaves induced slight pathological changes in the thymus and spleen. Additionally, the white blood cells (WBCs) and lymphocytes in peripheral blood were decreased at 6 h and 7 d after exposure, suggesting immune suppressive responses were induced. Among lymphocytes, the B lymphocytes were increased while the T lymphocytes were decreased at 7 d after exposure in the C10 and LC10 groups, but not in the L10 group. Moreover, multi-frequency microwaves regulated the B and T lymphocytes more strongly than the C band microwave. The results of transcriptomics and proteomics showed that both single and multi-frequency microwaves regulated numerous genes associated with immune regulation and cellular metabolism in peripheral blood and in the spleen. However, multi-frequency microwaves altered the expression of many more genes and proteins. Moreover, multi-frequency microwaves down-regulated T lymphocytes' development, differentiation and activation-associated genes, while they up-regulated B lymphocytes' activation-related genes. In conclusion, multi-frequency microwaves of 1.5 GHz and 4.3 GHz produced immune suppressive responses via regulating immune regulation and cellular metabolism-associated genes. Our findings provide meaningful information for exploring potential mechanisms underlying multi-frequency induced immune suppression.

Keywords: microwave; radiation; immune response; transcriptomic; proteomic

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1. Introduction

Microwave technology, non-ionizing electromagnetic radiation ranging from 300 MHz to 300 GHz, has been widely used in various fields, such as mobile communication, medicine, industrial synthesis and so on [1–4]. In addition, the anxiety and speculation about the potential health hazards caused by microwaves have been growing in recent years [5,6]. In the past decades, most of the researchers aimed to uncover the biological effects caused by microwaves with a single frequency at indicated power density [7,8]. Our group has previously reported that S band microwaves, ranging from 2 GHz to 4 GHz, could cause significant injuries on several organs and tissues, including the nervous system, cardiovascular system, reproductive system and immune system [9–12]. Moreover, the potential underlying mechanisms were explored [7,13,14]. However, people are always

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Problems in evaluating the health impacts of radio frequency radiation

Paul Ben Ishai [a,*], Devra Davis [b,c], Hugh Taylor [d], Linda Birnbaum [e,1]

[a] Department of Physics, Ariel University, Ariel, 4070000, Israel
[b] Environmental Health Trust, Washington, DC, 20002, USA
[c] School of Medicine,Ondokuz-Mayis University, Samsun, Turkey
[d] Yale School of Medicine, New Haven, CT, 05620, USA
[e] National Institute of Environmental Health Sciences and National Toxicology Program, Durham, NC, 27709, USA

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ABSTRACT

In an effort to clarify the nature of causal evidence regarding the potential impacts of RFR on biological systems, this paper relies on a well-established framework for considering causation expanded from that of Bradford Hill, that combines experimental and epidemiological evidence on carcinogenesis of RFR. The Precautionary Principle, while not perfect, has been the effective lodestone for establishing public policy to guard the safety of the general public from potentially harmful materials, practices or technologies. Yet, when considering the exposure of the public to anthropogenic electromagnetic fields, especially those arising from mobile communications and their infrastructure, it seems to be ignored. The current exposure standards recommended by the Federal Communications Commission (FCC) and International Commission on Non-Ionizing Radiation Protection (ICNIRP) consider only thermal effects (tissue heating) as potentially harmful. However, there is mounting evidence of non-thermal effects of exposure to electromagnetic radiation in biological systems and human populations. We review the latest literature on *in vitro* and *in vivo* studies, on clinical studies on electromagnetic hypersensitivity, as well as the epidemiological evidence for cancer due to the action of mobile based radiation exposure. We question whether the current regulatory atmosphere truly serves the public good when considered in terms of the Precautionary Principle and the principles for deducing causation established by Bradford Hill. We conclude that there is substantial scientific evidence that RFR causes cancer, endocrinological, neurological and other adverse health effects. In light of this evidence the primary mission of public bodies, such as the FCC to protect public health has not been fulfilled. Rather, we find that industry convenience is being prioritized and thereby subjecting the public to avoidable risks.

1. Introduction

The perennial question of the biological impacts of Radio Frequency Radiation (RFR) constitutes an especially challenging matter that has come to the fore recently, in part driven by public concerns over the introduction of 5G mobile communications. 5G Small Cell base stations are permitted to be sited as close as 3 m from the ground in proximity to homes, schools and offices in many locales in the US. In the U.S. alone, the industry estimates that up to one million new antennas will be required. 5G ranges broadly from 800 MHz to 100 GHz (Document). As Lin (2022a) has noted, for the higher mm-wave bands, wider spectrum is only accessible over short distances and will depend on the construction of numerous new cells in the dense urban environment. Despite Industry claims (*5G,* EMF Exposure and Safety, 2020), an increase in the number of transmitters is expected to lead to much higher levels of exposure for the general public (Blackman and Forge, 2019). This has provoked public concerns regarding the potential health impacts of RFR.

For nearly a century, well-established controlled bioassay protocols have traditionally formed the foundation for predicting and setting limits for public health exposures to pharmaceuticals, pesticides, radiation, and other agents. Yet as regarding the potential impacts of RFR, positive adverse experimental findings on RFR-induced carcinogenicity that have historically provided guidance for preventive policies, have been subjected to extraordinary and unprecedented attacks. The same can be said for studies of individuals exposed to RFR that solely confirm whether or not past harm has taken place. Research and training in this

* Corresponding author.
E-mail address: paulbi@ariel.ac.il (P. Ben Ishai).
[1] Scientist Emeritus and former Director.

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Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays

B. Blake Levitt and Henry Lai

Abstract: The siting of cellular phone base stations and other cellular infrastructure such as roof-mounted antenna arrays, especially in residential neighborhoods, is a contentious subject in land-use regulation. Local resistance from nearby residents and landowners is often based on fears of adverse health effects despite reassurances from telecommunications service providers that international exposure standards will be followed. Both anecdotal reports and some epidemiology studies have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. The objective of this paper is to review the existing studies of people living or working near cellular infrastructure and other pertinent studies that could apply to long-term, low-level radiofrequency radiation (RFR) exposures. While specific epidemiological research in this area is sparse and contradictory, and such exposures are difficult to quantify given the increasing background levels of RFR from myriad personal consumer products, some research does exist to warrant caution in infrastructure siting. Further epidemiology research that takes total ambient RFR exposures into consideration is warranted. Symptoms reported today may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.

Key words: radiofrequency radiation (RFR), antenna arrays, cellular phone base stations, microwave sickness, nonionizing electromagnetic fields, environmental pollution.

Résumé : La localisation des stations de base pour téléphones cellulaires et autres infrastructures cellulaires, comme les installations d'antennes sur les toitures, surtout dans les quartiers résidentiels, constitue un sujet litigieux d'utilisation du territoire. La résistance locale de la part des résidents et propriétaires fonciers limitrophes repose souvent sur les craintes d'effets adverses pour la santé, en dépit des réassurances venant des fournisseurs de services de télécommunication, à l'effet qu'ils appliquent les standards internationaux d'exposition. En plus de rapports anecdotiques, certaines études épidémiologiques font état de maux de tête, d'éruption cutanée, de perturbation du sommeil, de dépression, de diminution de libido, d'augmentations du taux de suicide, de problèmes de concentration, de vertiges, d'altération de la mémoire, d'augmentation du risque de cancers, de trémulations et autres effets neurophysiologiques, dans les populations vivant au voisinage des stations de base. Les auteurs révisent ici les études existantes portant sur les gens, vivant ou travaillant près d'infrastructures cellulaires ou autres études pertinentes qui pourraient s'appliquer aux expositions à long terme à la radiation de radiofréquence de faible intensité « RFR ». Bien que la recherche épidémiologique spécifique dans ce domaine soit rare et contradictoire, et que de telles expositions soient difficiles à quantifier compte tenu des degrés croissants du bruit de fond des RFR provenant de produits de myriades de consommateurs personnels, il existe certaines recherches qui justifient la prudence dans l'installation des infrastructures. Les futures études épidémiologiques sont nécessaires afin de prendre en compte la totalité des expositions à la RFR ambiante. Les symptômes rapportés jusqu'ici pourraient correspondre à la maladie classique des micro-ondes, décrite pour la première fois en 1978. Les champs électromagnétiques non-ionisants constituent les formes de pollution environnementale croissant le plus rapidement. On peut effectuer certaines extrapolations à partir de recherches autres qu'épidémiologiques concernant les effets biologiques d'expositions à des degrés bien au-dessous des directives internationales.

Mots-clés : radiofréquence de faible intensité « RFR », les installations d'antennes, des stations de base pour téléphones cellulaires, la maladie classique des micro-ondes, les champs électromagnétiques non-ionisants, pollution environnementale.

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B.B. Levitt.[1] P.O. Box 2014, New Preston, CT 06777, USA.
H. Lai. Department of Bioengineering, Box 355061, University of Washington, Seattle, WA 98195, USA.

[1]Corresponding author (e-mail: blakelevit@cs.com; bbl353355@gmail.com).

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Dariusz Leszczynski,
University of Helsinki, Finland

REVIEWED BY
Yael Stein,
Hadassah Medical Center, Israel
Wolfgang Kainz,
HPC for MRI Safety, United States

*CORRESPONDENCE
Victor Leach
✉ victor.leach@orsaa.org

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The assumption of safety is being used to justify the rollout of 5G technologies

Julie E. McCredden[1], Steven Weller[1,2] and Victor Leach[1]*

[1]Oceania Radiofrequency Scientific Advisory Association Inc. (ORSAA), Scarborough, QLD, Australia, [2]Centre for Environmental and Population Health, School of Medicine and Dentistry, Griffith University, Brisbane, QLD, Australia

KEYWORDS

5G, EMR, wireless radiation, EMF database, environmental health, conflicts of interest, science communication

Introduction

The advent of fifth-generation (5G) wireless communication introduces new technology utilizing near-millimeter radiofrequency waves [i.e., with a frequency of 30–300 GHz (mmWaves)]. The long-term effects of these signals on humans and the environment are unknown. Scientific literature reviews investigating biological harm from mmWave usage have concluded … *no in-depth conclusions can be drawn*… [(1), p. 16] and *no confirmed evidence* [(2), p. 601]. Unfortunately, these statements of scientific uncertainty have been used by industry and government advisory bodies to reassure the public of the safety of the 5G rollout. However, the assumption that 5G technologies are safe is not an evidence-based conclusion (3). Why this is so cannot be easily understood from existing summaries or reviews (4). Therefore, this article takes one step back from reviews to the original papers, so as to provide a visible overview of the existing mmWave evidence base. It then examines how the science is being conducted and communicated, finding errors in reasoning that cloud judgements and the subsequent conclusions drawn from the existing research.

Mapping out the mmWave research landscape

Public policy regarding the safety of electromagnetic fields (EMF) is often formulated from reviews rather than from individual papers, e.g., the recent SCHEER opinion (5). Literature reviews give readers a narrow view of past research, with many papers ignored or removed at the beginning of the review process. It is also possible that quality papers are being omitted in this process (4). Thus, all relevant mmWave research literature is not yet fully transparent to the readership in this field. To help the research community to formulate an initial overview opinion, we have mapped out the broader landscape by making visible the range of biological and health effect topics contained within the mmWave literature (see below). Then, within the main topics investigated, we have made evident the number of studies showing effects vs. the number of studies showing no effects "regardless of the study design, merit, flaws, experimental quality, shortcomings, limitations, or methodological weaknesses" [(6), p. 2]. As such, this opinion piece is not to be considered as a systematic review. However, the papers presented here [listed in Supplementary Table 1 (all >6GHz experimental papers) and (epidemiological papers)] could be used as the basis for future exploration utilizing a more formal systematic review approach.

Database search for studies on mmWaves and health

Literature reviews investigating EMF typically use several existing information sources, such as PubMed, EMF-portal, and the Institute of Electrical and Electronics Engineers (IEEE). However, these databases cover a much broader range of topics than the bioeffects of electromagnetic radiation, such as medical procedures and accidents, computational models and non-experimental theoretical discussions. To address the need for a focused knowledge collection, the Oceania Radiofrequency Scientific Advisory Association (ORSAA) (7) has developed the ORSAA Database of EMF Bioeffects (ODEB) (8) containing peer-reviewed studies investigating the biological and health effects of electromagnetic fields on humans, animals and the environment.

ODEB[1] was first established using the entire research database of the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA) and then expanded to incorporate all relevant papers from PubMed and the EMF-portal. ODEB also includes military studies from the 70's, biophysics research from the 80's onwards, and all experimental and epidemiological research from both industry and independent scientists since 2012. ODEB currently comprises over 4,000 peer-reviewed publications and is being continually updated. It is searchable in many different categories including biological effect end-points, exposure parameters, study type etc. When papers are added to the ODEB database, they are screened for relevance. This description of the ODEB collection and its sources has been provided to demonstrate that the database is an adequate resource for the mmWave literature overview described below.

Investigation limited to below-threshold, mmWave papers

The experimental papers delivering mmWave exposures at or below the ICNIRP limits test whether the current ICNIRP exposure thresholds are adequate to guarantee safety for the public. A literature search was thus performed by requesting from ODEB all papers that used radiofrequencies > 6 GHz and exposure intensities below the International Commission on Non-Ionizing Radiation Protection (ICNIRP); i.e., the 4 W/kg whole-body Specific Absorption Rate (SAR) limit and the 200 W m^{-2} local tissue incident power density limit; [(9), p. 6–8]. The result was a set of 295 papers containing all of the papers in the recent Karipidis et al. mmWave review (10), plus an additional 79 more experimental papers (nine non-English) and 19 more epidemiology papers (five non-English). Given that this paper aims to map out the entire landscape, inclusion of the 14 non-English papers is appropriate.

Including all of these sources, the ODEB search produced a current literature base for mmWave research comprising 238 experimental papers and 57 epidemiology papers [see Supplementary Table 1 (all >6GHz experimental papers) and (epidem papers)]. This is a relatively small knowledge base, given the many combinations of experimental parameters requiring examination, such as frequency, modulation pattern, intensity, exposure duration, and the numerous types of tissues, cells, and biological functions. In comparison with the broader radiofrequency literature, mmWave research constitutes <10% of the knowledge base.

Main themes

As there are so few experimental studies on the bioeffects of mmWaves, rigorous literature reviews at this point in time are most likely destined to find no strong evidence. Instead, it is instructive to map out the main biological and health categories that have been investigated within the entire collection of studies, for the reasons given above and to help identify focus areas for future research.

Experimental papers emerging from the ODEB literature search (previously described) were automatically classified into their main biological and health categories. Within these, the number of studies showing significant effects and the number of studies showing no significant effects were tabled. Four papers with uncertain effects [i.e., where outcomes were not reported, or conclusions were qualified (8)] were excluded. The results for the experimental studies are summarized in Figure 1 below.

Figure 1 shows that the mmWave experimental studies cover a wide range of bioeffects. Furthermore, for most of the categories in Figure 1, from *biochemical* to *behavior*, a preliminary weight of evidence is visible. Overall, this picture suggests that mmWaves may affect many biological and health categories that warrant further investigation. Several of these categories have potential implications for public health, e.g., cellular oxidative stress, changes in immune function, genotoxicity, brain/neuronal changes, and cell membrane permeability. In particular, effects have been found in all studies that have investigated oxidative stress [cellular stress due to the over-production of reactive oxygen species and the reduction of oxidative defenses (11)]. Oxidative stress underlies many auto-immune and chronic conditions, such as diabetes, cardiovascular disease, Alzheimer's disease and depression, some of which are becoming an increasing social and economic threat worldwide (12).

The existing epidemiology papers [listed in Supplementary Table 1 (epidem papers)] mainly focus on the effects of occupational exposures, e.g., the occurrence of lymphoma or the reduction of sperm count in radar workers. Of these papers, the majority show effects from mmWave exposures.

Countries involved in mmWave research

In order to understand where the mmWave research has been performed, the country of origin was extracted from ODEB

1 ODEB is a free research tool Available at: https://a037613.fmphost.com/fmi/webd/Research_Review_V4.

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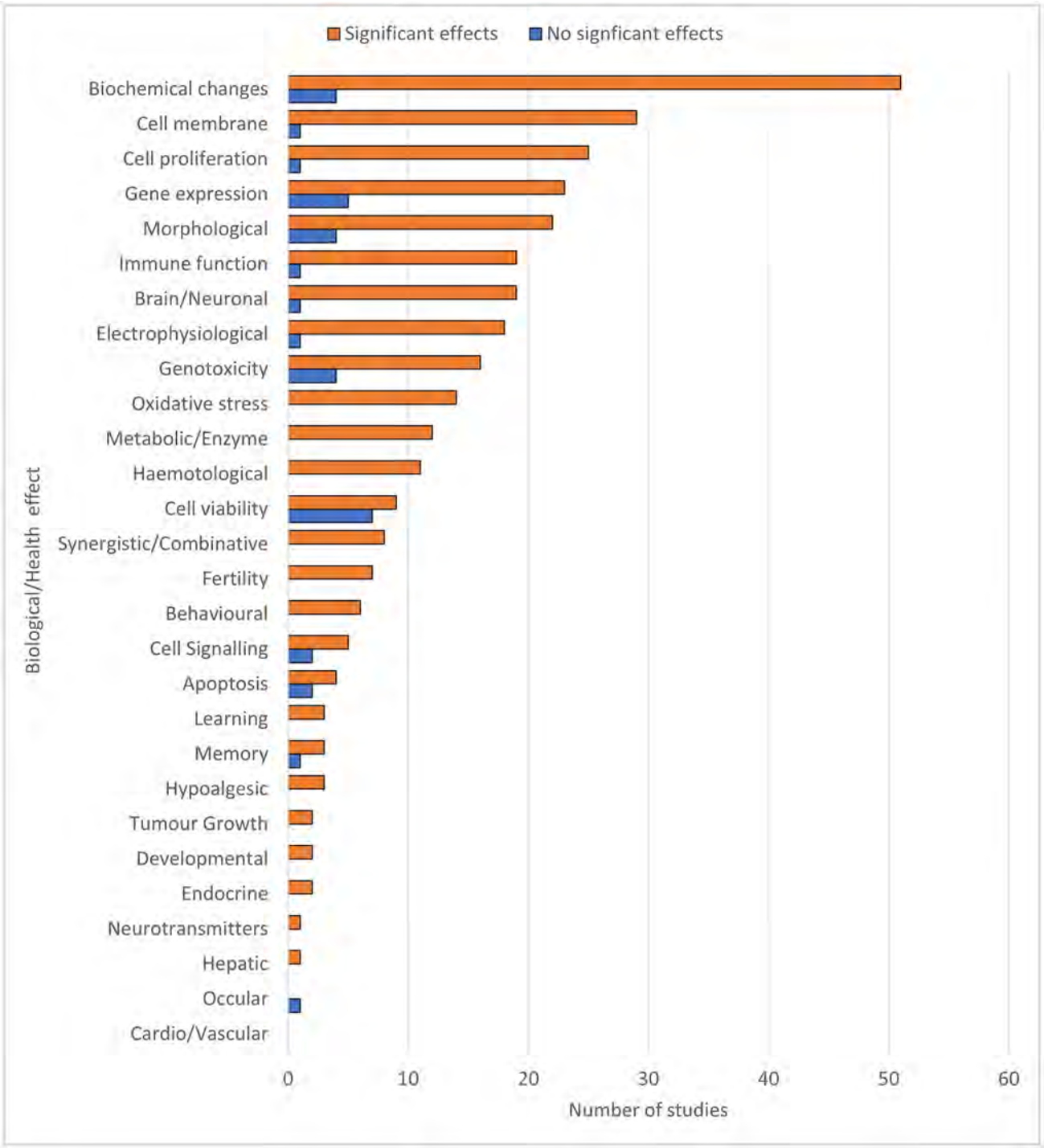

FIGURE 1
The main biological and health categories present in the mmWave experimental (i.e., *in vitro* and *in vivo*) literature base, and within each category, the number of papers producing effects vs. the number of papers resulting in no significant effects. The total number of studies is greater than the total number of papers because any given paper may have conducted more than one study and investigated more than one biological effect.

for all the papers included in this overview. Results showed that a large proportion of the research has been carried out in Russia (23%) and in the US (21%). Some countries have conducted several studies, and these make up a further third of the research: Italy (10%), France (6%), India (5%), Armenia (5%), Japan (4%), and China (3%). Countries that have each conducted only a few studies make up the remaining 23% of the research base.

Discussion

An overall trend despite the limited number of studies

Figure 1 shows that the relevant experimental research is minimal, as has been acknowledged in reviews (1, 2, 13). It is thus far too early for scientists to establish any definite theories because the experimental work using mmWaves is limited, there are a large number of end-points and processes to be considered, and for some biological end-points, the evidence appears contradictory. However, Figure 1 also reveals that the overall picture emerging from the existing knowledge base suggests a range of biological effects, some with strong evidence (>90% of studies), that may have potential health implications.

From the existing research, we can draw two conclusions:

1. For scientists, *the understanding of how mmWaves affect biological systems is still in its early stages*, thus there is an urgent need for further focused research to be conducted;
2. For policy makers, *there is enough smoke to suggest the risk of fire*, and therefore there is an urgent need for protective policy.

As Gee has pointed out (14), these two statements are not contradictory. The amount of evidence available in any area of science lies on a continuum from very weak (1–10%) to very strong (90–100%). Scientists require *strong* evidence of causality before laying down a new theory. In the case of the existing evidence for harm from 5G, scientists rightfully maintain that there are *no well-understood causal* links. However, government authorities tasked with protecting the health of humans, animals or plants need only *moderate* evidence as reasonable grounds for concern to enact the Precautionary Principle [e.g., (15)]. With so few experimental studies, but with an overall trend for biological effects, Figure 1 suggests that the current situation is one of *plausible risk*.

While the field of mmWave research has a limited knowledge base, there are early signs of evidence for bioeffects (as described above) that have implications for health. It is interesting to compare the interpretations of this state of affairs made by scientists compared to global policy makers. The science regarding skin is still *insufficient* to *devise science-based exposure limits*, says the scientist Leszczynski and so *precautionary measures should be considered for the deployment of the 5G* (13). In contrast, the industry-linked ICNIRP and the European Union (16) have determined that insuÿcient evidence provides reassurance of safety. No *evidence of harm* has been misconstrued as *evidence of no harm* [(17), p. 690], allowing the 5G rollout to proceed unfettered.

Standards compromised

When setting exposure limits, ICNIRP has not addressed the early evidence of biological effects with the potential to cause harm (18), as would be required by a risk management approach. ICNIRP radiation protection philosophy is thus deficient and not in alignment with that of the International Commission on Radiation Protection (ICRP) (19). The ICRP has a clear philosophy of radiation protection based on Justification, Optimization and Limitation.

Under the ICRP global radiation protection code of ethics, where mass exposures of populations are occurring without permission, even mild evidence of harm would be enough to advise governments to give pause to the technology, to consider the potential risks, to commit funds to further research and to enact strict precautions.

These precautions are not being implemented because the early message of plausible risk is unfortunately not being heard, partly due to poor reasoning and partly due to poor communication, as described below.

Logical fallacies in the communication of science

Along with assessing data quality, researchers can use the tools of reason to assess the quality of statements made in papers. Logical fallacies occur when various methods of argument are used to distort the reasoning, either intentionally or not (20). The art of integrating logical fallacies into communications has been used in the past by selected scientists working for industry, in order to convince the public and policy makers that their products do no harm, e.g., the smoking lobby used such techniques for decades (21). We have found that faulty reasoning has also been used to discuss mmWaves both in the public domain and in the research literature (4). To bring these issues to light and to invite discussion, some of the more frequently used logical fallacies are named in the sections below. These fallacies may not be intentional; e.g., they may be a result of simplifying the message so that the public can digest it. However, it is the responsibility of protection agencies, industry and researchers to ensure that their communications are clear and that fallacies are not inadvertently created when information is delivered to policy makers and to the public.

Fallacies used in describing millimeter waves

When government agencies or researchers introduce 5G technology as being based on mmWaves which are already in use in airport security screening [e.g., (2, 22)], this can create a "Faulty Analogy". This type of fallacy occurs when **two** things are alike in one or more ways, but then the incorrect assumption is made that they are necessarily alike in other ways (23). In this case, airport scanners and 5G technologies are similar in one way, in that they both use mmWaves; however, this similarity can lead people to believe that 5G technologies are also just as harmless as they believe airport scanners to be. In reality, the two types of technology are dissimilar in several important ways that are not mentioned in communications: (i) airport body scanners expose people for a few seconds and very infrequently, whereas exposures to 5G technologies occur many times a day throughout a person's lifetime, and (ii) the waveforms used by airport scanners are much simpler and not easily comparable with complex 5G waveforms. Using a Faulty Analogy to introduce mmWaves to the public could prevent consumers from considering any risks or from taking active precautions.

Millimeter waves are also introduced as if they are harmless for the human body. For mmWaves, the critically exposed organs are the skin and sclera of the eyes, and when 5G exposures are being discussed, it is often stated that mmWaves do not penetrate more

than a few millimeters into the skin. This creates a "Red Herring" fallacy (23), because it diverts attention toward the less important issue of skin surface tissue, and away from the more important issues of the mechanisms and biological functions of the skin. The facts that are ignored are: (i) In skin research, *penetrates* is a technical term, meaning that two-thirds of the original signal's energy is absorbed. There is still one-third that travels further, into deeper skin layers, nerves and blood. (ii) Skin is rich in nerves that are connected to the central and autonomic nervous systems. (iii) Skin is the body's first line of defense, rich in protective bacteria and part of the immune, waste management, and endocrine systems (13, 24).

There is very limited research into the bioeffects of mmWaves on the skin (13). The endocrine neurotransmitter and cardio systems to which the skin is connected and the critical sclera of the eyes have had a cursory investigation, as shown in Figure 1. However, it is predicted from theoretical models that the skin's sweat gland ducts (SGD) act as helical antennas, which can potentially carry mmWaves much deeper into the body (25, 26). Such deeper penetration has been confirmed, albeit at higher frequencies (94 GHz) (27). There are also predictions that transients from short pulses due to high data rates may create secondary waves called *Brillouin Precursors* that penetrate even deeper into the body, leading to the unwinding of large molecules, cell membrane damage and blood-brain leakage (28). Furthermore, Brillouin precursors do not decay as expected, which can lead to hot spots deep within the body (29). There are further concerns that the rapid pulse trains contained within 5G signals will cause intense hot spots on the skin, resulting in permanent tissue damage (30), and that the current ICNIRP guidelines do not protect against these hot-spots (31).

Altogether, these facts paint a very different picture of plausible risk than does the "Red Herring" statement given in public 5G communications that mmWaves only penetrate a few millimeters into the skin. Fifth and sixth-generation technologies should not be advancing without investigating the above issues, which are currently being ignored.

Fallacies used in reviews

When mmWave reviews are conducted, several principles are repeatedly used for critiquing experiential design and for dismissing or excluding various papers. However, we have found that several fallacies are present in these arguments, as described below.

Exposure principles confuse necessary and sufficient conditions

Quality studies need to report the dosimetry of the exposure signals clearly (i.e., what frequencies were used and what power densities or SARs were measured). Good dosimetry is a *necessary* condition of good reporting. However, it is not *sufficient* to guarantee that the exposures used in the experiment are adequate for testing the hypothesis, for the following reasons.

Real-world 5G signals are complex and variable. First, there are the variable low-frequency pulses (control, pilot, synchronization signals) and modulations being carried on the high-frequency 5G carrier waves. In addition, to send multiple signals simultaneously, many 4G/5G technologies use Orthogonal Frequency-Division Multiplexing (OFDM), which requires extremely high peak amplitudes. These methods of signal transfer create complexities in the waveforms that cannot be fully replicated using simulated signals created by frequency generators. Complex real-world signals are more bioactive (32) and are thus more likely to show bioeffects. Not surprisingly then, experiments that use signal generators are less likely to produce effects, while those that use real-world devices (e.g., mobile phones with, 50, 200, 500, or 217 Hz pulses embedded within the signals) are more likely to produce effects (32). That is, experiments that use real-world signals have a higher power (probability of finding an effect if there is one) than experiments that use simulated signals.

The type of exposure (to real-world devices/signals or to signal generators) thus needs to be a principle for judging the quality of a paper. However, this important principle is often ignored. Instead, a "Confusion of Necessary with Suÿcient Condition" fallacy occurs, where a study is acknowledged for reporting the *necessary* dosimetry, but the review does not ensure the inclusion of the more important *sufficient* conditions of the exposure, required to test the hypothesis. This means that studies with lower power are included in reviews and treated as if they are of high quality just because they reported the dosimetry. At the same time, studies with a higher power, that used real-world signals can be dismissed in the review because they do not clearly report the dosimetry [e.g., (33)].

As noted in (32) some reports have claimed that experiments that use a simulated signal from generators are superior because this allows the signal to be controlled in the laboratory experiment. However, this can be a "Red Herring" issue. While highly controlled experiments are to be aimed for, they are not the highest priority if they prevent the experimenter from being able to test the stimulus that is creating the response (which thereby reduces the power of the test).

Weakest points rather than strengths highlighted

Reviews also use other "quality of the study" issues to exclude papers or to downplay their results [e.g., (2)]. However, some of these issues are actually examples of the "Straw Person" fallacy, which occurs when the weakest points of an argument are attacked while stronger points are ignored. This fallacy can create a misrepresentation of an opponent's position in order to make one's own argument appear superior. Examples of the "Straw Person" fallacy occur in reviews that use less important issues as grounds to dismiss otherwise relevant and scientifically sound papers. Some examples of "Straw Person" dismissals are given below.

No replication or inconsistent results used to downplay results

Due to the low number of mmWave studies, the complexity of available parameter combinations, and given that all the studies are forging new ground, a lack of replication and inconsistencies between studies is to be expected. Moreover, it is well-known that funding bodies and universities do not fund replication studies. Therefore, lack of replication is a "Straw Person" in this emerging field, and to downplay the results of a sound experiment on that basis is fallacious; e.g., Two *studies by a Russian research group have also reported indicators of DNA damage in bacteria; however, these results have not been verified by other investigators* [(2), p. 599].

Collective "Straw Person" dismissal also occurs. For example, Figure 1 shows a range of bioeffects, leading to the suggestion of considerable "smoke" that warrants further investigation of a possible "fire". In contrast, the range of bioeffects is watered down in (2) by framing them as not yet replicated; e.g., *Although many bioeffects have been reported in many of the experimental studies, the results were generally not independently reproduced* [(2), p. 600].

"Poor methodology" has several meanings

Most experiments can be critiqued for containing some flaw or another; however, flaws occur on a continuum from minor to serious. To accuse a study of a *serious* methodological flaw requires a precise description of that flaw, e.g., the identification of a confounding variable. In contrast, if an experiment includes a noise factor, this is not a serious methodological flaw. The noise factor may weaken the result, by adding more randomness to the measurements, and therefore making it less likely that an effect will be found (i.e., by reducing the power of the test); however, the noise does not fully compromise the study.

Thus, when the term "methodological flaw" is used throughout a review, a logical fallacy of "Equivocation" may occur, because the meaning of this key term has one meaning in one portion of the discussion and then another meaning in another portion of the discussion (23). A concluding summary statement, e.g., that "many of the mmWave papers have methodological flaws", may then give the impression that all these studies have *major* flaws. In reality, many of the papers could contain non-major issues, such as noise factors and incorrect error bars. Without full explanations, it is impossible to tell if the flaws that papers are being accused of are fatal or non-fatal. We suggest that future reviews avoid a possible equivocation fallacy, by classifying methodological flaws into levels of seriousness, such as high, medium, and low and by giving clear justifications for why each paper is classified as such.

Non-linear dose-response misunderstood

Sometimes papers are rejected because they do not show a linear relationship between dose (exposure intensity × exposure duration) and effect. This is an incorrect rejection built on the "Red Herring" assumption that there is a linear relationship between dose and effect for radiofrequencies. This assumption has been countered by research that shows that (i) there are windows of power and frequency that cause harm (34), and (ii) that the human perceptual system has a non-linear response to electromagnetic frequencies (35–37). While linear dose-response models may be appropriate for telecommunications signaling, they are not appropriate for modeling biological responses where feedback mechanisms and adaptive responses occur.

The above examples of inappropriate dismissal of papers in reviews suggest that the credible evidence base for mmWave effects is likely to be larger than stated. To quote Barnes and Greenbaum (38), also cited by Lai (39).

> *The evidence that weak radiofrequency (RF) and low-frequency fields can modify human health is still less strong, but the experiments supporting both conclusions are too numerous to be uniformly written off as a group due to poor technique, poor dosimetry, or lack of blinding in some cases, or other good laboratory practices* [(38), p. 2].

Conclusions from reviews can be misinterpreted

After dismissing much of the evidence showing effects, as well as reporting the contradictory results, reviews have concluded that there is *no conclusive evidence* of harm. However, an "Appeal to Ignorance" fallacy can occur when the reviewers, the industry, and ICNIRP then give the impression that the statement *there is no harm* must be true because no counter evidence to that conclusion has been found; i.e., *because we have not found conclusive evidence of harm*. This fallacy has the effect of wrongfully shifting the burden of proof away from the one making the claim of no harm (23). In reality, the onus of proof is on industry and government to continue funding research that can enable a better understanding of the effects of mmWaves on humans and the environment.

The above logical fallacies embedded within the analysis and communication of the mmWave science may have resulted in significant omissions of critical studies or incorrect judgements about papers within reviews, making their conclusions unreliable; [e.g., see (4)].

Reviews that contain these fallacies are not a suitable basis on which to build public policy or safety standards.

Fallacies used in setting standards

Several fallacies are also embedded within the ICNIRP guidelines, for mmWaves as well as other radiofrequencies.

Only heating matters

The main fallacy that has been pointed out by many researchers is the "Thermal Only" fallacy, whereby ICNIRP and industry have adopted the position that *only heating can produce important biological or health effects*. This "Red Herring" takes the focus away from research that investigates non-thermal biological and health effects. For example, in the main mmWave literature review of skin effects presented within the current ICNIRP guidelines, a decision has been made to focus on heating effects only [(9), p. 6–8].

Averaging is an adequate measure of harm

When ICNIRP assumes that averaging over time and space are effective measures for measuring the, this is the fallacy of "Slanting" because not all of the evidence available is being used to inform the case (20).

The ICNIRP premise that averaging over time and space is suÿcient to calculate harm from exposure is deficient in realism in several ways. First, the statistical use of an average assumes an underlying normal distribution, which is not the case for complex telecommunications signaling. Moreover, averages hide potential biophysical effects resulting in a conclusion of no harm overall, even though extreme harm may have occurred for a small portion of tissue [see (18, 30)].

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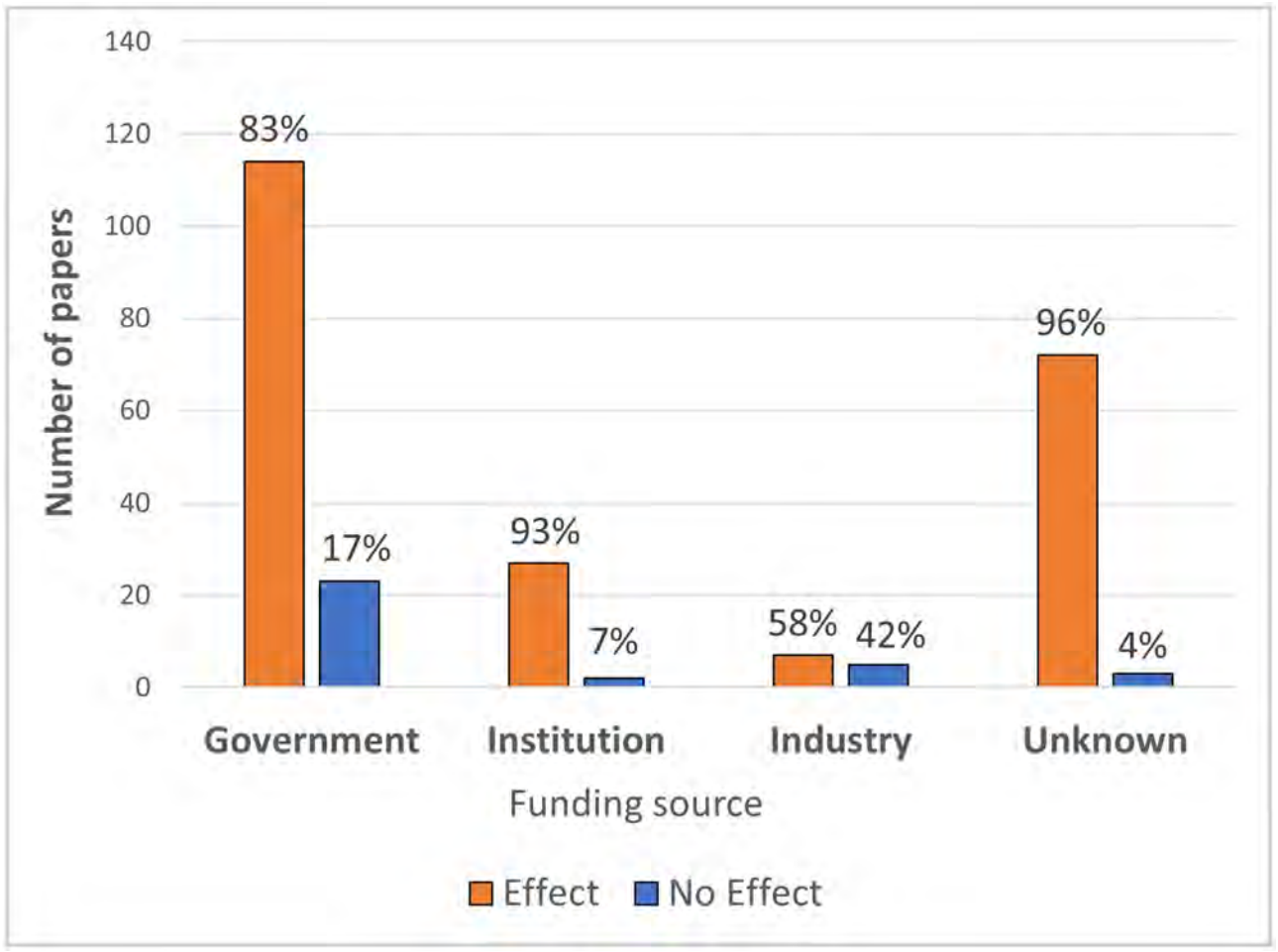

FIGURE 2
The relative proportion of "Effects" and "No Effects" outcomes from studies according to the funding source.

Authority uncertain

The fallacy of "Appeal to Authority" occurs when claims are believed because they are made by alleged authorities, but not all of the following are true: (i) they are making claims within their field of expertise, (ii) they are presenting facts about which there is some agreement, and (iii) they can be trusted (23). While bodies like ICNIRP and the WHO International EMF Project are given formal authority, other researchers have criticized them for being a small-self referencing group (40) with no dissenting voices (41). These bodies present one consistent message: that there is no evidence of harm from radiofrequencies, including mmWaves. In contrast, hundreds of scientists around the world with concerns for safety have appealed to the European Union for a moratorium on the 5G rollout (42, 43). Because there is no clear agreement on the facts, to assume an ultimate voice of authority on this topic is fallacious.

Furthermore, some expert scientists researching in this field have links with industry; therefore, conclusions from their papers need to be treated with caution. This is because industry can influence the science (44). For example, industry-funded research for UHF studies (including when partnered with government or military, public trusts, private foundations and institutions) was found to typically use short-term, single one-off exposures created by signal generators, to predominantly expose cell lines (*in vitro*) rather than live animals (*in vivo*) and to avoid epidemiological studies (45). These design decisions have resulted in studies that do not provide insights into potential health effects associated with multiple long-term, real-world exposure scenarios.

Similar to Huss et al. (46), an analysis of mmWave studies demonstrates how industry funding influences outcomes. Industry funded mmWave studies have produced a lower overall proportion of "Effect" outcomes, compared to government-funded and institution-based studies (see Figure 2).

Conclusions

The potential long-term health risks from global EMF continue to rise as exposures in the built environment increase in time and density. Mankind has chosen to base the justification for this rollout on shaky foundations, where there is minimal understanding of the impact of new radiofrequencies being introduced into the environment on long-term human and planetary health.

The evidence presented above suggests that there are credible risks of biological interference effects for frequencies planned for 5G, occurring well-below ICNIRP reference limits. Given the ubiquitous and often non-consensual nature of man-made wireless radiation exposures, the presence of even a small number of significant bioeffects requires follow up with more focused research.

The communication of existing investigations has not been fully clear or transparent. It is the responsibility of government review panels, regulatory bodies, scientists, public advocates, industry and policy makers to clearly communicate the research and its implications, so as to ensure that no fallacious conclusions can be drawn. If these are allowed to continue, both those delivering the message and the unsuspecting billions using their new 5G devices may be led in a direction that places global public and environmental health at risk.

The mmWave evidence base that has been made visible in this article suggests that plausible health effects cannot be ruled out, and that urgent action is needed on two fronts:

1. Further sound scientific research, *done carefully, using the best laboratory practices and sufficiently large samples to produce significant results*, funded and overseen by trusted bodies with appropriate expertise (38).
2. Precautionary actions to be taken by policy makers *via* use of *risk aversion* strategies such as the actions recommended in an EU commissioned report [(47), p. 152–153]. Risk aversion constitutes good leadership.

The limitations of scientific knowledge imply moral courage in taking precautionary action in time to avert harm [(17), p. 687].

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All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1058454/full#supplementary-material

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Electromagnetic fields, 5G and health: what about the precautionary principle?

John William Frank

Usher Institute, University of Edinburgh, Edinburgh, UK

Correspondence to
Professor John William Frank; john.frank@ed.ac.uk

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ABSTRACT

New fifth generation (5G) telecommunications systems, now being rolled out globally, have become the subject of a fierce controversy. Some health protection agencies and their scientific advisory committees have concluded that there is no conclusive scientific evidence of harm. Several recent reviews by independent scientists, however, suggest that there is significant uncertainty on this question, with rapidly emerging evidence of potentially harmful biological effects from radio frequency electromagnetic field (RF-EMF) exposures, at the levels 5G roll-out will entail. This essay identifies four relevant sources of scientific uncertainty and concern: (1) lack of clarity about precisely what technology is included in 5G; (2) a rapidly accumulating body of laboratory studies documenting disruptive in vitro and in vivo effects of RF-EMFs—but one with many gaps in it; (3) an almost total lack (as yet) of high-quality epidemiological studies of adverse human health effects from 5G EMF exposure specifically, but rapidly emerging epidemiological evidence of such effects from past generations of RF-EMF exposure; (4) persistent allegations that some national telecommunications regulatory authorities do not base their RF-EMF safety policies on the latest science, related to unmanaged conflicts of interest. The author, an experienced epidemiologist, concludes that one cannot dismiss the growing health concerns about RF-EMFs, especially in an era when higher population levels of exposure are occurring widely, due to the spatially dense transmitters which 5G systems require. Based on the precautionary principle, the author echoes the calls of others for a moratorium on the further roll-out of 5G systems globally, pending more conclusive research on their safety.

BACKGROUND

Fifth generation (5G) technology is being widely promoted by politicians, government officials, and private sector interests.[1–3] They contend that its advent will bring clear economic and lifestyle benefits, through massive increases in wireless and mobile connectivity at home, work, school and in the community. Examples of these 5G benefits include driverless vehicles and 'The Internet of Things'—automated and continuous communication between the machines in our daily lives.[4 5] On the other hand, the public health response to this wave of communications innovation has become a sense of deep concern, related to widespread scientific uncertainties, as well as a lack of use of existing evidence, in the current international safety guidelines for 5G and related radio frequency electromagnetic field (RF-EMF) exposures.[5–8] This commentary sets out the reasons for such concern.

WHAT IS 5G AND WHY IS IT DIFFERENT FROM PAST EMF EXPOSURES?

Developed over just the last decade, radio frequency (wireless) transmission systems in the 5G category are being rolled out throughout the world. These systems will massively increase the volume, speed and spatial reach of digital data transfer.[4–6] The four successive previous generations (1G, 2G, 3G and 4G) of wireless transmission systems were deployed initially for wireless and mobile phones (1980s and 1990s), followed by WiFi (2000s), and then smart metres and the Internet of Things (2010s). Each successive generation of transmission systems has used higher frequencies of electromagnetic waves to carry ever-larger volumes of data, faster, in more ubiquitous locations. 5G is widely acknowledged to be a step change in this sequence, since it additionally uses much higher frequency (3 to 300 GHz) radio waves than in the past. 5G will also make use of very new—and thus relatively unevaluated, in terms of safety—supportive technology (including pulsing, beaming, phased arrays and massive input/massive output (MIMO)—see below) to enable this higher data transmission capacity.[4–6]

However—unlike prior generations of wireless transmission systems—5G ultrahigh-frequency waves are easily interrupted by vegetation foliage (and building walls, often requiring additional signal boosting within each building). This inherent fragility of 5G high-frequency waves means that transmission boosting 'cell' antennae are generally required every 100–300 m or less—far more spatially dense than the miles-apart transmission masts required for older 2G, 3G and 4G technology using lower frequency waves.[4–6]

This dense transmission network is also required in order to achieve the 'everywhere/anytime' connectivity promised by 5G developers, and necessitated by new technology such as driverless cars, which must never be out of internet contact, for safety reasons. Critics of 5G agree[6–8]—but its supporters do not[9 10]—that the overall population levels of exposure to RF-EMFs will be greatly increased by the 5G roll-out. One compelling argument for that view is the 'inverse square law' of EMF exposure: intensity varies as the inverse of the square of the distance from the emitting source.[11] With plans afoot internationally to put a 5G booster antenna on 'every second or third lamp-post', it is difficult to believe that overall population exposures will not increase substantially. Existing 4G

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Case Report

Case Report: The Microwave Syndrome after Installation of 5G Emphasizes the Need for Protection from Radiofrequency Radiation

Lennart Hardell[1*], Mona Nilsson[2]

[1]Department of Oncology, Orebro University Hospital, Sweden (retired), The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden

[2]Swedish Radiation Protection Foundation, Gredby 14, SE-178 92 Adelsö, Sweden

[*]**Corresponding author:** Lennart Hardell, Department of Oncology, Orebro University Hospital, Sweden (retired), The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden

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Abstract

In this case, report two previously healthy persons, a man aged 63 years and a woman aged 62 years, developed symptoms of the microwave syndrome after installation of a 5G base station for wireless communication on the roof above their apartment. A base station for previous telecommunication generation technology (3G/4G) was present at the same spot since several years. Very high radiofrequency (RF) radiation with maximum (highest measured peak value) levels of 354 000, 1 690 000, and >2 500 000 μW/m^2 were measured at three occasions in the bedroom located only 5 meters below the new 5G base station, compared to maximum (peak) 9 000 μW/m^2 prior to the 5G deployment. The rapidly emerging symptoms after the 5G deployment were typical for the microwave syndrome with e.g., neurological symptoms, tinnitus, fatigue, insomnia, emotional distress, skin disorders, and blood pressure variability. The symptoms were more pronounced in the woman. Due to the severity of symptoms, the couple left their dwelling and moved to a small office room with maximum (peak) RF radiation 3 500 μW/m^2. Within a couple of days, most of their symptoms alleviated or disappeared completely. This medical history can be regarded as a classic provocation test. The RF radiation levels in the apartment were well below the limit proposed to be "safe" below which no health effects would occur, recommended by the International Commission on Non-Ionizing Radiation (ICNIRP). These now presented symptoms of the microwave syndrome were caused by non-thermal effects from RF radiation and highlight that the ICNIRP guidelines used in most countries including Sweden do not protect human health. Guidelines based on all biological negative effects from RF radiation are urgently needed, as well as monitoring human health, not the least due to rapidly increasing levels of exposure.

Keywords: Base station; 5G; Radiofrequency radiation; Electromagnetic hypersensitivity; Microwave syndrome; Health

Introduction

In recent years, human exposure to pulse-modulated microwave radiation [also called radiofrequency (RF) radiation] from wireless technology has increased exponentially. Microwaves are frequencies in the range of 300 MHz to 300 GHz within the radiofrequency (RF) spectrum [1]. The increase is mainly a result of the expansion of 4G+ and 5G as well as an increased amount of consumer products based on technologies that emit microwave radiation.

In parallel with this exploding RF radiation exposure, regulations and so-called safety limits applicable to the permitted RF radiation in most countries are based on a severely outdated approach from the 1950s. These 'safety" limits (or guidelines) only protect people against harmful effects that occur as a result of acute heating, also called thermal effects. These occur when

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Development of the Microwave Syndrome in Two Men Shortly after Installation of 5G on the Roof above their Office

*Nilsson M[1] and Hardell L[2]**

[1]Swedish Radiation Protection Foundation, Sweden

[2]The Environment and Cancer Research Foundation, Sweden

Abstract

The 5th generation, 5G, for wireless communication is rolled out without previous studies on potential effects on human health and the environment. In this case study we describe two men, case 1 and case 2, working in three offic rooms close to base stations. After the deployment of 5G, both men developed symptoms typical for the microwave syndrome, e.g., headache, tinnitus, dizziness, balance disorder, concentration and attention deficiency, and fatigue. Radiofrequency Radiation (RFR) after the 5G deployment was measured in the three offices In offic one maximum (peak) RFR during one minute varied from 463 to 1,180,000 μW/m^2, in offic two from 6,230 to 501,000 and in offic three from 13,700 to 613,000 μW/m^2. The symptoms disappeared in both men within a couple of weeks (case 1) or immediately (case 2) after leaving the offic for other office with much lower maximum peak RFR emissions, maximum for case 1 =16 and for case 2 =2,920 μW/m^2. This case report may be regarded as a provocation study on health from 5G RFR. The clinical picture in both men was clearly related to the exposure, although the exposures were well below the guidelines recommended by ICNIRP that are claimed to protect against all health effects. We conclude that the guidelines for RFR exposure based only on tissue heating by ICNIRP are inadequate to protect human health and that 5G appears to provoke symptoms of microwave syndrome in previously healthy people.

Keywords: Base station; 5G; Radiofrequency radiation; Electromagnetic hypersensitivity microwave syndrome; Health

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Correspondence:
Lennart Hardell, The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden,
E-mail: lennart.hardell@environmentandcancer.com

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Introduction

Guidelines for exposure to Radiofrequency Radiation (RFR), also called microwaves, from ICNIRP [1] and the FCC [2] are based on outdated assumptions that ignore current scientific evidence on health effects. Tissue heating within very short exposure time is the only accepted basis for these guidelines. Thereby these guidelines do not protect against numerous non-thermal health effects observed for RFR exposure at non-thermal levels [3]. Microwaves are frequencies in the range of 300 MHz to 300 GHz and it is within this range of frequencies that modern wireless technologies for instance 3G, 4G, 5G and Wi-Fi operate. People may react to RFR with e.g., insomnia, heart palpitations, tinnitus, skin disorders, headache, and neurological symptoms at exposure levels clearly below the guidelines suggested by ICNIRP and FCC. The terms microwave syndrome, microwave illness, radiofrequency sickness or Electromagnetic Hypersensitivity (EHS) have been attributed to these health effects. The symptoms develop at levels of RFR exposure well below the guidelines from ICNIRP, and are alleviated by elimination of or reduced exposure, but may in some cases persist to some degree. Individuals suffering from EHS react with health symptoms already at very low non-thermal exposure levels to RF-radiation [4]. The symptoms of microwave syndrome or illness were described already in the 1960's by researchers in East European Countries [5] as a consequence of long-term occupational exposure to microwaves/RFR. These non-thermal effects depend primarily on the modulation and/or pulsation of the signal and also on the peak and average intensity of the RFR. The symptoms decline and may disappear completely after exposure has ceased and may after a few days to several weeks have disappeared completely [6]. Recently we published a case report on two persons, who developed the microwave syndrome after installation of base station for 5G on the roof just above their apartment [7]. Due to the severity of the symptoms caused by the sharp increase in non-thermal levels of microwaves from the 5G base station, the couple had to move to

Original Article

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Anatomy Section

Effect of 1800-2100 MHz Electromagnetic Radiation on Learning-Memory and Hippocampal Morphology in Swiss Albino Mice

G KRISHNA KISHORE[1], KV VENKATESHU[2], NS SRIDEVI[3]

ABSTRACT

Introduction: With advancing technology the mobile phone with multiple features is used as a multipurpose device and attract people of all age groups. Increased usage of mobile phone raises the question of possible adverse effects on health.

Aim: To assess the 1800-2100 MHz radiation effect on learning-memory and microscopic anatomy of hippocampal Cornu Ammonis (CA3) neurons in mice.

Materials and Methods: A total of 18 albino mice were divided into 3 groups (6 Mice per group). Group-I: Control Group, Group-II: Exposed to Radio frequency-Electromagnetic radiation (RF-EMR) for 30 minutes/day for 3 months, Group-III: Exposed to RF-EMR for 60 minutes/day for 3 months. Followed by the exposure, learning memory was assessed by using Hebb-Williams maze in all the groups. The mice were then sacrificed, brains were dissected out and sections were taken at the level of hippocampus and then stained with Haematoxylin and Eosin for microscopy.

The results were expressed in Mean±SD and analysed by using one-way (analysis of variance) ANOVA followed by LSD (Least Square Difference) test for paired wise data. The p-value<0.05 was considered as statistically significant.

Results: The time taken by the animal to reach the target chamber was significantly increased in Group-III (exposed 60 minutes/day for 3 months), whereas group-II (exposed 30 minutes/day for 3 months) showed no significant changes when compared to Group-I (control group). Microscopic anatomy of hippocampal CA3 neurons in exposed group shows less number of pyramidal cells with darkened nuclei, cytoplasm was vacuolated and cells were scattered.

Conclusion: Exposure to 1800-2100 MHz radiation leads to damage and decrease of neurons in hippocampal region, which alters the learning and memory.

Keywords: Cornu ammonis, Hebb-Williams maze, Radio frequency

INTRODUCTION

The extensive use of Global System for Mobile communication (GSM) mobile phones throughout the world raises the possible adverse effects on human health especially on the Central Nervous System (CNS), the brain. In many countries more than half of the population relies/depend on mobiles for wireless communication and internet data [1]. In 2015, more than 7 billion people were using mobiles in the world, estimating to 62.9% of the world's population. Rapid increase of mobile users in general and specifically upto 80% of youngsters owning a mobile has made communication and technology easier [2].

In this concern, there is a growing interest in scientific community for the potential deleterious effects of Radio Frequency Electro Magnetic Radiation (RF EMR) on the public health, especially much focus on the effects of RF EMR on structural and functional integrity of the brain because the radiation exposure is directly to the head region [3]. In 2006 and 2010, World Health Organisation (WHO) issued a research agenda for high priority research on effects of RF exposure on ageing and neurodegenerative diseases in animals and effects of pre and post-natal RF exposure on development and behaviour in animals [4,5]. The mobile phone releases non-ionising radiation which has low frequency and considered to be safe, but recent studies evidenced that it has an impact on the living tissues especially on the brain which can cause headache, memory loss, heat over the ear, decreased concentration and other cognitive effects [6].

The hippocampus is a part of brain which belongs to the limbic system and is involved in cognitive functions like spatial learning and working memory. It plays a crucial role in the formation of new memories and it is considered as a sensitive region and is affected by mobile phone radiation. The hippocampus is a "S"-shaped folded structure located on the floor of the lateral ventricle on both the cerebral hemispheres. Hippocampal formation consists of hippocampus proper, dentate gyrus and subiculum. Hippocampus proper is also known as Cornu Ammonis (CA), which consists of CA1, CA2, CA3 and CA4 sub-regions [7].

Studies have found that damage to the hippocampal neurons may lead to impairment of memory and learning, behavioural disturbances and impact on Hypothalamo-Pituitary-Adrenal (HPA) axis [3,8,9]. The present study was undertaken to evaluate the long term exposure effect of mobile phone radiofrequency electromagnetic radiation-4G (1800-2100 MHz) on cognitive functions like spatial learning, working memory and hippocampal morphology in adult swiss albino mice.

MATERIALS AND METHODS

The Experimental study was carried out after the approval of Institutional Animal Ethical Committee (IAEC/PHARMA/SDUMC/2017-18/04). The study was conducted at central animal house Sri Devaraj Urs Medical College, Kolar from November 2017-January 2018, the duration of the study was 3 months.

Animals

Six weeks old healthy male Swiss-Albino Mice were used in this study, the animals were procured from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) registered brooders-Invivo Biosciences, Bengaluru.

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Early-Life Exposure to Pulsed LTE Radiofrequency Fields Causes Persistent Changes in Activity and Behavior in C57BL/6 J Mice

Kerry A. Broom,[1]* **Richard Findlay**,[2] **Darren S. Addison**,[1] **Cristian Goiceanu**,[3] **and Zenon Sienkiewicz**[1]

[1]*Centre for Radiation, Chemical and Environmental Hazards, Public Health England, Chilton, Oxfordshire, UK*
[2]*Physics Group, EMFcomp Limited, Harwell Campus, Harwell, Oxfordshire, UK*
[3]*Department of Environmental Health, National Institute of Public Health, Regional Center Iasi, Iasi, Romania*

Despite much research, gaps remain in knowledge about the potential health effects of exposure to radiofrequency (RF) fields. This study investigated the effects of early-life exposure to pulsed long term evolution (LTE) 1,846 MHz downlink signals on innate mouse behavior. Animals were exposed for 30 min/day, 5 days/week at a whole-body average specific energy absorption rate (SAR) of 0.5 or 1 W/kg from late pregnancy (gestation day 13.5) to weaning (postnatal day 21). A behavioral tracking system measured locomotor, drinking, and feeding behavior in the home cage from 12 to 28 weeks of age. The exposure caused significant effects on both appetitive behaviors and activity of offspring that depended on the SAR. Compared with sham-exposed controls, exposure at 0.5 W/kg significantly decreased drinking frequency ($P \leq 0.000$) and significantly decreased distance moved ($P \leq 0.001$). In contrast, exposure at 1 W/kg significantly increased drinking frequency ($P \leq 0.001$) and significantly increased moving duration ($P \leq 0.005$). In the absence of other plausible explanations, it is concluded that repeated exposure to low-level RF fields in early life may have a persistent and long-term effect on adult behavior. Bioelectromagnetics. 2019;40:498–511. © 2019 The Authors. Bioelectromagnetics Published by Wiley Periodicals, Inc.

Keywords: **electromagnetic fields; locomotion; activity; brain; rodent**

INTRODUCTION

People are increasingly exposed to a broad spectrum of radiofrequency (RF) fields from an array of sources operating from a few hundred MHz to a few GHz. Sources include mobile and cordless phones, Bluetooth devices, and Wi-Fi [Sienkiewicz et al., 2017]. Despite much research, there are still gaps in knowledge about the potential of low-level RF fields to cause biological effects, and there are concerns that these exposures may have long-term effects on human health [SCENIHR, 2015]. In addition, the ubiquitous nature of our exposure to these RF fields means that, even if the risk to individuals is low, a substantial number of people among the population could experience health effects [Kheifets et al., 2001; WHO, 2010].

Since the development of mobile cellular telephony, adults and children have been exposed to prolonged low-level RF fields from base stations and to acute, localized exposures when the phone handsets are used. Children have been assumed to be more sensitive than adults to these exposures, due to the

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Conflict of interest: RF works for an independent EMF safety organization and declares no competing interests. ZS is a member of the main Commission of ICNIRP and declares no competing interests.

*Correspondence to: Kerry A. Broom, Public Health England, Centre for Radiation, Chemical and Environmental Hazards, Chilton, UK. E-mail: Kerry.Broom@phe.gov.uk

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Planetary electromagnetic pollution: it is time to assess its impact

As the Planetary Health Alliance moves forward after a productive second annual meeting, a discussion on the rapid global proliferation of artificial electromagnetic fields would now be apt. The most notable is the blanket of radiofrequency electromagnetic radiation, largely microwave radiation generated for wireless communication and surveillance technologies, as mounting scientific evidence suggests that prolonged exposure to radiofrequency electromagnetic radiation has serious biological and health effects. However, public exposure regulations in most countries continue to be based on the guidelines of the International Commission on Non-Ionizing Radiation Protection[1] and Institute of Electrical and Electronics Engineers,[2] which were established in the 1990s on the belief that only acute thermal effects are hazardous. Prevention of tissue heating by radiofrequency electromagnetic radiation is now proven to be ineffective in preventing biochemical and physiological interference. For example, acute non-thermal exposure has been shown to alter human brain metabolism by NIH scientists,[3] electrical activity in the brain,[4] and systemic immune responses.[5] Chronic exposure has been associated with increased oxidative stress and DNA damage[6,7] and cancer risk.[8] Laboratory studies, including large rodent studies by the US National Toxicology Program[9] and Ramazzini Institute of Italy,[10] confirm these biological and health effects in vivo. As we address the threats to human health from the changing environmental conditions due to human activity,[11] the increasing exposure to artificial electromagnetic radiation needs to be included in this discussion.

Due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 10^{18} times (figure). Radiofrequency electromagnetic radiation is also used for radar, security scanners, smart meters, and medical equipment (MRI, diathermy, and radiofrequency ablation). It is plausibly the most rapidly increasing anthropogenic environmental exposure since the mid-20th century, and levels will surge considerably again, as technologies like the Internet of Things and 5G add millions more radiofrequency transmitters around us.

Unprecedented human exposure to radiofrequency electromagnetic radiation from conception until death has been occurring in the past two decades. Evidence of its effects on the CNS, including altered neurodevelopment[14] and increased risk of some neurodegenerative diseases,[15] is a major concern considering the steady increase in their incidence. Evidence exists for an association between neurodevelopmental or

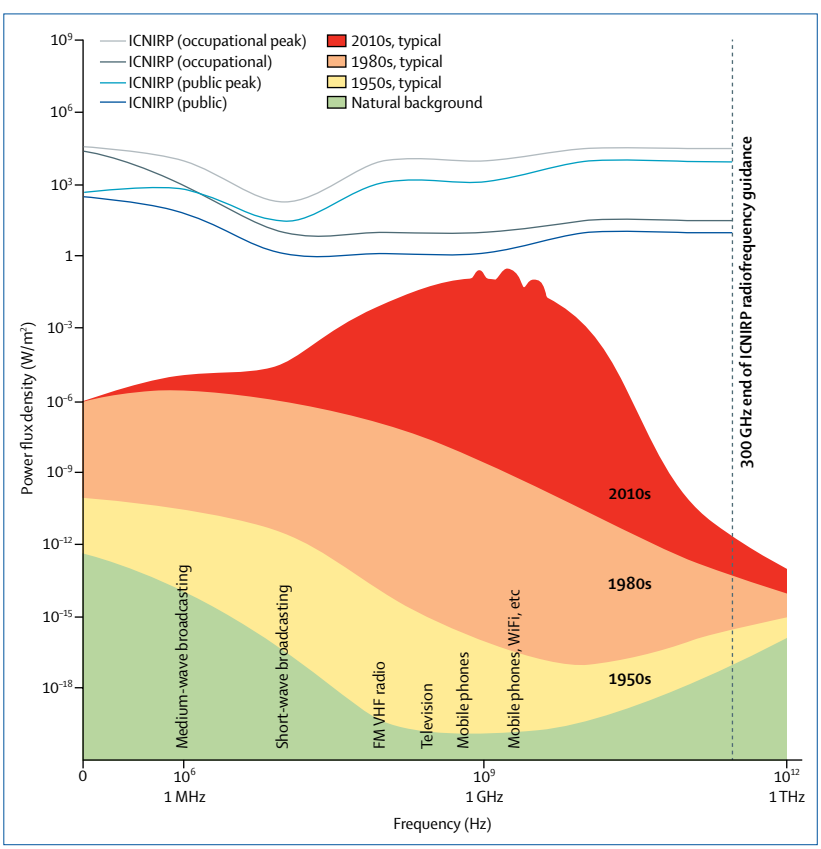

Figure: **Typical maximum daily exposure to radiofrequency electromagnetic radiation from man-made and natural power flux densities in comparison with International Commission on Non-Ionizing Radiation Protection safety guidelines[1]**

Anthropogenic radiofrequency electromagnetic radiation levels are illustrated for different periods in the evolution of wireless communication technologies. These exposure levels are frequently experienced daily by people using various wireless devices. The levels are instantaneous and not time-averaged over 6 minutes as specified by International Commission on Non-Ionizing Radiation Protection for thermal reasons. Figure modified from Philips and Lamburn[12] with permission. Natural levels of radiofrequency electromagnetic radiation were based on the NASA review report CR-166661.[13]

behavioural disorders in children and exposure to wireless devices,[14] and experimental evidence, such as the Yale finding, shows that prenatal exposure could cause structural and functional changes in the brain associated with ADHD-like behaviour.[16] These findings deserve urgent attention.

For the **Oceania Radiofrequency Scientific Advisory Association** see www.orsaa.org

At the Oceania Radiofrequency Scientific Advisory Association, an independent scientific organisation, volunteering scientists have constructed the world's largest categorised online database of peer-reviewed studies on radiofrequency electromagnetic radiation and other man-made electromagnetic fields of lower frequencies. A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68·2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields. We have published our preliminary data on radiofrequency electromagnetic radiation, which shows that 89% (216 of 242) of experimental studies that investigated oxidative stress endpoints showed significant effects.[7] This weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radiofrequency exposure levels. Instead, the evidence supports the International EMF Scientist Appeal by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

For the **International EMF Scientist Appeal** see www.emfscientist.org

Evidence also exists of the effects of radiofrequency electromagnetic radiation on flora and fauna. For example, the reported global reduction in bees and other insects is plausibly linked to the increased radiofrequency electromagnetic radiation in the environment.[17] Honeybees are among the species that use magnetoreception, which is sensitive to anthropogenic electromagnetic fields, for navigation.

Man-made electromagnetic fields range from extremely low frequency (associated with electricity supplies and electrical appliances) to low, medium, high, and extremely high frequency (mostly associated with wireless communication). The potential effects of these anthropogenic electromagnetic fields on natural electromagnetic fields, such as the Schumann Resonance that controls the weather and climate, have not been properly studied. Similarly, we do not adequately understand the effects of anthropogenic radiofrequency electromagnetic radiation on other natural and man-made atmospheric components or the ionosphere. It has been widely claimed that radiofrequency electromagnetic radiation, being non-ionising radiation, does not possess enough photon energy to cause DNA damage. This has now been proven wrong experimentally.[18,19] Radiofrequency electromagnetic radiation causes DNA damage apparently through oxidative stress,[7] similar to near-UV radiation, which was also long thought to be harmless.

At a time when environmental health scientists tackle serious global issues such as climate change and chemical toxicants in public health, there is an urgent need to address so-called electrosmog. A genuine evidence-based approach to the risk assessment and regulation of anthropogenic electromagnetic fields will help the health of us all, as well as that of our planetary home. Some government health authorities have recently taken steps to reduce public exposure to radiofrequency electromagnetic radiation by regulating use of wireless devices by children and recommending preferential use of wired communication devices in general, but this ought to be a coordinated international effort.

Priyanka Bandara, David O Carpenter
Oceania Radiofrequency Scientific Advisory Association, Scarborough, QLD 4020, Australia (PB); and Institute for Health and the Environment, University at Albany, Rensselaer, NY, USA (DOC)
pri.bandara@orsaa.org

We declare no competing interests. We thank Alasdair Philips for assistance with the figure and Victor Leach and Steve Weller for assistance with the ORSAA Database, which has enabled our overview of the scientific evidence in this area of research.

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Effects of pre and postnatal 2450 MHz continuous wave (CW) radiofrequency radiation on thymus: Four generation exposure

Fazile Cantürk Tan [a], Betül Yalçin [b], Arzu Hanım Yay [b], Burak Tan [c], Korkut Yeğin [d], and Süleyman Daşdağ [e]

[a]Department of Biophysics, Erciyes University, Kayseri, Turkey; [b]Department of Histology and Embryology, Erciyes University, Kayseri, Turkey; [c]Department of Physiology, Erciyes University, Kayseri, Turkey; [d]Department of Electrical and Electronics Engineering, Ege University, İzmir, Turkey; [e]Department of Biophysics, İstanbul Medeniyet University, İstanbul, Turkey

ABSTRACT

This study aims to investigate the effects of pre- and postnatal 2450 MHz continuous wave (CW) radiofrequency radiation (RFR) on the thymus of rats spanning four generations. Four groups; sham, irradiated female, irradiated male, irradiated male and female, each consisting of four rats (one male and three females), were created. During the experiment, rats in the exposure groups were whole-body exposed to 2450 MHz CW-RFR for 12 h/day. Irradiation started one month before the fertilization in the experimental group. When the offspring were two months old, four rats, one male and three female, were allocated for the second-generation study. The remaining offspring were sacrificed under general anesthesia, and their thymuses were removed. The same procedure was applied to the next generation. Two months after the second generation gave birth, third-generation rats were decapitated, and their thymuses were removed. In all groups, cortex, medulla and resident cells could be clearly distinguished in the second and third generations. No differences were observed between the control and two experimental groups, defined as irradiated female and irradiated male. In contrast, vascularization was observed in the thymus of the fourth-generation offspring of the group where both males and females were irradiated. The number of offspring and mass of all rats decreased in the third-generation group. Pre-and postnatal 2450 MHz continuous wave radiofrequency radiation exposure may potentially affect the thymus of future generations.

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2450 MHz RF; pre-and postnatal exposure; continuous wave; thymus; four generations

Introduction

The classification of radio frequencies (RF) as 2B agents by the International Agency for Research on Cancer (IARC) and the common use of wireless communication (Wi-Fi) devices in data transmission have raised health fears associated with electromagnetic fields (EMF) exposure. Developing tissues and organs are susceptible to harmful agents. The World Health Organization (WHO) has led research on the effect of early-life exposure to microwave (MW) as high precedence for 2006 and 2010 research on EMF because of the possible vulnerability of children (Laudisi et al. 2012).

Long-term pre- and postnatal RF radiation (RFR) exposure and the delayed effects are not known sufficiently. As the effects of RFR are still uncertain, the Council of Europe recommends that restrictions be placed on internet access and usage of mobile phones in all schools to preserve juveniles from the potential harm of radiation (Watson 2011). There are many reports about the effect of mobile phone exposure on health, but research on the effect of Wi-Fi 2.4 GHz RFR is considerably less than mobile phones (Dasdag et al. 1999, 2000, 2009; Dasdag et al. 2015a). However, Dasdag et al. investigated the effect of pulsed 2.4 GHz RFR on the brain and found it can cause adverse effects (Dasdag et al. 2015b). Although many organs, especially the brain, have been the focus of these studies, the thymus is often overlooked and has not been considered as being affected by RFR.

The thymus is a central organ of the immune system and the lymphatic system, which differentiate into antigen-recognizing cells and lymphocytes produced by the bone marrow in mammalian cells (Dominguez-Gerpe and Rey-Menéndez 2003; Miller 2020; Rezzani et al. 2014). During early embryogenesis, with the onset of hematopoiesis begins development of the immune system and then throughout prenatal life continues with successive hematopoietic cell production, cell migration, and differentiation (Laudisi et al. 2012). The thymus is vulnerable to physiological alters such as pregnancy,

CONTACT Süleyman Daşdağ suleyman.dasdag@medeniyet.edu.tr İstanbul Medeniyet University, Faculty of Medicine, Department of Biophysics, İstanbul 34700, Turkey

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Very high radiofrequency radiation at Skeppsbron in Stockholm, Sweden from mobile phone base station antennas positioned close to pedestrians' heads

Tarmo Koppel [a], Mikko Ahonen [b], Michael Carlberg [c], Lennart Hardell [c,*]

[a] Tallinn University of Technology, SOC353 Ehitajate tee 5, 19086, Tallinn, Estonia
[b] Päivölä Institute, Päivölantie 52, Tarttila, 37770, Finland
[c] The Environment and Cancer Research Foundation, Studievägen 35, SE 702 17, Örebro, Sweden

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ABSTRACT

In urban environment there is a constant increase of public exposure to radiofrequency electromagnetic fields from mobile phone base stations. With the placement of mobile phone base station antennas radiofrequency hotspots emerge. This study investigates an area at Skeppsbron street in Stockholm, Sweden with an aggregation of base station antennas placed at low level close to pedestrians' heads. Detailed spatial distribution measurements were performed with 1) a radiofrequency broadband analyzer and 2) a portable exposimeter. The results display a greatly uneven distribution of the radiofrequency field with hotspots. The highest spatial average across all quadrat cells was 12.1 V m^{-1} (388 mW m^{-2}), whereas the maximum recorded reading from the entire area was 31.6 V m^{-1} (2648 mW m^{-2}). Exposimeter measurements show that the majority of exposure is due to mobile phone downlink bands. Most dominant are 2600 and 2100 MHz bands used by 4G and 3G mobile phone services, respectively. The average radiofrequency radiation values from the earlier studies show that the level of ambient RF radiation exposure in Stockholm is increasing. This study concluded that mobile phone base station antennas at Skeppsbron, Stockholm are examples of poor radiofrequency infrastructure design which brings upon highly elevated exposure levels to popular seaside promenade and a busy traffic street.

1. Introduction

Electromagnetic fields are known physical risk factors. When mobile phone base station antennas are installed, the immediate physical environment, including the public and the living spaces can be greatly affected by microwaves.

Measuring public exposure to radiofrequency fields is significant from public health perspective, but also for future epidemiological studies. Given the rapid development of mobile communication technologies, the radiofrequency landscape is continuously diversifying and intensifying: more frequencies are introduced to provide novel mobile phone and data services; more base station antennas are constantly installed to facilitate the increasing need for data amounts, pushed through the networks. Meanwhile, public exposure also increases.

In previous publications we have reported environmental exposure to radiofrequency (RF) electromagnetic (EMF) radiation at certain places in Stockholm in Sweden such as the Central Railway Station (Hardell et al., 2016), the Old Town (Hardell et al., 2017), with special attention to Järntorget in the Old Town (Hardell et al., 2019), and Stockholm city (Carlberg et al., 2019). Of special interest was to measure RF radiation in one Stockholm apartment with two groups of base station antennas nearby (Hardell et al., 2018). That apartment was further examined using a RF broadband analyzer and the results were compared with another Stockholm apartment with substantially much lower RF radiation but equally good wireless communication possibility (Koppel et al., 2019).

Earlier studies done in Europe show constant increase of public exposure, especially in urban environment. The increase is attributed to new mobile phone base stations installed, but also to the increased usage of corresponding mobile services. Sánchez-Montero et al. (2017) monitored urban exposure in Alcalá de Henares (Spain) for ten years and reported city mean field increase from 0.277 (203 μW m^{-2}) in 2006 to 0.395 V m^{-1} (414 μW m^{-2}) in 2015. Sánchez-Montero et al. (2017) admit that during the ten years of monitoring the number of mobile phone base

* Corresponding author. Studievägen 35, SE-702 17, Örebro, Sweden.
E-mail address: lennart.hardell@environmentandcancer.com (L. Hardell).

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COMMENT

Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest

LENNART HARDELL and MICHAEL CARLBERG

The Environment and Cancer Research Foundation, SE-702 17 Örebro, Sweden

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Abstract. The fifth generation, 5G, of radiofrequency (RF) radiation is about to be implemented globally without investigating the risks to human health and the environment. This has created debate among concerned individuals in numerous countries. In an appeal to the European Union (EU) in September 2017, currently endorsed by >390 scientists and medical doctors, a moratorium on 5G deployment was requested until proper scientific evaluation of potential negative consequences has been conducted. This request has not been acknowledged by the EU. The evaluation of RF radiation health risks from 5G technology is ignored in a report by a government expert group in Switzerland and a recent publication from The International Commission on Non-Ionizing Radiation Protection. Conflicts of interest and ties to the industry seem to have contributed to the biased reports. The lack of proper unbiased risk evaluation of the 5G technology places populations at risk. Furthermore, there seems to be a cartel of individuals monopolizing evaluation committees, thus reinforcing the no-risk paradigm. We believe that this activity should qualify as scientific misconduct.

Introduction

Most politicians and other decision-makers using guidelines for exposure to radiofrequency (RF) radiation seem to ignore the risks to human health and the environment. The fact that the International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) in May 2011 classified RF radiation in the frequency range of 30 kHz to 300 GHz to be a 'possible' human carcinogen, Group 2B (1,2), is being ignored. This has been recently exemplified in a hearing at the Tallinn Parliament in Estonia (3).

An important factor may be the influence on politicians by individuals and organizations with inborn conflicts of interests (COIs) and their own agenda in supporting the no-risk paradigm (4,5). The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has repeatedly ignored scientific evidence on adverse effects of RF radiation to humans and the environment. Their guidelines for exposure are based solely on the thermal (heating) paradigm and were first published in ICNIRP 1998 (6), updated in ICNIRP 2009 (7) and have now been newly published in ICNIRP 2020 (8), with no change of concept, only relying on thermal effects from RF radiation on humans. The large amount of peer-reviewed science on non-thermal effects has been ignored in all ICNIRP evaluations (9,10). Additionally, ICNIRP has successfully maintained their obsolete guidelines worldwide.

COIs can be detrimental, and it is necessary to be as unbiased as possible when assessing health risks. There are three points that should be emphasized. Firstly, the evidence regarding health risks from environmental factors may not be unambiguous, and therefore informed judgements must be made. Furthermore, there are gaps in knowledge that call for experienced evaluations, and no conclusion can be reached without value judgements. Secondly, paradigms are defended against the evidence and against external assessments by social networks in the scientific community. Thirdly, the stronger the impact of decisions about health risks on economic, military and political interests, the stronger will stakeholders try to influence these decision processes.

Since the IARC evaluation in 2011 (1,2), the evidence on human cancer risks from RF radiation has been strengthened based on human cancer epidemiology reports (9-11), animal carcinogenicity studies (12-14) and experimental findings on oxidative mechanisms (15) and genotoxicity (16). Therefore, the IARC Category should be upgraded from Group 2B to Group 1, a human carcinogen (17).

The deployment of the fifth generation, 5G, of RF radiation is a major concern in numerous countries, with groups of citizens trying to implement a moratorium until thorough research

Correspondence to: Dr Lennart Hardell, The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17 Örebro, Sweden
E-mail: lennart.hardell@environmentandcancer.com

Key words: Switzerland, European Union, World Health Organization, International Commission on Non-Ionizing Radiation Protection, Scientific Committee on Emerging and Newly Identified Health Risks, Swedish Radiation Safety Authority, 5G, electromagnetic field, appeals, moratorium, microwave radiation, radiofrequency electromagnetic field, health risks, non-ionizing radiation guidelines, conflicts of interest

Review Article

Lennart Hardell* and Tarmo Koppel

Electromagnetic hypersensitivity close to mobile phone base stations – a case study in Stockholm, Sweden

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Abstract: A previously healthy worker developed symptoms assigned to electromagnetic hypersensitivity (EHS) after moving to an office with exposure to high levels of anthropogenic electromagnetic fields (EMFs). These symptoms consisted of e.g. headache, arthralgia, tinnitus, dizziness, memory loss, fatique, insomnia, transitory cardiovascular abnormalities, and skin lesions. Most of the symptoms were alleviated after 2 weeks sick leave. The highest radiofrequency (RF) field level at the working place was 1.72 V/m (7,852 μW/m^2). Maximum value for extremely low frequency electromagnetic field (ELF-EMF) from electric power at 50 Hz was measured to 285 nT (mean 241 nT). For electric train ELF-EMF at 16.7 Hz was measured to 383 nT (mean 76 nT). Exposure to EMFs at the working place could be the cause for developing EHS related symptoms. The association was strengthened by the symptom reduction outside the working place.

Keywords: electromagnetic hypersensitivity; EMF; radiofrequency radiation; symptoms.

Introduction

Exposure to extremely low frequency (ELF) electromagnetic fields (EMF) and radiofrequency (RF) EMF is in most cases involuntary and unknown to people. Both ELF-EMF and RF-EMF have been evaluated by IARC to be possible human carcinogens, Group 2B [1–3]. In fact EMFs should be regarded to be environmental pollutants that do not smell, have no taste and are invisible.

***Corresponding author: Lennart Hardell,** The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden, E-mail: lennart.hardell@environmentandcancer.com
Tarmo Koppel, Tallinn University of Technology, Tallinn, Estonia, E-mail: tarmo.koppel@taltech.ee

Already in the 1970s the 'microwave syndrome' was described in the former Soviet Union [4]. Persons working with radar or radio equipment reported symptoms of fatigue, headache, dizziness, disturbed sleep, concentration and memory problems.

In the 1980s similar symptoms were reported among Swedish persons working in front of cathode ray tube monitors [5]. In Finns such symptoms were attributed to exposure to EMF [6]. This syndrome was termed electromagnetic hypersensitivity (EHS), although still without an International Classification of Diseases (ICD-code) [7].

EHS consists of a wide range of different symptoms that may vary from person to person. EMF sensitivity varies among individuals from mild to severe. The prevalence has been reported to be 1.5% in Sweden [8], 3.2% in California [9], 5% in Switzerland [10], and 13% in Taiwan [11].

We report here on a person who developed symptoms consistent with those described among EHS subjects. The symptoms developed at a work place with exposure to EMFs. Our hypothesis is that the symptoms may be attributed to that exposure. We obtained informed consent by the person to publish the symptoms and work history anonymously.

Methods

The subject attributed the development of EHS symptoms to her office room where she had been working one year since April 2018 for a total of 183 working days. As the source of the adverse health effects was unknown, the investigators devised a broad spectrum approach for EMF measurements, to include all possible sources of EMFs.

The room was thoroughly measured encompassing different types of electromagnetic fields, including:

- Extremely low frequency (ELF) magnetic field (MF)
- Intermediate frequency (IF) magnetic field (MF)
- Radiofrequency (RF) electromagnetic field.

Three types of measurements approaches were utilized characterizing:

- Spatial field distribution
- Temporal field dynamics
- Spectrum analysis of EMF

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World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review)

LENNART HARDELL

Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden

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Abstract. In May 2011 the International Agency for Research on Cancer (IARC) evaluated cancer risks from radiofrequency (RF) radiation. Human epidemiological studies gave evidence of increased risk for glioma and acoustic neuroma. RF radiation was classified as Group 2B, a possible human carcinogen. Further epidemiological, animal and mechanistic studies have strengthened the association. In spite of this, in most countries little or nothing has been done to reduce exposure and educate people on health hazards from RF radiation. On the contrary ambient levels have increased. In 2014 the WHO launched a draft of a Monograph on RF fields and health for public comments. It turned out that five of the six members of the Core Group in charge of the draft are affiliated with International Commission on Non-Ionizing Radiation Protection (ICNIRP), an industry loyal NGO, and thus have a serious conflict of interest. Just as by ICNIRP, evaluation of non-thermal biological effects from RF radiation are dismissed as scientific evidence of adverse health effects in the Monograph. This has provoked many comments sent to the WHO. However, at a meeting on March 3, 2017 at the WHO Geneva office it was stated that the WHO has no intention to change the Core Group.

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2. The WHO fact sheet
3. The WHO EMF project
4. WHO radio frequency fields: Environmental health criteria monograph
5. Human Health Effects of Non-Ionizing Radiation - Informal meeting at WHO March 3, 2017
6. Exposure to RF radiation within the WHO building in Geneva
7. Concluding remarks

Correspondence to: Dr Lennart Hardell, Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden
E-mail: lennart.hardell@regionorebrolan.se

Key words: electromagnetic fields, EMF, radiofrequency radiation, public exposure, cancer, WHO, monograph, conflict of interest, ICNIRP, non-thermal effects, health risks

1. Introduction

The use of wireless digital technology has grown rapidly during the last couple of decades (http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf). During use, mobile phones and cordless phones emit radiofrequency (RF) radiation. The brain is the main target organ for RF emissions from the handheld wireless phone (1,2). An evaluation of the scientific evidence on the brain tumour risk was made in May 2011 by the International Agency for Research on Cancer (IARC) at the World Health Organization (WHO). IARC is independently financed and has its own governing and scientific councils, which WHO staff only attend as observers (http://www.who.int/ionizing_radiation/research/iarc/en/).

Epidemiological studies provided supportive evidence of increased risk for head and brain tumours, i.e., acoustic neuroma and glioma. The working group reached the conclusion that RF radiation from devices that emit non-ionizing RF radiation in the frequency range 30 kHz-300 GHz, is a Group 2B, i.e. a 'possible', human carcinogen (3,4). Later studies have corroborated these findings and have thus strengthened the evidence (5-8).

Several laboratory studies have indicated mechanisms of action for RF radiation carcinogenesis such as on DNA repair, oxidative stress, down regulation of mRNA and DNA damage with single strand breaks (9-13). A report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (14). An increased incidence of glioma in the brain and malignant schwannoma in the heart was found in rats. Acoustic neuroma or vestibular schwannoma is a similar type of tumour as the one found in the heart, although benign. Thus, this animal study supported human epidemiological findings on RF radiation and brain tumour risk (8).

The IARC cancer classification includes all sources of RF radiation. The exposure from mobile phone base stations, Wi-Fi access points, smart phones, laptops and tablets can be long-term, sometimes around the clock, both at home and at

High radiofrequency radiation at Stockholm Old Town: An exposimeter study including the Royal Castle, Supreme Court, three major squares and the Swedish Parliament

LENNART HARDELL[1], MICHAEL CARLBERG[1], TARMO KOPPEL[2] and LENA HEDENDAHL[3]

[1]Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden; [2]Department of Labour Environment and Safety, Tallinn University of Technology, 19086 Tallinn, Estonia; [3]Independent Environment and Health Research Luleå, SE-972 53 Luleå, Sweden

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Abstract. Exposure to radiofrequency (RF) radiation was classified as a possible human carcinogen, Group 2B, by the International Agency for Research on Cancer at WHO in 2011. The exposure pattern is changing due to the rapid development of technology. Outdoor RF radiation level was measured during five tours in Stockholm Old Town in April, 2016 using the EME Spy 200 exposimeter with 20 predefined frequencies. The results were based on 10,437 samples in total. The mean level of the total RF radiation was 4,293 μW/m^2 (0.4293 μW/cm^2). The highest mean levels were obtained for global system for mobile communications (GSM) + universal mobile telecommunications system (UMTS) 900 downlink and long-term evolution (LTE) 2600 downlink (1,558 and 1,265 μW/m^2, respectively). The town squares displayed highest total mean levels, with the example of Järntorget square with 24,277 μW/m^2 (min 257, max 173,302 μW/m^2). These results were in large contrast to areas with lowest total exposure, such as the Supreme Court, with a mean level of 404 μW/m^2 (min 20.4, max 4,088 μW/m^2). In addition, measurements in the streets surrounding the Royal Castle were lower than the total for the Old Town, with a mean of 756 μW/m^2 (min 0.3, max 50,967 μW/m^2). The BioInitiative 2012 Report defined the scientific benchmark for possible health risks as 30-60 μW/m^2. Our results of outdoor RF radiation exposure at Stockholm Old Town are significantly above that level. The mean exposure level at Järntorget square was 405-fold higher than 60 μW/m^2. Our results were below the reference level on 10,000,000 μW/m^2 established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which, however, are less credible, as they do not take non-thermal effects into consideration and are not based on sound scientific evaluation. Our highest measured mean level at Järntorget was 0.24% of the ICNIRP level. A number of studies have found adverse, non-thermal (no measurable temperature increase) health effects far below the ICNIRP guidelines.

Correspondence to: Professor Lennart Hardell, Department of Oncology, Faculty of Medicine and Health, Örebro University, Långhuset, Fakultetsgatan 1, SE-701 82 Örebro, Sweden
E-mail: lennart.hardell@regionorebrolan.se

Key words: radiofrequency radiation, radiofrequency electromagnetic field, base stations, exposimeter, public exposure, health, cancer

Introduction

The results of a study on public exposure to radiofrequency (RF) radiation at the Stockholm Central Railway Station in Sweden were recently published (1). The exposimeter EME Spy 200 that covers 20 different radiofrequency bands from 87 to 5,850 MHz was used. The results were based on 1,669 data points recorded in November, 2015. The median value for total exposure was 921 μW/m^2 (0.092 μW/cm^2), with certain outliers >95,544 μW/m^2 (6 V/m, which is the upper detection limit). One example of such very high measured power density was from a global system for mobile communications (GSM) + universal mobile telecommunications system (UMTS) 900 downlink band from a base station located at the Stockholm Central Station lower level (1). People standing at that area or passing by are involuntarily exposed to high RF radiation without their knowledge. It was concluded that this represented an improper location of a base station with an unnecessary high downlink level.

In European countries, the Old Town is a point of a national heritage, a place and source of cultural and historical development throughout centuries. Stockholm Old Town has already been retrofitted with several existing antennas to accommodate voice and data transmission. The aim of the present study was to characterize RF radiation already in place and its effect on the public. The antenna grid is expected to be further expanded to accommodate the rollout of 5G mobile networking as the next wave of mobile technology is implemented. As mobile base station antennas are placed on rooftops, outer walls of buildings and other places, visual perturbations appear in the form of antenna casings, cables and other peripheral devices. Not only does this damage the aesthetic appearance of the historic districts of the Old Town,

Radiofrequency radiation at Stockholm Central Railway Station in Sweden and some medical aspects on public exposure to RF fields

LENNART HARDELL[1], TARMO KOPPEL[2], MICHAEL CARLBERG[1], MIKKO AHONEN[3] and LENA HEDENDAHL[4]

[1]Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden; [2]Department of Labour Environment and Safety Tallinn University of Technology, SCO351 Ehitajate tee 5, 19086 Tallinn; [3]Institute of Environmental Health and Safety, 11615 Tallinn, Estonia; [4]Independent Environment and Health Research Luleå, SE-972 53 Luleå, Sweden

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Abstract. The Stockholm Central Railway Station in Sweden was investigated for public radiofrequency (RF) radiation exposure. The exposimeter EME Spy 200 was used to collect the RF exposure data across the railway station. The exposimeter covers 20 different radiofrequency bands from 88 to 5,850 MHz. In total 1,669 data points were recorded. The median value for total exposure was 921 μW/m^2 (or 0.092 μW/cm^2; 1 μW/m^2=0.0001 μW/cm^2) with some outliers over 95,544 μW/m^2 (6 V/m, upper detection limit). The mean total RF radiation level varied between 2,817 to 4,891 μW/m^2 for each walking round. High mean measurements were obtained for GSM + UMTS 900 downlink varying between 1,165 and 2,075 μW/m^2. High levels were also obtained for UMTS 2100 downlink; 442 to 1,632 μW/m^2. Also LTE 800 downlink, GSM 1800 downlink, and LTE 2600 downlink were in the higher range of measurements. Hot spots were identified, for example close to a wall mounted base station yielding over 95,544 μW/m^2 and thus exceeding the exposimeter's detection limit. Almost all of the total measured levels were above the precautionary target level of 3-6 μW/m^2 as proposed by the BioInitiative Working Group in 2012. That target level was one-tenth of the scientific benchmark providing a safety margin either for children, or chronic exposure conditions. We compare the levels of RF radiation exposures identified in the present study to published scientific results reporting adverse biological effects and health harm at levels equivalent to, or below those measured in this Stockholm Central Railway Station project. It should be noted that these RF radiation levels give transient exposure, since people are generally passing through the areas tested, except for subsets of people who are there for hours each day of work.

Correspondence to: Dr Lennart Hardell, Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden
E-mail: lennart.hardell@regionorebrolan.se

Key words: electromagnetic fields, radiofrequency radiation, public exposure, base stations, exposimeter

Introduction

On 31 May 2011 the WHO International Agency for Research on Cancer (IARC) categorized the radiation fields from mobile phones, and from other devices that emit similar non-ionizing electromagnetic field (EMF) radiation in the frequency range 30 kHz to 300 GHz, as a Group 2B, i.e. a 'possible', human carcinogen (1,2). Nine years earlier IARC had also classified the electromagnetic fields from overhead electric power lines as a Group 2B carcinogen (3).

The IARC decision on mobile phones was based mainly on two sets of case-control human studies: the Hardell group of studies from Sweden (4-6) and the IARC Interphone study (7-9). Both provided complementary and generally mutually supportive evidence of increased risk for brain tumours, i.e. glioma and acoustic neuroma. Later published studies by us (10-13) and the French CERENAT study on glioma and meningioma published in 2014 (14) supported an increased risk for brain tumours and use of mobile phones. These results were further supported by a study on mice showing tumour-promoting effect from radiofrequency (RF) radiation at low to moderate levels (0.04 and 0.4 W/kg SAR), radiation well below exposure limits for users of mobile phones (15). Thus, implications of the study by Tillman *et al* (16) were successfully tested. It should be added that a long-term animal toxicity study at 900 MHz published in 1997 resulted in statistically significant increased lymphoma risk in mice (17).

Recently, a report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (18). An increased incidence of glioma and malignant Schwannoma in the heart was found. Acoustic neuroma or vestibular Schwannoma is the same type of tumour as the one found in the heart, although benign.

The carcinogenicity findings evaluated by IARC in 2011 were related to personal wireless phone use, including mobile phones and DECT phones. The overall exposure including

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REVIEW

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Genetic effects of non-ionizing electromagnetic fields

Henry Lai

Department of Bioengineering, University of Washington, Seattle, WA, USA

ABSTRACT

This is a review of the research on the genetic effects of non-ionizing electromagnetic field (EMF), mainly on radiofrequency radiation (RFR) and static and extremely low frequency EMF (ELF-EMF). The majority of the studies are on genotoxicity (e.g., DNA damage, chromatin conformation changes, etc.) and gene expression. Genetic effects of EMF depend on various factors, including field parameters and characteristics (frequency, intensity, wave-shape), cell type, and exposure duration. The types of gene expression affected (e.g., genes involved in cell cycle arrest, apoptosis and stress responses, heat-shock proteins) are consistent with the findings that EMF causes genetic damages. Many studies reported effects in cells and animals after exposure to EMF at intensities similar to those in the public and occupational environments. The mechanisms by which effects are induced by EMF are basically unknown. Involvement of free radicals is a likely possibility. EMF also interacts synergistically with different entities on genetic functions. Interactions, particularly with chemotherapeutic compounds, raise the possibility of using EMF as an adjuvant for cancer treatment to increase the efficacy and decrease side effects of traditional chemotherapeutic drugs. Other data, such as adaptive effects and mitotic spindle aberrations after EMF exposure, further support the notion that EMF causes genetic effects in living organisms.

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Radiofrequency radiation; static/extremely low frequency EMF; genetic effects; genotoxicity; gene expression

Introduction

This is a review on studies on the genetic effects of non-ionizing electromagnetic fields (EMF). We will concentrate on two parts of the EMF spectrum which are common in our environment: static and extremely low-frequency electromagnetic fields (ELF-EMF) and radiofrequency radiation (RFR).

Studies are summarized in Supplements 1 (RFR) and 2 (static/ELF-EMF). Basically, there are two types of studies: genetic damages and gene expression. The research covers a wide area of biological systems: both in vitro and in vivo involving many animal and cell models, and various exposure conditions. First, a few words have to be said on the exposure set-ups used in these studies. It is relatively easy to set up a reliable exposure system for static and ELF-EMF. Most exposure systems used these studies are generally satisfactory. However, it is difficul to set up good exposure systems for RFR studies. In my opinion, most set-ups are relatively satisfactory, considering that there is no perfect guideline on what is a good system. However, preferably, incident power density and specific absorption rate should be provided in each study. These are generally lacking when telecommunication devices, such as cellular phones, are used in a study. It becomes difficul to compare the results of these studies with other studies using exposure systems. It is not totally without merit to use these devices for studies. If properly set up, these devices provide more realistic exposure parameters. A general problem is that some researchers generally showed ignorance on the independent variable, i.e., EMF, that they worked on.

Regarding biological measurements, with few exceptions, the researcher are generally knowledgeable in the methodology used. However, there are studies that showed that the researchers are not familiar with the methodology that they used in their studies. An example is the use of the "Comet assay" to determine DNA strand breaks. 31% of the studies listed in Supplements 1 and 2 used the "Comet assay". A few words have to be said on it. Different versions of the assay have been developed. These versions have different detection sensitivities and can be used to measure different aspects of DNA strand breaks. A comparison of data from experiments using different versions of the assay may be misleading. Another concern is that most of the 'comet assay' studies were carried out by experimenters who had no prior experience on the assay. My experience with the 'Comet assay' is that it is a very sensitive assay and requires great care in performing. Thus, different detection sensitivities could result from different

CONTACT Henry Lai hlai@uw.edu Department of Bioengineering,University of Washington, Seattle, WA 98195, USA
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Commentary

Aspects on the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020 Guidelines on Radiofrequency Radiation

Lennart Hardell[1*], Mona Nilsson[2], Tarmo Koppel[3], Michael Carlberg[1]

[1]The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden

[2]Swedish Radiation Protection Foundation, Gredby 14, SE-178 92 Adelsö, Sweden

[3]Tallinn University of Technology, SOC353 Ehitajate tee 5, 19086 Tallinn, Estonia

[*]**Corresponding Author:** Lennart Hardell, The Environment and Cancer Research Foundation, Studievägen 35, SE 702 17, Örebro, Sweden

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Abstract

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published 2020 updated guidelines on radiofrequency (RF) radiation in the frequency range 100 kHz to 300 GHz. Harmful effects on human health and the environment at levels below the guidelines are downplayed although evidence is steadily increasing. Only thermal (heating) effects are acknowledged and therefore form the basis for the guidelines. Despite the increasing scientific evidence of non-thermal effects, the new ICNIRP guidelines are not lower compared with the previous levels. Expert groups from the WHO, the EU Commission and Sweden are to a large extent made up of members from ICNIRP, with no representative from the many scientists who are critical of the ICNIRP standpoint.

Keywords: EU; WHO; ICNIRP; 5G; Microwave radiation

Non-thermal Biological Effects of Microwaves

Igor Belyaev

List of Abbreviations - Anomalous viscosity time dependence (AVTD); blood-brain barrier (BBB); catalase (CAT); Digital Enhanced (former European) Cordless Telecommunications (DECT); circularly polarized (CP); continuous wave (CW); Digital Advanced Mobile Phone System (DAMPS); discontinuous transmission (DTX); electroencephalographic (EEG); electromagnetic field (EMF); embryonic stem (ES) cells; ethidium bromide (EtBr); extremely low frequency (ELF); Gaussian Minimum Shift Keying (GMSK); Ginkgo biloba (Gb); Global System for Mobile Communication (GSM); glutathione peroxidase (GSH-Px); International Commission for Non-Ionizing Radiation Protection (ICNIRP); linearly polarized (LP); malondialdehyde (MDA); micronucleus (MN) assay; microwaves (MWs); N-acetyl-beta-d-glucosaminidase (NAG); nitric oxide (NO); non-thermal (NT); ornithine decarboxylase (ODC); phorbol ester 12-myristate 13-acetate (PMA); phosphorylated H2AX histone (γ-H2AX); power density (PD); regional cerebral blood flow (rCBF); Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP); specific absorption rate (SAR); static magnetic field (SMF); superoxide dismutase (SOD); Time Division Multiple Access (TDMA); tumor suppressor p53 binding protein 1 (53BP1); ultraviolet (UV); Universal Mobile Telecommunications System (UMTS).

Abstract **- The aim of this paper is to overview the diverse biological effects of non-thermal microwaves (NT MWs) and complex dependence of these effects on various physical and biological parameters. Besides dependencies on frequency and modulation, the available data suggest dependencies of the NT MW effects on intermittence and coherence time of exposure, polarization, static magnetic filed, electromagnetic stray field, genotype, gender, physiological and individual factors, cell density during of exposure and indicate that duration of exposure may be not less important than power density (PD) for the NT MW effects. Further evaluation of these dependencies are needed for understanding the mechanisms by which NT MWs affect biological systems, planning in vivo and epidemiological studies, developing medical treatments, setting safety standards, and minimizing the adverse effects of MWs from mobile communication.**

Key words **- non-thermal effects of microwaves, mobile (cellular) phones.**

I. INTRODUCTION

Electromagnetic exposures vary in many parameters: power (specific absorption rate, incident power density), wavelength/frequency, near field - far field, polarization (linear, circular) continues wave (CW) and pulsed fields (pulse repetition rate, pulse width or duty cycle, pulse shape, pulse to average power, etc.), modulation (amplitude, frequency, phase, complex), static magnetic field (SMF) and electromagnetic stray field at the place of exposure, overall duration and intermittence of exposure (continuous, interrupted), acute and chronic exposures. With increased absorption of energy, so-called thermal effects of microwaves (MWs) are usually observed that deal with MW-induced heating. Specific absorption rate (SAR) or power density (PD) is a main determinate for the thermal MW effects. Many other physical parameters of exposure may be important for so-called non-thermal (NT) biological effects, which are induced by MWs at intensities well below any heating [1-11]. An important question is how these physical parameters should be taken into account in safety standards.

Most often, the current safety standards are based on the thermal effects of MWs obtained in short-term (acute) exposures. In some countries, such as Russia, the NT MW effects, especially those induced during prolonged (chronic) exposures, are accepted and taken into account for establishment of the national safety standards [10-12]. It should be stressed, that in contrast to the ICNIRP (International Commission for Non-Ionizing Radiation Protection) safety standards [13], which are based on the acute thermal effects of MWs, the standards adopted by the Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) are based on the experimental data from chronic (up to 4 month) exposures of animals to MWs at various physical parameters including intensity, frequency and modulation, which were performed in the former Soviet Union and Russia [10-12]. Since establishment of the current safety standards, the situation with exposure of general population to MWs has been changed significantly. Nowadays, most part of population is chronically exposed to MW signals from various sources including mobile phones and base stations. These exposures are characterized by low intensities, varieties of signals, and long-term durations of exposure that are comparable with a lifespan. So far, the "dose" (accumulated absorbed energy that is measured in radiobiology as the dose rate multiplied by the exposure time) is not adopted for the MW exposures and SAR or PD is usually used for the guidelines. To what degree SAR/PD can be applied to the nowadays NT MW chronic exposures is not known and the current state of research demands reevaluation of the safety standards [12].

There are two main approaches to treat numerous data regarding the NT MW effects. The first one is based on the consideration of these effects dependent on various physical parameters and biological variables as has consistently been described in many experimental studies and will be partially reviewed in this paper. The second approach is based on neglecting or minimizing the experimentally observed NT MW effects based on the current state of theoretical physical science that is insufficient for comprehensive explanation of the NT MWs effects. As a result of such various treatments of

Igor Y. Belyaev, Ph.D., D.Sc. Department of Genetics, Microbiology and Toxicology The Arrhenius Laboratories for Natural Sciences Stockholm University S-106 91 Stockholm, Sweden Tel: +46-8-16 4108 FAX: +46-8-16 4315 Mob: +46-0739590339 E. mail: Igor.Belyaev@gmt.su.se

Radiofrequency radiation from nearby base stations gives high levels in an apartment in Stockholm, Sweden: A case report

LENNART HARDELL[1,2,4], MICHAEL CARLBERG[1,2] and LENA K. HEDENDAHL[2,3]

[1]Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro; [2]The Environment and Cancer Research Foundation, SE-702 17 Örebro; [3]Independent Environment and Health Research Luleå, SE-972 53 Luleå, Sweden

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Abstract. Exposure to radiofrequency (RF) radiation was classified in 2011 as a possible human carcinogen, Group 2B, by the International Agency for Research on Cancer of the World Health Organisation. Evidence of the risk of cancer risk has since strengthened. Exposure is changing due to the rapid development of technology resulting in increased ambient radiation. RF radiation of sufficient intensity heats tissues, but the energy is insufficient to cause ionization, hence it is called non-ionizing radiation. These non-thermal exposure levels have resulted in biological effects in humans, animals and cells, including an increased cancer risk. In the present study, the levels of RF radiation were measured in an apartment close to two groups of mobile phone base stations on the roof. A total of 74,531 measurements were made corresponding to ~83 h of recording. The total mean RF radiation level was 3,811 μW/m^2 (range 15.2-112,318 μW/m^2) for the measurement of the whole apartment, including balconies. Particularly high levels were measured on three balconies and 3 of 4 bedrooms. The total mean RF radiation level decreased by 98% when the measured down-links from the base stations for 2, 3 and 4 G were disregarded. The results are discussed in relation to the detrimental health effects of non-thermal RF radiation. Due to the current high RF radiation, the apartment is not suitable for long-term living, particularly for children who may be more sensitive than adults. For a definitive conclusion regarding the effect of RF radiation from nearby base stations, one option would be to turn them off and repeat the measurements. However, the simplest and safest solution would be to turn them off and dismantle them.

Correspondence to: Professor Lennart Hardell, Department of Oncology, Faculty of Medicine and Health, Örebro University, 1 Fakultetsgatan, SE-701 82 Örebro, Sweden
E-mail: lennart.hardell@environmentandcancer.com

[4]*Present address:* The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17 Örebro, Sweden

Key words: radiofrequency radiation, microwaves, measurement, exposure, health, cancer

Introduction

The use of wireless digital technology has grown rapidly during the last couple of decades. While in use, mobile and cordless phones emit radiofrequency (RF) radiation. The brain is the main target of exposure to RF radiation with handheld wireless phones (mobile and cordless) (1,2). An increased risk for brain tumors has been of concern for a long time. In May 2011, RF radiation in the range 30-300 GHz could be categorized in Group 2B, i.e., a 'possible' human carcinogen, by the International Agency for Research on Cancer (IARC) of WHO (3,4). The decision was based mainly on case-control human studies on the use of wireless phones by the Hardell group in Sweden (mobile and cordless phones; DECT) and the IARC Interphone study (mobile phones), which showed an increased risk for brain and head tumours, i.e., glioma and acoustic neuroma (3-6), which has since been confirmed (7-10), resulting in a recommendation to upgrade IARC's 2011 classification of RF radiation to Group 1, a human carcinogen. This conclusion was published in our up-dated review in 2013 (11) using the so-called Hill viewpoints on the association or causation put forward at the height of the tobacco and lung cancer controversy (12).

Due to the increasing use of the wireless technology, environmental exposure to RF radiation has been increasing, but there has been no systematic study of ambient exposure. We have measured RF radiation at Stockholm Central Station (13) and the Stockholm Old Town in Sweden (14). The results generally exceeded the levels known to have adverse biological effects. By contrast, low levels were measured at certain places in the WHO building in Geneva (15).

We have measured RF radiation in an apartment with a central location at Östermalm in Stockholm. The apartment is located on the 6th floor, with a tower including a bedroom on the first floor of the tower (7th floor) and a conference room on the second and highest floor (8th) of the tower, at the same level as the roof of the building. The measurements did not involve any human subjects, and therefore no ethical permission was needed. We also discuss laboratory studies on RF-radiation and biological effects relative to the levels of RF in question. Of particular interest are the non-thermal levels of RF radiation and

Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz

LENNART HARDELL[1,2] and MICHAEL CARLBERG[1,2]

[1]Department of Oncology, University Hospital, SE-701 85 Örebro;
[2]The Environment and Cancer Research Foundation, SE 702 17 Örebro, Sweden

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Abstract. During the use of handheld mobile and cordless phones, the brain is the main target of radiofrequency (RF) radiation. An increased risk of developing glioma and acoustic neuroma has been found in human epidemiological studies. Primarily based on these findings, the International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) classified in May, 2011 RF radiation at the frequency range of 30 kHz-300 GHz as a 'possible' human carcinogen, Group 2B. A carcinogenic potential for RF radiation in animal studies was already published in 1982. This has been confirmed over the years, more recently in the Ramazzini Institute rat study. An increased incidence of glioma in the brain and malignant schwannoma in the heart was found in the US National Toxicology Program (NTP) study on rats and mice. The NTP final report is to be published; however, the extended reports are published on the internet for evaluation and are reviewed herein in more detail in relation to human epidemiological studies. Thus, the main aim of this study was to compare earlier human epidemiological studies with NTP findings, including a short review of animal studies. We conclude that there is clear evidence that RF radiation is a human carcinogen, causing glioma and vestibular schwannoma (acoustic neuroma). There is some evidence of an increased risk of developing thyroid cancer, and clear evidence that RF radiation is a multi-site carcinogen. Based on the Preamble to the IARC Monographs, RF radiation should be classified as carcinogenic to humans, Group 1.

Correspondence to: Dr Lennart Hardell, *Present address:* The Environment and Cancer Research Foundation, Studievägen 35, SE 702 17 Örebro, Sweden
E-mail: lennart_hardell@hotmail.com

Key words: National Toxicology Program study, carcinogenesis, radiofrequency radiation, glioma, acoustic neuroma, cancer

Introduction

Recently, the US National Toxicology Program (NTP) released results on the toxicology and carcinogenicity of radiofrequency (RF) radiation in rats and mice, as further discussed below. This initiated this article for the comparison of earlier human epidemiological studies with the NTP the findings, including a short review of animal studies.

NTP is an interagency program established in 1978 to coordinate toxicology research and testing across the Department of Health and Human Services. The program was also created to strengthen the science base in toxicology, develop and validate improved testing methods, and provide information about potentially toxic chemicals to health regulatory and research agencies, scientific and medical communities, and the public. NTP is headquartered at the National Institute of Environmental Health Sciences (NIEHS) (https://ntp.niehs.nih.gov/about/org/index.html).

The brain is the main target of the exposure to RF radiation during the use of handheld wireless phones; both mobile and cordless phones (1,2). Thus, an increased risk of developing brain tumors has long been a cause for concern.

Our study group has since the end of the 1990s published results from case-control studies on use of wireless phones and brain tumor risk (3). A statistically significant increased risk for ipsilateral use of mobile phones, the same side of the brain as the phone was used, was published for malignant brain tumors (4) and vestibular schwannoma (5). Further scientific evidence on the association has more recently been discussed by Carlberg and Hardell (6).

In May, 2011 the International Agency for Research on Cancer (IARC) concluded that radiofrequency (RF) radiation in the frequency range 30 kHz-300 GHz is a 'possible' human carcinogen Group 2B (7,8). The classification was based primarily on evidence that long-term users of wireless phones (mobile and cordless phones) have an increased risk for glioma and acoustic neuroma. One major reason that the rating was not a 'probable' or a 'known' risk was the lack of clear evidence from animal studies. IARC at the World Health Organization (WHO) is independently financed and has its own governing and scientific councils, which WHO staff

Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk

Eva Markovà,[1,2] Lars O.G. Malmgren,[3] and Igor Y. Belyaev[1,2,4]

[1]Department of Genetics, Microbiology and Toxicology, Stockholm University, Stockholm, Sweden; [2]Laboratory of Molecular Genetics, Cancer Research Institute, Bratislava, Slovak Republic; [3]MAX-lab, Lund University, Lund, Sweden; [4]Laboratory of Radiobiology, General Physics Institute, Russian Academy of Science, Moscow, Russia

Background: It is widely accepted that DNA double-strand breaks (DSBs) and their misrepair in stem cells are critical events in the multistage origination of various leukemias and tumors, including gliomas.

Objectives: We studied whether microwaves from mobile telephones of the Global System for Mobile Communication (GSM) and the Universal Global Telecommunications System (UMTS) induce DSBs or affect DSB repair in stem cells.

Methods: We analyzed tumor suppressor TP53 binding protein 1 (53BP1) foci that are typically formed at the sites of DSB location (referred to as DNA repair foci) by laser confocal microscopy.

Results: Microwaves from mobile phones inhibited formation of 53BP1 foci in human primary fibroblasts and mesenchymal stem cells. These data parallel our previous findings for human lymphocytes. Importantly, the same GSM carrier frequency (915 MHz) and UMTS frequency band (1947.4 MHz) were effective for all cell types. Exposure at 905 MHz did not inhibit 53BP1 foci in differentiated cells, either fibroblasts or lymphocytes, whereas some effects were seen in stem cells at 905 MHz. Contrary to fibroblasts, stem cells did not adapt to chronic exposure during 2 weeks.

Conclusions: The strongest microwave effects were always observed in stem cells. This result may suggest both significant misbalance in DSB repair and severe stress response. Our findings that stem cells are most sensitive to microwave exposure and react to more frequencies than do differentiated cells may be important for cancer risk assessment and indicate that stem cells are the most relevant cellular model for validating safe mobile communication signals.

Key words: 53BP1 foci, DNA double-strand breaks, microwaves, mobile phones, stem cells. *Environ Health Perspect* 118:394–399 (2010). doi:10.1289/ehp.0900781 available via *http://dx.doi.org/* [Online 23 October 2009]

The intensity levels of exposure to microwaves (MWs) from mobile telephones are lower than the International Commission on Nonionizing Radiation Protection (ICNIRP) standards, which are based on thermal effects of acute MW exposures (ICNIRP 1998). However, effects of prolonged exposure to nonthermal (NT) MWs at intensities comparable with those of mobile phones have also been observed in many studies that indicate a relationship between NT MW exposure and permeability of the brain–blood barrier (Nittby et al. 2008), cerebral blood flow (Huber et al. 2005), stress response (Blank and Goodman 2004), and neuronal damage (Salford et al. 2003). The data obtained by the comet assay (Diem et al. 2005; Lai and Singh 1997) and the micronuclei assay (d'Ambrosio et al. 2002; Trosic et al. 2002; Zotti-Martelli et al. 2005) imply possible genotoxic effects of NT MWs, whereas other studies did not support this genotoxicity (Meltz 2003). Experimental data have indicated that the NT MW effects occur depending on several physical parameters, including carrier frequency, polarization, modulation, and intermittence (Belyaev 2005a). Differences in these physical parameters and biological variables, including genetic background and physiologic state, may explain various outcomes of studies with NT MWs (Belyaev 2005b; Huss et al. 2007).

A recent review of available epidemiologic studies concluded that the use of mobile phones for > 10 years is associated with increased risk of ipsilateral gliomas and acoustic neurinomas (Hardell et al. 2008). For a long time stem cells have been considered an important cellular target for origination of cancer—both tumors and leukemia (Feinberg et al. 2006; Soltysova et al. 2005). Gliomas are believed to originate from stem cells in the brain (Altaner 2008). DNA double-strand breaks (DSBs) and their misrepair are critical molecular events resulting in chromosomal aberrations, which have often been associated with origination of various leukemias and tumors, including gliomas (Fischer and Meese 2007). Only one study on possible MW-induced DSBs in stem cells is available (Nikolova et al. 2005). Surprisingly, the data obtained in that study by the neutral comet assay suggested that prolonged exposure time abolished the DSB formation observed at the shorter exposure time. Furthermore, the neutral comet assay has limited applicability to detect DSBs because similar increases in comet tails may be also caused by nongenotoxic effects that imply changes in chromatin conformation, such as relaxation of DNA loops (Belyaev et al. 1999).

Several proteins involved in DSB repair, such as phosphorylated histone 2A family member X (γ-H2AX) and tumor suppressor TP53 binding protein 1 (53BP1), have been shown to produce discrete foci that colocalize to DSBs, referred to as DNA repair foci (Kao et al. 2003; Sedelnikova et al. 2002). Analysis of DNA repair foci is currently accepted as the most sensitive and specific technique for measuring DSBs in untreated cells, as well as in cells exposed to cytotoxic agents (Bocker and Iliakis 2006; Bonner et al. 2008). By analysis of the DNA repair foci in normal human fibroblasts, we were able to detect DSBs induced by a very low dose of ionizing radiation, 1 cGy, which results in only 0.4 DSB/cell on average (Markovà et al. 2007). We have also used this technique to analyze 53BP1/γ-H2AX foci in human lymphocytes exposed to MWs from Global System for Mobile Communication (GSM)/Universal Global Telecommunications System (UMTS) phones (Belyaev et al. 2005, 2009; Markovà et al. 2005). We have found that MW exposure inhibited formation of endogenous 53BP1/γ-H2AX foci (Belyaev et al. 2005, 2009; Markovà et al. 2005). This inhibition might be caused by a decrease in accessibility of DSBs to proteins because of stress-induced chromatin condensation (Belyaev et al. 2009). Inability to form DNA repair foci has been correlated to radiosensitivity, genomic instability, and other

Address correspondence to I.Y. Belyaev, Department of Genetics, Microbiology and Toxicology, Stockholm University, S-106 91 Stockholm, Sweden. Telephone: 46-8-16-41-08. Fax: 46-8-6129552. E-mail: Igor.Belyaev@gmt.su.se

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Changes in the excitability of primary hippocampal neurons following exposure to 3.0 GHz radiofrequency electromagnetic fields

Ibtissam Echchgadda[1]✉, Jody C. Cantu[2], Gleb P. Tolstykh[2], Joseph W. Butterworth[2], Jason A. Payne[1] & Bennett L. Ibey[1]

Exposures to radiofrequency electromagnetic fields (RF-EMFs, 100 kHz to 6 GHz) have been associated with both positive and negative effects on cognitive behavior. To elucidate the mechanism of RF-EMF interaction, a few studies have examined its impact on neuronal activity and synaptic plasticity. However, there is still a need for additional basic research that further our understanding of the underlying mechanisms of RF-EMFs on the neuronal system. The present study investigated changes in neuronal activity and synaptic transmission following a 60-min exposure to 3.0 GHz RF-EMF at a low dose (specific absorption rate (SAR) < 1 W/kg). We showed that RF-EMF exposure decreased the amplitude of action potential (AP), depolarized neuronal resting membrane potential (MP), and increased neuronal excitability and synaptic transmission in cultured primary hippocampal neurons (PHNs). The results show that RF-EMF exposure can alter neuronal activity and highlight that more investigations should be performed to fully explore the RF-EMF effects and mechanisms.

Effects of exposure to radiofrequency electromagnetic fi lds (RF-EMFs, 100 kHz to 6 GHz) at low levels (whole body specific absorption rate (wbSAR) ≤ 4 W/kg) has been linked to changes in cognitive function[1,2]. While still debated because of lack of matching replications, both detrimental and benefic al changes in memory, learning, and task performance due to RF-EMF exposures have been reported[3–20]. These effects were shown to depend on exposure duration (either short-term or chronic) and field intensity.

Neuronal activity and plasticity, which play a central role in cognitive function such as learning and memory[21,22], have been examined in cultured neuronal cells to investigate low-level RF-EMF underlying cellular mechanisms of interaction. El Khoueiry et al. reported a dose-dependent decrease in neurons electrical activity during 15-min exposures to 1800 MHz RF-EMF signals. Using 60-electrode multielectrode arrays (MEAs), the group measured a dose-dependent decrease in spontaneous bursting rates in cultured cortical neurons during both pulse-modulated Global System for Mobile Communication (GSM) and continuous wave (CW) RF-EMF exposures at SAR ranging from 0.01 to 9.2 W/kg[23]. Moreover, Xu et al. showed a decrease in excitability of cultured hippocampal neurons demonstrated by a reduction in the amplitude of α-amino-3-hydroxy-5-methyl-4-soxazole propionic acid (AMPA) miniature excitatory postsynaptic currents (mEPSCs) following a chronic exposure to 1800 MHz GSM at an average SAR of 2.4 W/kg for 15 min per day for 8 days[24]. They reported that the exposure also resulted in a slight reduction in the expression of postsynaptic density 95 and a decrease in the number of spines[24,25]. In the same line of changes in components of synaptic plasticity, Chen et al. also reported inhibition of neurite outgrowth of embryonic neuronal stem cells differentiated neurons following a continuous 3-day exposure to 1800 MHz at average SAR of 4.0 W/kg[26]. The authors reported that the exposure, however, did not affect cell apoptosis, proliferation, and cell cycle[26]. A decrease in number of neurites has also been observed with an extended exposure, up to 6 days, of developing rat primary cortical neurons and murine SN56 cholinergic cell line when exposed to 900 MHz continuous GSM-modulated EMF at a lower dose of 1.0 W/kg[27].

[1]Air Force Research Laboratory, 711Th Human Performance Wing, Airman Systems Directorate, Bioeffects Division, Radio Frequency Bioeffects Branch, JBSA Fort Sam Houston, 4141 Petroleum Road, San Antonio, TX 78234, USA. [2]General Dynamics Information Technology, JBSA Fort Sam Houston, 4141 Petroleum Road, San Antonio, TX 78234, USA. ✉email: ibtissam.echchgadda.1@us.af.mil

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Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission

L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservisi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Strollo, A. Vornoli, F. Belpoggi*

Cesare Maltoni Cancer Research Center, Ramazzini Institute, Castello di Bentivoglio, via Saliceto 3, Bentivoglio, 40010 Bologna, Italy

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ABSTRACT

Background: In 2011, IARC classified radiofrequency radiation (RFR) as possible human carcinogen (Group 2B). According to IARC, animals studies, as well as epidemiological ones, showed limited evidence of carcinogenicity. In 2016, the NTP published the first results of its long-term bioassays on near field RFR, reporting increased incidence of malignant glial tumors of the brain and heart Schwannoma in rats exposed to GSM – and CDMA – modulated cell phone RFR. The tumors observed in the NTP study are of the type similar to the ones observed in some epidemiological studies of cell phone users.

Objectives: The Ramazzini Institute (RI) performed a life-span carcinogenic study on Sprague-Dawley rats to evaluate the carcinogenic effects of RFR in the situation of far field, reproducing the environmental exposure to RFR generated by 1.8 GHz GSM antenna of the radio base stations of mobile phone. This is the largest long-term study ever performed in rats on the health effects of RFR, including 2448 animals. In this article, we reported the final results regarding brain and heart tumors.

Methods: Male and female Sprague-Dawley rats were exposed from prenatal life until natural death to a 1.8 GHz GSM far field of 0, 5, 25, 50 V/m with a whole-body exposure for 19 h/day.

Results: A statistically significant increase in the incidence of heart Schwannomas was observed in treated male rats at the highest dose (50 V/m). Furthermore, an increase in the incidence of heart Schwann cells hyperplasia was observed in treated male and female rats at the highest dose (50 V/m), although this was not statistically significant. An increase in the incidence of malignant glial tumors was observed in treated female rats at the highest dose (50 V/m), although not statistically significant.

Conclusions: The RI findings on far field exposure to RFR are consistent with and reinforce the results of the NTP study on near field exposure, as both reported an increase in the incidence of tumors of the brain and heart in RFR-exposed Sprague-Dawley rats. These tumors are of the same histotype of those observed in some epidemiological studies on cell phone users. These experimental studies provide sufficient evidence to call for the re-evaluation of IARC conclusions regarding the carcinogenic potential of RFR in humans.

1. Introduction

Early warnings on the potential carcinogenic risks of mobile phone radiofrequency radiation (RFR) raised in the early 2000 when, for the first time, it was published that people using mobile phones had a significant increased risk to develop vestibular Schwannoma and brain tumors (Hardell et al., 2003, 2002). In 2011, the International Agency for Research on Cancer (IARC) classified RFR as possible human carcinogen (Group 2B) based on limited evidence both in humans and experimental animals (Baan et al., 2011; IARC, 2013). Two epidemiological case-control studies resulted more informative for the IARC evaluation, showing that the risk to develop brain tumors and vestibular Schwannoma was increased in people with the highest cumulative use of mobile phones, in people who had used mobile phones on the

* Corresponding author.
E-mail address: belpoggif@ramazzini.it (F. Belpoggi).

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frontiers in Public Health

REVIEW
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Effects of Radiofrequency Electromagnetic Radiation on Neurotransmitters in the Brain

Cuicui Hu[1,2], *Hongyan Zuo*[2*] *and Yang Li*[1,2*]

[1] *Anhui Medical University, Academy of Life Sciences, Hefei, China,* [2] *Department of Experimental Pathology, Beijing Institute of Radiation Medicine, Beijing, China*

With the rapid development of electronic information in the past 30 years, technical achievements based on electromagnetism have been widely used in various fields pertaining to human production and life. Consequently, electromagnetic radiation (EMR) has become a substantial new pollution source in modern civilization. The biological effects of EMR have attracted considerable attention worldwide. The possible interaction of EMR with human organs, especially the brain, is currently where the most attention is focused. Many studies have shown that the nervous system is an important target organ system sensitive to EMR. In recent years, an increasing number of studies have focused on the neurobiological effects of EMR, including the metabolism and transport of neurotransmitters. As messengers of synaptic transmission, neurotransmitters play critical roles in cognitive and emotional behavior. Here, the effects of EMR on the metabolism and receptors of neurotransmitters in the brain are summarized.

Keywords: EMR, brain, neurotransmitter, metabolism, transmission, receptor

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***Correspondence:**
Hongyan Zuo
zuohy2005@126.com
Yang Li
leeyoung109@hotmail.com

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BACKGROUND

Electromagnetic radiation (EMR) is closely related to human life and originates from various electrical systems, such as mobile phones, microwave ovens, communication base stations, high-voltage lines, electronic instruments and other electromagnetic equipment. EMR produces various electromagnetic waves of different frequencies, resulting in the increasing EMR intensity in human living spaces. The high-frequency waves such as cosmic, gamma and X-rays, have enough energy to cause ionization. Non-ionizing electromagnetic waves, including ultraviolet, visible region, infrared, microwave, and radio waves are frequently used in daily life, especially radiofrequency electromagnetic fields (RF-EMFs, 30 kHz-300 GHz) for communications, and extremely low-frequency EMFs (ELF-EMFs, 3 Hz-3 kHz) generated by electricity. RF is also commonly referred to as microwave (MW) radiation. The impact of EMR on human health has also gradually attracted attention, and the modulation of brain functional connectivity was observed in human body (1–3). This review summarizes the effects of RF-EMF on neurotransmitters in the brain.

The effects of EMR on body systems might depend on the frequency, intensity and power of radiation, so the parameters of EMR provide a challenge for a literature review. Specific absorption rate (SAR) measures the rate of energy absorbed by the human body when exposed to electromagnetic fields between 100 kHz and 10 GHz. With the unit of watt per kilogram (W/kg), SAR reflects the power absorbed per mass of tissue. The SAR value depends on the frequency, incident direction, E-polarization direction, and the structure of different tissues.So far, the SAR values range from 10^{-4} to 35 W/kg in those reported studies on the bioeffects of microwave radiation.

Review Article

Lennart Hardell* and Tarmo Koppel

Electromagnetic hypersensitivity close to mobile phone base stations – a case study in Stockholm, Sweden

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Abstract: A previously healthy worker developed symptoms assigned to electromagnetic hypersensitivity (EHS) after moving to an office with exposure to high levels of anthropogenic electromagnetic fields (EMFs). These symptoms consisted of e.g. headache, arthralgia, tinnitus, dizziness, memory loss, fatique, insomnia, transitory cardiovascular abnormalities, and skin lesions. Most of the symptoms were alleviated after 2 weeks sick leave. The highest radiofrequency (RF) field level at the working place was 1.72 V/m (7,852 μW/m^2). Maximum value for extremely low frequency electromagnetic field (ELF-EMF) from electric power at 50 Hz was measured to 285 nT (mean 241 nT). For electric train ELF-EMF at 16.7 Hz was measured to 383 nT (mean 76 nT). Exposure to EMFs at the working place could be the cause for developing EHS related symptoms. The association was strengthened by the symptom reduction outside the working place.

Keywords: electromagnetic hypersensitivity; EMF; radiofrequency radiation; symptoms.

Introduction

Exposure to extremely low frequency (ELF) electromagnetic fields (EMF) and radiofrequency (RF) EMF is in most cases involuntary and unknown to people. Both ELF-EMF and RF-EMF have been evaluated by IARC to be possible human carcinogens, Group 2B [1–3]. In fact EMFs should be regarded to be environmental pollutants that do not smell, have no taste and are invisible.

***Corresponding author: Lennart Hardell,** The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden, E-mail: lennart.hardell@environmentandcancer.com
Tarmo Koppel, Tallinn University of Technology, Tallinn, Estonia, E-mail: tarmo.koppel@taltech.ee

Already in the 1970s the 'microwave syndrome' was described in the former Soviet Union [4]. Persons working with radar or radio equipment reported symptoms of fatigue, headache, dizziness, disturbed sleep, concentration and memory problems.

In the 1980s similar symptoms were reported among Swedish persons working in front of cathode ray tube monitors [5]. In Finns such symptoms were attributed to exposure to EMF [6]. This syndrome was termed electromagnetic hypersensitivity (EHS), although still without an International Classification of Diseases (ICD-code) [7].

EHS consists of a wide range of different symptoms that may vary from person to person. EMF sensitivity varies among individuals from mild to severe. The prevalence has been reported to be 1.5% in Sweden [8], 3.2% in California [9], 5% in Switzerland [10], and 13% in Taiwan [11].

We report here on a person who developed symptoms consistent with those described among EHS subjects. The symptoms developed at a work place with exposure to EMFs. Our hypothesis is that the symptoms may be attributed to that exposure. We obtained informed consent by the person to publish the symptoms and work history anonymously.

Methods

The subject attributed the development of EHS symptoms to her office room where she had been working one year since April 2018 for a total of 183 working days. As the source of the adverse health effects was unknown, the investigators devised a broad spectrum approach for EMF measurements, to include all possible sources of EMFs.

The room was thoroughly measured encompassing different types of electromagnetic fields, including:

- Extremely low frequency (ELF) magnetic field (MF)
- Intermediate frequency (IF) magnetic field (MF)
- Radiofrequency (RF) electromagnetic field.

Three types of measurements approaches were utilized characterizing:

- Spatial field distribution
- Temporal field dynamics
- Spectrum analysis of EMF

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Health impact of 5G

Current state of knowledge of 5G-related carcinogenic and reproductive/developmental hazards as they emerge from epidemiological studies and in vivo experimental studies

The upcoming deployment of 5G mobile networks will allow for significantly faster mobile broadband speeds and increasingly extensive mobile data usage. Technical innovations include a different transmission system (MIMO: use of multiple-input and multiple-output antennas), directional signal transmission or reception (beamforming), and the use of other frequency ranges. At the same time, a change is expected in the exposure to electromagnetic fields (EMF) of humans and the environment. In addition to those used to date, the 5G pioneer bands identified at EU level have frequencies of 700 MHz, 3.6 GHz (3.4 to 3.8 GHz) and 26 GHz (24.25 to 27.5 GHz). The first two frequencies (FR1) are similar to those used for 2G to 4G technologies and have been investigated in both epidemiological and experimental studies for different end points (including carcinogenicity and reproductive/developmental effects), while 26 GHz (FR2) and higher frequencies have not been adequately studied for the same end points.

The International Agency for Research on Cancer (IARC) classified radiofrequency (RF) EMF as 'possibly carcinogenic to humans' (Group 2B) and recently recommended RF exposure for re-evaluation 'with high priority' (IARC, 2019). Since 2011 a great number of studies have been performed, both epidemiological and experimental. The present review addresses the current knowledge regarding both carcinogenic and reproductive/developmental hazards of RF as exploited by 5G. There are various *in vivo* experimental and epidemiological studies on RF at a lower frequency range (450 to 6000 MHz), which also includes the frequencies used in previous generations' broadband cellular networks, but very few (and inadequate) on the higher frequency range (24 to 100 GHz, centimetre/MMW).

The review shows: 1) 5G lower frequencies (700 and 3 600 MHz): a) limited evidence of carcinogenicity in epidemiological studies; b) sufficient evidence of carcinogenicity in experimental bioassays; c) sufficient evidence of reproductive/developmental adverse effects in humans; d) sufficient evidence of reproductive/developmental adverse effects in experimental animals; 2) 5G higher frequencies (24.25-27.5 GHz): the systematic review found no adequate studies either in humans or in experimental animals.

Conclusions: 1) cancer: FR1 (450 to 6 000 MHz): EMF are probably carcinogenic for humans, in particular related to gliomas and acoustic neuromas; FR2 (24 to 100 GHz): no adequate studies were performed on the higher frequencies; 2) reproductive developmental effects: FR1 (450 to 6 000 MHz): these frequencies clearly affect male fertility and possibly female fertility too. They may have possible adverse effects on the development of embryos, foetuses and newborns; FR2 (24 to 100 GHz): no adequate studies were performed on non-thermal effects of the higher frequencies.

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Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102)☆

Anthony B. Miller[a,*], L. Lloyd Morgan[b], Iris Udasin[c], Devra Lee Davis[d,e]

[a] Dalla Lana School of Public Health, University of Toronto, Canada
[b] Environmental Health Trust, Berkeley, CA, United States
[c] Rutgers University School of Public Health, United States
[d] Environmental Health Trust, Teton Village, WY, United States
[e] Hebrew University of Jerusalem, Israel

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ABSTRACT

Epidemiology studies (case-control, cohort, time trend and case studies) published since the International Agency for Research on Cancer (IARC) 2011 categorization of radiofrequency radiation (RFR) from mobile phones and other wireless devices as a possible human carcinogen (Group 2B) are reviewed and summarized. Glioma is an important human cancer found to be associated with RFR in 9 case-control studies conducted in Sweden and France, as well as in some other countries. Increasing glioma incidence trends have been reported in the UK and other countries. Non-malignant endpoints linked include acoustic neuroma (vestibular Schwannoma) and meningioma. Because they allow more detailed consideration of exposure, case-control studies can be superior to cohort studies or other methods in evaluating potential risks for brain cancer. When considered with recent animal experimental evidence, the recent epidemiological studies strengthen and support the conclusion that RFR should be categorized as carcinogenic to humans (IARC Group 1). Opportunistic epidemiological studies are proposed that can be carried out through cross-sectional analyses of high, medium, and low mobile phone users with respect to hearing, vision, memory, reaction time, and other indicators that can easily be assessed through standardized computer-based tests. As exposure data are not uniformly available, billing records should be used whenever available to corroborate reported exposures.

1. Introduction

With rapidly increasing applications for wireless devices targeting populations of all ages, exposures to the associated radiofrequency radiation (RFR) are increasing in number and diversity. Radiation sources include communications devices such as mobile (cell) or cordless phones, laptops and tablets, baby monitors, wearable devices and associated infrastructure (e.g. routers, antennae on towers, and distributed antennae systems (DAS) that can employ directional couplers or wireless amplifiers to enhance accessibility). Thus, the technology entails direct and growing personal exposures to an expanding array of wireless transmitting devices (WTDs).

In 2011, a Working Group of the World Health Organization's International Agency for Research on Cancer (IARC) classified RFR as a possible human carcinogen (Group 2B) (IARC, 2013). In this paper we review the human epidemiology and some other relevant studies published since the IARC Working Group meeting.

1.1. Wireless phone types

The principal sources of exposure of humans to RFR are cell and cordless phones. The radiated power and technologies for cell phones have evolved over the years, as summarized in Table 1 (Hardell and Carlberg, 2015).

2. Case-control studies; glioma

Aydin et al. (2011) reported the results of CEFALO, a multicenter

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* Corresponding author.
E-mail addresses: ab.miller@utoronto.ca (A.B. Miller), lloyd.l.morgan@gmail.com (L.L. Morgan), iu22@eohsi.rutgers.edu (I. Udasin), ddavis@ehtrust.org (D.L. Davis).

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Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer

A. Balmori [1]

C/ Rigoberto Cortejoso, 14 47014, Valladolid, Spain

ARTICLE INFO

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ABSTRACT

The objective of this work was to perform a complete review of the existing scientific literature to update the knowledge on the effects of base station antennas on humans. Studies performed in real urban conditions, with mobile phone base stations situated close to apartments, were selected. Overall results of this review show three types of effects by base station antennas on the health of people: radiofrequency sickness (RS), cancer (C) and changes in biochemical parameters (CBP). Considering all the studies reviewed globally (n = 38), 73.6% (28/38) showed effects: 73.9% (17/23) for radiofrequency sickness, 76.9% (10/13) for cancer and 75.0% (6/8) for changes in biochemical parameters. Furthermore, studies that did not meet the strict conditions to be included in this review provided important supplementary evidence. The existence of similar effects from studies by different sources (but with RF of similar characteristics), such as radar, radio and television antennas, wireless smart meters and laboratory studies, reinforce the conclusions of this review. Of special importance are the studies performed on animals or trees near base station antennas that cannot be aware of their proximity and to which psychosomatic effects can never be attributed.

1. Introduction

During the last few decades, hundreds of thousands of mobile phone base stations and other types of wireless communications antennas have been installed around the world, in cities and in nature, including protected natural areas, in addition to pre-existing antennas (television, radio broadcasting, radar, etc.). Only the aesthetic aspects or urban regulations have been generally considered in this deployment, while the biological, environmental and health impacts of the associated non-ionizing electromagnetic radiation emissions have not been assessed so far. Therefore, the effects on humans living around these anthropogenic electromagnetic field sources (antennas) have not been considered.

In France, there is a significant contribution of mobile phone base stations in the exposure to radiofrequency electromagnetic fields (RF-EMF) of urban citizens living nearby (De Giudici et al., 2021). Some studies from India indicate that more than 15% of people have levels of EMF strength above 12 V/m due to their proximity to antennas (Premlal and Eldhose, 2017). Exposure estimates have shown that RF-EMF from mobile telephone systems is stronger in urban than in rural areas. For instance, in Sweden the levels of RF radiation have increased considerably in recent years, both outdoor and indoor, due to new telecommunication technologies, and the median power density measured for RF fields between 30 MHz and 3 GHz was 16 $\mu W/m^2$ in rural areas, 270 $\mu W/m^2$ in urban areas and 2400 $\mu W/m^2$ in city areas (Hardell et al., 2018). Total exposure varies not only between urban and rural areas but also, depending on residential characteristics, between different floors of a building, with a tendency for building exposure to increase at higher floors (Breckenkamp et al., 2012).

Over the past five decades, and more intensively since the beginning of this century, many studies and several reviews have been published on the effects of anthropogenic electromagnetic radiation on humans living around the antennas. The first studies were carried out with radio and television antennas, investigating increases in cancer and leukaemia (Milham, 1988; Maskarinec et al., 1994; Hocking et al., 1996; Dolk et al., 1997a, 1997b; Michelozzi et al., 1998; Altpeter et al., 2000), as well as around radars (Kolodynski and Kolodynska, 1996; Goldsmith, 1997).

Regarding base station antennas, there are scientific discrepancies in their effects: some studies concluded that there are no health-related effects (e.g. Augner and Hacker, 2009; Blettner et al., 2009; Röösli et al., 2010; Baliatsas et al., 2016) whereas others found increases in cancer and other health problems in humans living around antennas (e.g. Santini et al., 2002; Navarro et al., 2003; Bortkiewicz et al., 2004;

E-mail address: abalmorimartinez@gmail.com.
[1] Independent researcher

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Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil ☆

Adilza C. Dode [a,b,e,*], Mônica M.D. Leão [c], Francisco de A.F. Tejo [d], Antônio C.R. Gomes [e], Daiana C. Dode [e,f], Michael C. Dode [e], Cristina W. Moreira [b], Vânia A. Condessa [b], Cláudia Albinatti [b], Waleska T. Caiaffa [g]

[a] Minas Methodist University Center Izabela Hendrix, Belo Horizonte City, Minas Gerais State, Brazil
[b] Municipal Government of Belo Horizonte, Municipal Health Department, Belo Horizonte City, Minas Gerais State, Brazil
[c] UFMG—Universidade Federal de Minas Gerais-Belo Horizonte, Environmental and Sanitary Engineering Department, Belo Horizonte City, Minas Gerais State, Brazil
[d] UFCG—Universidade Federal de Campina Grande, Center of Electrical Engineering and Informatics, Academic Unit of Electrical Engineering, Paraíba State, Brazil
[e] MRE Engenharia (Electromagnetic Radiations Measurement—Engineering), Belo Horizonte City, Minas Gerais State, Brazil
[f] Faculty of Medical Sciences, Medicine-Belo Horizonte, Belo Horizonte City, Minas Gerais State, Brazil
[g] UFMG—Universidade Federal de Minas Gerais-Belo Horizonte, Urban Health Observatory, Belo Horizonte City, Minas Gerais State, Brazil

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ABSTRACT

Pollution caused by the electromagnetic fields (EMFs) of radio frequencies (RF) generated by the telecommunication system is one of the greatest environmental problems of the twentieth century. The purpose of this research was to verify the existence of a spatial correlation between base station (BS) clusters and cases of deaths by neoplasia in the Belo Horizonte municipality, Minas Gerais state, Brazil, from 1996 to 2006 and to measure the human exposure levels to EMF where there is a major concentration of cellular telephone transmitter antennas. A descriptive spatial analysis of the BSs and the cases of death by neoplasia identified in the municipality was performed through an ecological–epidemiological approach, using georeferencing. The database employed in the survey was composed of three data banks: 1. death by neoplasia documented by the Health Municipal Department; 2. BSs documented in ANATEL ("Agência Nacional de Telecomunicações": 'Telecommunications National Agency'); and 3. census and demographic city population data obtained from official archives provided by IBGE ("Instituto Brasileiro de Geografia e Estatística": 'Brazilian Institute of Geography and Statistics'). The results show that approximately 856 BSs were installed through December 2006. Most (39.60%) of the BSs were located in the "Centro-Sul" ('Central-Southern') region of the municipality. Between 1996 and 2006, 7191 deaths by neoplasia occurred and within an area of 500 m from the BS, the mortality rate was 34.76 per 10,000 inhabitants. Outside of this area, a decrease in the number of deaths by neoplasia occurred. The greatest accumulated incidence was 5.83 per 1000 in the Central-Southern region and the lowest incidence was 2.05 per 1000 in the Barreiro region. During the environmental monitoring, the largest accumulated electric field measured was 12.4 V/m and the smallest was 0.4 V/m. The largest density power was 40.78 μW/cm^2, and the smallest was 0.04 μW/cm^2.

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1. Introduction

Mobile phone radio base stations (RBSs) are now found in cities and communities worldwide. They can be found near or even on top of homes, schools, hospitals, daycare centers and offices. In Brazil, the number of mobile phone users is estimated to be over 200 million and there are more than 5 billion users worldwide. In the municipality of Belo Horizonte, the capital of the state of Minas Gerais, there are approximately 1000 base stations (BSs) with 128.77 accesses by mobile phones per 100 inhabitants and in Brazil, there are 49,979 BSs licensed through April 2011 (ANATEL, 2011).

The non-ionizing electromagnetic radiation from the BSs is of low intensity compared to the current guidelines on human exposure limits. However, its emission is continuous. This raises concerns as to whether the health and well-being of people living or working close to the BSs are at risk Khurana et al., 2010; Alanko et al., 2008.

The *emission* of a BS is usually described by its effectively radiated power in watts (W), which describes the total amount of radiation emitted by the antenna of the BS. Their intensity, called the power density, is commonly measured in milliwatts per square centimeter (mW/cm^2) or microwatt per square centimeter (μW/cm^2) and it expresses the power per unit area impinging normally to the external surface of the subject. The *immission* (absorption) of the subject is measured by the specific absorption rate (SAR), which is reported in

☆ All the authors declare that they have no conflicts of interest.

* Corresponding author at: Rua Desembargador Assis Rocha, 279, Bairro Belvedere, 30320-250, Belo Horizonte (MG), Brazil. Tel.: +55 031 3286 1892.
E-mail addresses: adilzadode@terra.com.br (A.C. Dode), monica@desa.ufmg.br (M.M.D. Leão).

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Case Report

How does long term exposure to base stations and mobile phones affect human hormone profiles?

Emad F. Eskander *, Selim F. Estefan, Ahmed A. Abd-Rabou

Hormones Department, Medical Research Division, National Research Centre, Cairo, Egypt

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ABSTRACT

Objectives: This study is concerned with assessing the role of exposure to radio frequency radiation (RFR) emitted either from mobiles or base stations and its relations with human's hormone profiles.

Design and methods: All volunteers' samples were collected for hormonal analysis.

Results: This study showed significant decrease in volunteers' ACTH, cortisol, thyroid hormones, prolactin for young females, and testosterone levels.

Conclusion: The present study revealed that high RFR effects on pituitary–adrenal axis.

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Introduction

Because of the increase in the usage of wireless communication devices of mobile phones in recent years, there is an anxious concern on the possible hazardous effects of prolonged exposure to radio frequency radiation (RFR) [1]. In considering the biological effects of RFR, the intensity and frequency of the radiation and exposure duration are important determinants of the responses.

It has been reported that exposure to RFR could affect the nervous system [2]. Hardell et al. found that cell phone users had an increased risk of malignant gliomas [3]. Subjecting human spermatozoa to RFR showed decrease in sperms motility and vitality and increase in DNA fragmentation [4]. The authors hypothesize that the high sporadic incidence of the clinical symptoms of the autoimmune multiple Sclerosis disease [5] may be a result of long exposure to RFR from mobiles.

This study is concerned with assessing the effect of RFR emitted from mobile phones and base stations on human hormone profiles, with anticipation to offer recommendations to assure health care and safety for humans continuously exposed to radio frequency radiation.

Design and methods

Study subjects

This study was conducted for 6 years on 82 mobile phone volunteers with age ranges 14–22 years ($n=41$) and 25–60 years ($n=41$). Those users were divided into three subgroups according to the time of their exposure to RFR: (weak $n=19$), (moderate $n=9$), and (strong $n=13$) per day, in addition to 20 negative control subjects.

On the other hand, volunteers exposed to RFR emitted from base stations ($n=34$) were selected with age ranges 14–22 years ($n=17$), and 25–60 years ($n=17$) and living at distances 20–100 m and 100–500 m apart from the base station. Additional 10 subjects of each age range living at a distance more than 500 m apart from the base station were considered as negative control group.

The source of the RFR (base stations or mobile phones) was GSM-950 MHz magnetic field and the ICNIRP-Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic field (up to 300 GHz) (International Commission on Non-Ionizing Radiation Protection). The present study was approved by the Ethics Committee of National Research Centre.

Volunteers inclusion criteria

Volunteers participated in the study fulfilled the following inclusion criteria: age 14–60 years, mobile phone users, or living at distances 20–100 m and 100–500 m apart from the base station.

* Corresponding author at: Hormones Department, Medical Research Division, National Research Centre, Cairo, 12622, Egypt. Fax: +20 2 33370931.
E-mail address: gysi_pharma@yahoo.com (E.F. Eskander).

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ORIGINAL ARTICLE

Health effects of living near mobile phone base transceiver station (BTS) antennae: a report from Isfahan, Iran

Daryoush Shahbazi-Gahrouei, Mojtaba Karbalae, Habib allah Moradi, and Milad Baradaran-Ghahfarokhi

Department of Medical Physics and Medical Engineering, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

Background: In recent years, by tremendous use of mobile phone telecommunication, a growing concern about the possible health hazards has increased greatly among public and scientists. The mobile phone exposure has been shown to have many effects upon the immune functions, stimulating hormones, mammalian brain, sperm motility and morphology, and neurological pathologies syndrome. The aim of this study was to find out the psychological and psychobiological reactions of the people who are living near mobile phone base transceiver stations (BTS) antenna, in Isfahan, Iran. *Materials and methods*: A cross-sectional study on 250 randomly selected inhabitants (133 women and 117 men) was performed in October 2012 till November 2012. The inhabitants were requested to complete a standardized questionnaire that focused on the relevant psychological and psychobiological reactions parameters. A computer program (SPSS version16.0, Chicago, IL) was used for statistical analysis using the Chi-square test with Yates correction. All the data were tested using a criterion level of $p = 0.05$. *Results*: The results showed that most of the symptoms such as nausea, headache, dizziness, irritability, discomfort, nervousness, depression, sleep disturbance, memory loss and lowering of libido were statistically significant in the inhabitants living near the BTS antenna (<300 m distances) compared to those living far from the BTS antenna (>300 m). *Conclusion*: It is suggested that cellular phone BTS antenna should not be sited closer than 300 m to populations to minimize exposure of neighbors.

Keywords

Electromagnetic field, health effects, microwave radiation, mobile phone BTS

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Introduction

In recent years, use of mobile phone telecommunication has drastically increased the amount of human exposition from the microwaves (MWs) radiation in everyday life. Because it became impossible to imagine a world without mobile communication, a growing concern about the possible health hazards have increased greatly among public, even on those who do not use such phones (Repacholi, 2001).

In this regard, the World Health Organization (WHO) established a project to assess environmental and health effects of Electro Magnetic Field (EMF) in the frequency of 0 to 300 Giga Hertz (GHz) (Dasdag et al., 2003; Hamblin et al., 2006). The mobile phones technology uses 880 and 1800 MHz frequency range (Valberg et al., 2007). Accordingly, the term Electromagnetic Hypersensitivity (EHS) was created for symptoms possibly related to EMF. However, the definition and diagnosis remains controversial (Hansson et al., 2006).

Address correspondence to Mojtaba Karbalae, Medical Physics and Medical Engineering Department, Isfahan University of Medical Sciences (IUMS), Isfahan 81746, Iran. Tel: +98 311 7922432. Fax: +98 311 6688597. E-mail: mehdi_karbalaee@yahoo.com

The emitted microwaves have been shown to have many effects upon the immune functions (Repacholi, 2001), stimulating hormones (Fattahi-asl et al., 2012, 2013; Shahbazi-Gahrouei et al., 2012), mammalian brain (de Tommaso et al., 2009), sperm motility and morphology (Agarwal et al., 2009) and neurological pathologies syndrome (Leszczynski et al., 2002).

According to the results gained in a number of experiments, for most of the people, a linear physiological dose-response relationship between EMF field density and the symptoms seemed to be unlikely (Roosli, 2008). Diem et al. reported DNA single- and double-strand induced breaks due to 1800 MHz RF-EMF exposure at 1.2 W/kg SAR (Diem et al., 2005). Nittby et al. have investigated that albumin extravasation enhanced in the rats due to exposer to mobile phones at 12 mW/kg SAR (Nittby et al., 2009). Ammari et al. investigated the effects of a chronic GSM 900 MHz exposure on glia in the rat brain (Ammari et al., 2008). While Rubin et al. found no differences between people with EHS and controls with regard to psychopathological diagnoses (Rubin et al., 2008). Gurisik et al. also found no significant differences between RF-exposed cells and sham-exposed in any of the conditions examined or assays (Gurisik et al., 2006). Lee et al. reported that 1763 MHz RF radiation alone did not reflect any stress response (Lee et al., 2006).

RIGHTSLINK

Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations

VINI G. KHURANA, LENNART HARDELL, JORIS EVERAERT, ALICJA BORTKIEWICZ, MICHAEL CARLBERG, MIKKO AHONEN

Human populations are increasingly exposed to microwave/radiofrequency (RF) emissions from wireless communication technology, including mobile phones and their base stations. By searching PubMed, we identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact. *Key words*: base stations; electromagnetic field (EMF); epidemiology; health effects; mobile phone; radiofrequency (RF); electromagnetic radiation.

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INTRODUCTION

Mobile phone base stations are now found ubiquitously in communities worldwide. They are frequently found near or on shops, homes, schools, daycare centers, and hospitals (Figure 1). The radiofrequency (RF) electromagnetic radiation from these base stations is regarded as being low power; however, their output is continuous.[1] This raises the question as to whether the health of people residing or working in close proximity to base stations is at any risk.

Received from: Department of Neurosurgery, The Canberra Hospital, The Australian National University Medical School, Garran, Australia (VGK); Department of Oncology, University Hospital, Orebro, Sweden (LH, MC); Research Institute for Nature and Forest [INBO], Brussels, Belgium (JE); Department of Work Physiology and Ergonomics, Nofer Institute of Occupational Medicine, Lodz, Poland (AB); Department of Computer Science, University Hospital, Orebro, Sweden (MA). Send correspondence to: Dr. Vini G. Khurana, Department of Neurosurgery, The Canberra Hospital, PO Box 103, Woden ACT 2606, Australia; email: <vgkhurana@gmail.com>.

Disclosures: The authors declare no conflicts of interest.

METHODS

By searching PubMed and using keywords such as base station, mast, electromagnetic field (EMF), radiofrequency (RF), epidemiology, health effects, mobile phone, and cell phone, and by searching the references of primary sources, we were able to find only 10 human population studies from seven countries that examined the health effects of mobile phone base stations. Seven of the studies explored the association between base station proximity and neurobehavioral symptoms via population-based questionnaires; the other three retrospectively explored the association between base station proximity and cancer via medical records. A meta-analysis based on this literature is not possible due to differences in study design, statistical measures/risk estimates, exposure categories, and endpoints/outcomes. The 10 studies are therefore summarized in chronological order (Table 1).

RESULTS AND DISCUSSION

We found epidemiological studies pertaining to the health effects of mobile phone base station RF emissions to be quite consistent in pointing to a possible adverse health impact. Eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. The studies by Navarro et al.,[2] Santini et al.,[3] Gadzicka et al.,[4] and Hutter et al.[5] reported differences in the distance-dependent prevalence of symptoms such as headache, impaired concentration, and irritability, while Abdel-Rassoul et al.[6] also found lower cognitive performance in individuals living ≤ 10 meters from base stations compared with the more distant control group. The studies by Eger et al.[7] and Wolf and Wolf[8] reported increased incidence of cancer in persons living for several years < 400 meters from base stations. By contrast, the large retrospective study by Meyer et al.[9] found no increased incidence of cancer near base stations in Bavaria. Blettner et al.[10] reported in Phase 1 of their study that more health problems were found closer to base stations, but in Phase 2[11] concluded that measured EMF emissions were not related to adverse health effects (Table 1).

Each of the 10 studies reviewed by us had various strengths and limitations as summarized in Table 1. Per-

Figure 1—Mobile phone base stations ("antennae" or "masts") in Australia. Upper left: Community shop roof showing plethora of flat panel antennae. Upper right: Hospital roof with flat panel antennae painted to blend in. Lower left: Top of a street light pole. Lower center: Mast erected next to a daycare center. Lower right: Antennae mounted on an office block top floor.

taining to those base station studies in which EMF measurements were not carried out,[3,4,7,9] it should be noted that distance is not the most suitable classifier for exposure to RF-EMF. Antennae numbers and configurations, as well as the absorption and reflection of their fields by houses, trees, or other geographic hindrances may influence the exposure level. Further, self-estimation of distance to nearest base station is not the best predictor of exposure since the location of the closest base station is not always known. Such exposure misclassification inevitably biases any association towards null. Multiple testing might also produce spurious results if not adjusted for,[3,5] as might failure to adjust for participant age and gender.[7] Latency is also an important consideration in the context of cancer incidence following or during a putative environmental exposure. In this regard, the study by Meyer et al.[9] found no association between mobile phone base station exposure and cancer incidence, but had a relatively limited observation period of only two years. On the other hand, the studies by Eger et al.[7] and Wolf and Wolf[8] found a significant association between mobile phone base station exposure and increased cancer incidence, although the approximate five-year latency between base station exposure and cancer diagnosis appears to be unexpectedly short in both of these studies.

Other problems in several population-based questionnaires are the potential for bias, especially selection[8] and participation[2,3,5,6,11] biases, and self-reporting of outcomes in combination with the exposure assessment methods used. For example, regarding limitations in exposure assessment, in a large two-phase base station study from Germany,[12,13]of the Phase 1 participants (n = 30,047), only 1326 (4.4%) participated with a single "spot" EMF measurement recorded in the bedroom for Phase 2. Further, health effect contributions from all relevant EMF sources and other non-EMF environmental sources need to be taken into account.[12] We acknowledge that participant concern instead of exposure could be the triggering factor of adverse health effects, however this "nocebo effect" does not appear to fully explain the findings.[4,5] Further, the biological relevance of the overall adverse findings (Table 1) is supported by the fact that some of the symptoms in these base-station studies have also been reported among mobile phone users, such as headaches, concentration difficulties, and sleep disorders.[13,14] Finally, none of the studies that found adverse health effects of base stations reported RF exposures above accepted international guidelines, the implication being that if such findings continue to be reproduced, current exposure standards are inadequate in protecting human populations.[15]

TABLE 1 Summary of Epidemiological Studies of Mobile Phone Base Station Health Effects

Publication (Year; Country)	Clinical Assessment	Study Design	Base Station Details	Participants	EMF Measured	Key Findings	Strengths	Limitations
Navarro[2] (2003; Spain)	Neuro-behavioral	Survey-questionnaire	GSM-DCS 1800 MHz	101	Yes	More symptoms with closer proximity to base station (< 150 m)	Detailed questionnaire, EMF measured, distances studied[a]	Low participation, self-estimated distances, subjects aware[b]
Santini[2] (2003; France)	Neuro-behavioral	Survey-questionnaire	n/s	530	No	More symptoms with closer proximity to base station (< 300 m)	Detailed questionnaire, distances & other EMF exposures assessed	As above, plus no EMF measurements, no base station details
Eger[7] (2004; Germany)	Cancer incidence	Retrospective case review	GSM 935 MHz	967	No	3 x risk of cancer after 5 yrs of exposure (< 400 m); early age of cancer diagnosis	Maximum beam intensity calculated, reliable cancer data collection	Other environmental risk factors not assessed; analysis not adjusted for age and sex.
Wolf & Wolf[8] (2004; Israel)	Cancer incidence	Retrospective case review	TDMA 850 MHz	1844	Yes	> 4 x risk of cancer after 3–7 yrs exposure (< 350 m); early age of cancer diagnosis	Reliable cancer & demographic data, no other major environmental pollutant identified	Not all environmental risk factors assessed; possible selection bias; no age, sex adjustment.
Gadzicka[4] (2006; Poland)	Neuro-behavioral	Survey-questionnaire	n/s	500	No	More headache with proximity < 150 m; nocebo unlikely[c]	Detailed questionnaire, distances & EMF studied, nocebo studied	Subjects aware, no base station details
Hutter[5] (2006; Austria)	Neuro-behavioral	Cross-sectional	900 MHz	336	Yes	Headaches & impaired concentration at higher power density; nocebo unlikely	Detailed questionnaire and testing, EMF measured, distances studied; nocebo effect studied	Subjects aware, low participation rate
Meyer[9] (2006; Germany)	Cancer incidence	Retrospective case review	n/s	177,428	No	No increased cancer incidence in municipalities with or without base stations	Wide population assessed (Bavaria)	Observation period only 2 years, vague definitions of exposure, exposure onset unknown, distance to base station unknown
Abdel-Rassoul[6] (2007; Egypt)	Neuro-behavioral	Cross-sectional	n/s	165	Yes	More symptoms & lower cognitive performance if living under or < 10 m from base station	Detailed questionnaire and testing, EMF measured, distances studied, subjects unaware	Exact base station details n/s, low number of participants
Blettner[10] (2009; Germany)	Neuro-behavioral	Cross-sectional	n/s	30,047	No	More health complaints closer to base station (< 500 m)	Wide population assessed, detailed survey, nocebo effect assessed	EMF measurements not carried out (see phase II in Berg-Beckhoff et al., 2009; below)
Berg-Beckhoff[11] (2009; Germany)	Neuro-behavioral	Cross-sectional	GSM 900 MHz GSM 1800 MHz UMTS 1920–1980 MHz	1326	Yes	Health effects probably caused by stress and not by RF-EMF	Measured EMF emissions, standardized questionnaires	Low participation, no detailed list of symptoms published, single "spot" measurement in one place in dwelling, no occupational exposure assessed, time lag from assessment of symptoms and EMF measurement

n / s = not specified.
[a]"Distance" refers to distance between base station and subjects' households.
[b]"Subjects aware" refers to study participants being aware of the nature of the study.
[c]"Nocebo" effect unlikely because the majority of subjects in the study reported little or no concern for base station proximity.

CONCLUSIONS

Despite variations in the design, size and quality of these studies as summarized in Table 1, it is the consistency of the base-station epidemiological literature from several countries that we find striking. In particular, the increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations found in 80% of the available studies. It should be pointed out that the overall findings of health problems associated with base stations might be based on methodological weaknesses, especially since exposure to RF electromagnetic radiation was not always measured.

There are some proposed mechanisms via which low-intensity EMF might affect animal and human health,[16,17] but full comprehensive mechanisms still remain to be determined.[18,19] Despite this, the accumulating epidemiological literature pertaining to the health effects of mobile phones[13,20] and their base stations (Table 1) suggests that previous exposure standards based on the thermal effects of EMF should no longer be regarded as tenable. In August 2007, an international working group of scientists, researchers, and public health policy professionals (the BioInitiative Working Group) released its report on EMF and health.[21] It raised evidence-based concerns about the safety of existing public limits that regulate how much EMF is allowable from power lines, cellular phones, base stations, and many other sources of EMF exposure in daily life. The BioInitiative Report[21] provided detailed scientific information on health impacts when people were exposed to electromagnetic radiation hundreds or even thousands of times below limits currently established by the FCC and International Commission for Non-Ionizing Radiation Protection in Europe (ICNIRP). The authors reviewed more than 2000 scientific studies and reviews, and have concluded that: (1) the existing public safety limits are inadequate to protect public health; and (2) from a public health policy standpoint, new public safety limits and limits on further deployment of risky technologies are warranted based on the total weight of evidence.[21] A precautionary limit of 1 mW/m^2 (0.1 $microW/cm^2$ or 0.614 V/m) was suggested in Section 17 of the BioInitiative Report to be adopted for outdoor, cumulative RF exposure.[21] This limit is a cautious approximation based on the results of several human RF-EMF studies in which no substantial adverse effects on well being were found at low exposures akin to power densities of less than 0.5 – 1 mW/m^2.[2,5,22–26] RF-EMF exposure at distances > 500 m from the types of mobile phone base stations reviewed herein should fall below the precautionary limit of 0.614 V/m.

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Mobile phone infrastructure regulation in Europe: Scientific challenges and human rights protection

Claudia Roda [a,*], *Susan Perry* [b]

[a] *Computer Science Department, The American University of Paris, 147 rue de Grenelle, 75007 Paris, France*
[b] *International Politics Department, The American University of Paris, 6 rue du Colonel Combes, 75007 Paris, France*

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ABSTRACT

As the progress of mobile phone technology accelerates throughout Europe, the regulatory framework necessary for its safe and extended use has been slow to develop. This article analyses the relationship between scientific knowledge and regulation concerning the heath effects of increasing emissions of electromagnetic fields (EMF). From a conservationist perspective, no other example of industrial impact on the natural environment has achieved such extended penetration so quickly. From a theoretical standpoint, stakeholders are faced with a difficult choice between comprehensive risk assessment versus immediate application of the precautionary principle. By exploring the interaction between citizens, governments, and international bodies, we first analyze the challenges faced by regulators in the presence of uncertain scientific knowledge and standards of measurement. We then highlight the inadequacy of current risk assessment parameters. Lastly, within the context of State and European regulation of EMF exposure, we expand scholarship on the human rights framework to protect vulnerable populations from environmental pollution. We conclude that, because scientific knowledge is incomplete, a precautionary approach is better suited to State obligations under international human rights law.

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1. Introduction

The use of mobile phones is ubiquitous, and is estimated to have reached 96% penetration worldwide (ITU, 2013, p. 1). Mobile broadband, used for wireless access to the Internet, has more than 2 billion subscriptions worldwide, with penetration levels that reach 68% in Europe (ITU, 2013, p. 6). Scientific research has attempted to determine whether exposure to electromagnetic fields (EMF) during mobile phone use is dangerous to human health. Yet, while the public remains focused on the possible dangers of the mobile device itself, the rapidly growing infrastructure necessary for mobile communication is interfering with human physiology, as 'the antennae of broadcast stations are the most powerful continuous sources of RF energy intentionally radiated into free space' (ICNIRP, 2009, p. 11). From a conservationist perspective, no other example of industrial impact on the natural environment has achieved such extended penetration so quickly.

Base transceiver stations (BTS) – equipment normally connected to elevated structures that relay electromagnetic signals between mobile devices and a network – emit electromagnetic energy. EMF emission is widespread; the European Union, for example, requires maximal coverage for its citizens.[1] However, virtually no national legislation exists to protect the same consumers from the possible effects of prolonged EMF exposure via BTS, nor do most governments

* *Corresponding author*. Tel.: +33 1 40620701.
E-mail addresses: croda@aup.edu (C. Roda), sperry@aup.edu (S. Perry).

[1] The Digital Agenda for Europe (DAE) required Member States to devise and make operational by 2012 national broadband plans with the objective of meeting the broadband targets for Europe by 2020.

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Article

Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus

Sultan Ayoub Meo [1,*], Yazeed Alsubaie [1], Zaid Almubarak [1], Hisham Almutawa [1], Yazeed AlQasem [1] and Rana Muhammed Hasanato [2]

[1] Department of Physiology, College of Medicine, King Saud University, P.O. Box 2925, Riyadh 11461 Saudi Arabia; E-Mails: yazeed-1992-@hotmail.com (Y.A.); z-almubarak@hotmail.com (Z.A.); hisham-001@hotmail.com (H.A.); yazeed.alq@gmail.com (Y.A.)

[2] Department of Clinical Bio-Chemistry, College of Medicine, King Saud University, P.O. Box 2925, Riyadh 11461 Saudi Arabia; E-Mail: rhasanato@ksu.edu.sa

* Author to whom correspondence should be addressed; E-Mail: sultanmeo@hotmail.com; Tel.: +96-611-467-1604; Fax: +96-611-467-2567.

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Abstract: Installation of mobile phone base stations in residential areas has initiated public debate about possible adverse effects on human health. This study aimed to determine the association of exposure to radio frequency electromagnetic field radiation (RF-EMFR) generated by mobile phone base stations with glycated hemoglobin (HbA1c) and occurrence of type 2 diabetes mellitus. For this study, two different elementary schools (school-1 and school-2) were selected. We recruited 159 students in total; 96 male students from school-1, with age range 12–16 years, and 63 male students with age range 12–17 years from school-2. Mobile phone base stations with towers existed about 200 m away from the school buildings. RF-EMFR was measured inside both schools. In school-1, RF-EMFR was 9.601 nW/cm^2 at frequency of 925 MHz, and students had been exposed to RF-EMFR for a duration of 6 h daily, five days in a week. In school-2, RF-EMFR was 1.909 nW/cm^2 at frequency of 925 MHz and students had been exposed for 6 h daily, five days in a week. 5–6 mL blood was collected from all the students and HbA1c was

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Estimation of some antioxidants in people exposed to electromagnetic waves from Internet towers in Samarra

Methaq Nazhan Mahmood[1], Asmaa Hashim Shaker[2], Humam E. Mohammed[3]

[1]Department of Applied Chemistry, College of Applied Science, University of Samarra, Samarra, Iraq

[2]Department of Chemistry, College of Education for Women, University of Tikrit, Tikrit, Iraq

[3]Department of Pathological Analyses, College of Applied Sciences, University of Samarra, Samarra, Iraq

Corresponding author: Methaq Nazhan Mahmood, Department of Applied Chemistry, College of Applied Science, University of Samarra, Samarra, Iraq. Email: Charter61@uosamarra.edu.iq

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ABSTRACT

The current study was conducted as a preliminary study in the Samarra city of Iraq. The study explored direct and indirect impact on people exposed to Internet network towers on residential premises in the cities of Iraq. The study included collection of samples from people exposed to radioactive frequencies of Internet towers for a period ranging from 1 to 10 years. In all, 43 blood samples of males and female participants (age: 20–35 years) were collected exposed to radioactive frequencies (present at the places where constellations were located); also, 20 samples were collected from those (20–35-year old) not exposed to radioactive frequencies (from places far from the Internet towers), which acted as a control group. Measurements and analyses were made for antioxidants that included the following enzymes: glutathione peroxidase (GPx), superoxide dismutase (SOD), glutathione (GSH), *malondialdehyde* (MDA), and peroxynitrate (or peroxonitrite [$ONOO^-$]). Antioxidants are one of the most essential lines of defense against free radicals that cause diseases and premature aging. The results demonstrated a significant increase in the levels of GPx and SOD concentrations and a decrease in the levels of GSH concentration in the blood serum of participants exposed to electromagnetic waves of Internet towers compared to the control group. The results also showed a significant increase in the concentrations of both MDA and $ONOO^-$ compared to the non-exposed subjects of the control group.

Keywords: *antioxidants; electromagnetic waves; Internet towers; Samarra*

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ORIGINAL ARTICLE

A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station

Gursatej Gandhi, Gurpreet Kaur, and Uzma Nisar

Department of Human Genetics, Guru Nanak Dev University, Amritsar, Punjab, India

Abstract

Mobile phone base stations facilitate good communication, but the continuously emitting radiations from these stations have raised health concerns. Hence in this study, genetic damage using the single cell gel electrophoresis (comet) assay was assessed in peripheral blood leukocytes of individuals residing in the vicinity of a mobile phone base station and comparing it to that in healthy controls. The power density in the area within 300 m from the base station exceeded the permissive limits and was significantly ($p = 0.000$) higher compared to the area from where control samples were collected. The study participants comprised 63 persons with residences near a mobile phone tower, and 28 healthy controls matched for gender, age, alcohol drinking and occupational sub-groups. Genetic damage parameters of DNA migration length, damage frequency (DF) and damage index were significantly ($p = 0.000$) elevated in the sample group compared to respective values in healthy controls. The female residents ($n = 25$) of the sample group had significantly ($p = 0.004$) elevated DF than the male residents ($n = 38$). The linear regression analysis further revealed daily mobile phone usage, location of residence and power density as significant predictors of genetic damage. The genetic damage evident in the participants of this study needs to be addressed against future disease-risk, which in addition to neurodegenerative disorders, may lead to cancer.

Keywords

DNA damage, radiofrequency radiations, peripheral blood leukocytes

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Introduction

The wireless technology has seen unprecedented expansion the world over and has become all pervasive. Though on one hand, there has been indispensable improvement in the quality of communication, yet it has also emerged as an unceasing source of radiofrequency radiations (RFRs) being emitted, both from mobile (cell) phone base stations and the cell phone itself, which acts as a two-way radio, i.e. transceiver (Kwan-Hoong, 2005), generally operating in the frequency range of 900 MHz–1.9 GHz (Levitt and Lai, 2010). According to the Telecom Industry of India (Telecom sector in India, 2012), the Indian Telecommunications network is the third largest in the world and the second largest among the emerging economies of Asia; the industry continues to grow having 540 000 communication towers with more and more towers being erected (DoT, 2012). There is also correspondingly high mobile phone subscribers' base, being second after China (Das, 2012). The need for an expansive network to maintain the escalating mobile phone subscribers' base has resulted in the proliferation of antennas atop masts, both in urban as well as rural areas, adding to the quagmire of environmental pollutants as the RFRs.

The continuous emission of RFR has prompted concerns about its effect and the potential risks to those living near mobile phone base stations despite the fact that the microwaves in the RFR spectrum are of low frequency (ARPANSA, 2011). Besides affecting the well-being and performance of the population, headaches, sleep disturbances, discomfort, irritability, depression, memory loss and concentration problems have been documented in France (Santini et al., 2002), Spain (Navarro et al., 2003), Poland (Bortkiewicz et al., 2004) and Egypt (Abdel-Rassoul et al., 2006). In Austria, where the exposure limits (0.001 W/m^2) are among the lowest in the world, health symptoms included buzzing in the head, heart palpitations, unwellness, lightheadedness, anxiety, breathlessness, respiratory problems, nervousness, agitation, headaches, tinnitus, heat sensation and depression (Oberfeld et al., 2004). Of more concern are studies on the occurrence of cancers among those residing near mobile phone base stations. A four-fold increase in the incidence of cancers of all kinds among residents living within 300-m radius of a mobile phone mast from three to seven years has been reported (Wolf and Wolf, 2004). In another study, a three-fold increase in the incidence of malignant tumors of blood, breast, ovary, pancreas, stomach, lung, kidney, bowel, prostate and skin melanoma was found after five years' exposure in people

Address correspondence to Dr Gursatej Gandhi, Department of Human Genetics, Guru Nanak Dev University, Amritsar 143 005, Punjab, India. Tel: (O): +91-183-2258802-09 Extn.3444. Fax (Univ.): +91-183-2258820. E-mail: gandhig07@hotmail.com

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RF Radiation–Induced Changes in the Prenatal Development of Mice

Ioannis N. Magras[1]* and Thomas D. Xenos[2]

[1]*Department of Anatomy, Histology, and Embryology, School of Veterinary Medicine, Aristotle University of Thessaloniki, Thessalonike, Greece*
[2]*Department of Telecommunications, School of Electrical Engineering and Computer Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece*

The possible effects of radiofrequency (RF) radiation on prenatal development has been investigated in mice. This study consisted of RF level measurements and in vivo experiments at several places around an ''antenna park.'' At these locations RF power densities between 168 nW/cm^2 and 1053 nW/cm^2 were measured. Twelve pairs of mice, divided in two groups, were placed in locations of different power densities and were repeatedly mated five times. One hundred eighteen newborns were collected. They were measured, weighed, and examined macro- and microscopically. A progressive decrease in the number of newborns per dam was observed, which ended in irreversible infertility. The prenatal development of the newborns, however, evaluated by the crown-rump length, the body weight, and the number of the lumbar, sacral, and coccygeal vertebrae, was improved. *Bioelectromagnetics 18:455–461, 1997.* © 1997 Wiley-Liss, Inc.

Key words: RF radiation effects; prenatal development; mice development

Five years ago the ''antenna-park of Thessaloniki'' progressively developed on the top of the nearby mountain Chortiatis, 1.5 km away from a small village of the same name. Today, almost 100 commercial TV and FM-radio broadcasting transmitters in the VHF and the UHF bands are situated there. The antennas are installed on towers well visible from a large part of the village. Living so close to the antennae and the vast amount of RF power they transmit, which is of the order of 300 kW, the people of the village Chortiatis, anxious for their health, encouraged the author to undertake a research program.

The hypothesis that RF radiation may adversely affect the health of the animal organism is still under consideration in public and scientific forums. One of the critical issues seems to be the RF effects on the reproductive process [Chernoff et al., 1992]. Numerous studies dealing with this subject ended up with seemingly contradictory results. Therefore, an ''in vivo'' study on experimental animals sensitive to RF radiation, was chosen. Based on the relevant literature, this research investigated RF radiation effects on the reproductive system, particularly on prenatal development. The mouse was selected as the experimental animal, because it is easily manipulated in the environment in which the experiments had to take place. Of course, experimenting at the mountain sites, far from the easily controlled laboratory conditions, might add a certain amount of uncertainty; therefore, these experiments should be considered preliminary.

MATERIALS AND METHODS

We used a total of 36 mice (18 females and 18 males), 2 months old and sexually mature (BALB/c/f breed colony). Breeding colony virgin males and females were obtained from the ''Theageneion Anticancer Institute of Thessaloniki.'' The use of these experimental animals was approved by the Veterinary Service of the Municipality of Thessaloniki, according to the provisions of the laws 1197/81 and 2015/92 and the Presidential Decree 160/91 of the Greek Democracy. Upon arrival, all experimental animals were quarantined for 2 weeks to discover and to allow them to acclimatise the mountain environment, an altitude ranging between 570 (position h) and 730 m (position d) above sea level. All the mice were healthy at the end of this period and showed no signs of illness during

*Correspondence to: Ioannis N. Magras, Department of Anatomy, Histology, and Embryology, School of Veterinary Medicine, Aristotle University of Thessaloniki, 540-06 Thessaloniki, Greece.

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Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective☆

Dominique Belpomme [a, b, 1], Lennart Hardell [a, c, 1, 2], Igor Belyaev [a, d, e, 1], Ernesto Burgio [a, f], David O. Carpenter [a, g, h, *, 1]

[a] European Cancer Environment Research Institute, Brussels, Belgium
[b] Paris V University Hospital, Paris, France
[c] Department of Oncology, Orebro University Hospital, Faculty of Medicine, Orebro, Sweden
[d] Department of Radiobiology, Cancer Research Institute, Biomedical Research Center, Slovak Academy of Science, Bratislava, Slovak Republic
[e] Laboratory of Radiobiology, Institute of General Physics, Russian Academy of Science, Moscow, Russian Federation
[f] Instituto Scientifico Biomedico Euro Mediterraneo, Mesagne, Italy
[g] Institute for Health and the Environment, University at Albany, Albany, NY, USA
[h] Child Health Research Centre, The University of Queensland, Faculty of Medicine, Brisbane, Australia

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ABSTRACT

Exposure to low frequency and radiofrequency electromagnetic fields at low intensities poses a significant health hazard that has not been adequately addressed by national and international organizations such as the World Health Organization. There is strong evidence that excessive exposure to mobile phone-frequencies over long periods of time increases the risk of brain cancer both in humans and animals. The mechanism(s) responsible include induction of reactive oxygen species, gene expression alteration and DNA damage through both epigenetic and genetic processes. *In vivo* and *in vitro* studies demonstrate adverse effects on male and female reproduction, almost certainly due to generation of reactive oxygen species. There is increasing evidence the exposures can result in neurobehavioral decrements and that some individuals develop a syndrome of "electro-hypersensitivity" or "microwave illness", which is one of several syndromes commonly categorized as "idiopathic environmental intolerance". While the symptoms are non-specific, new biochemical indicators and imaging techniques allow diagnosis that excludes the symptoms as being only psychosomatic. Unfortunately standards set by most national and international bodies are not protective of human health. This is a particular concern in children, given the rapid expansion of use of wireless technologies, the greater susceptibility of the developing nervous system, the hyperconductivity of their brain tissue, the greater penetration of radiofrequency radiation relative to head size and their potential for a longer lifetime exposure.
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1. Introduction

Electromagnetic fields (EMFs) are packets of energy that have no mass. They vary in frequency and wavelength. At the high end of the electromagnetic spectrum there are cosmic and X-rays that have enough energy to cause ionization, and therefore are known as ionizing EMFs. Below in frequency and energy are ultraviolet, visible light and infrared EMFs. Excessive exposure to ultraviolet EMFs poses clear danger to human health, but life on earth would not be possible without visible light and infrared EMFs. Below these forms of EMF are those used for communications (radiofrequency or RF-EMFs, 30 kHz-300 GHz) and those generated by electricity (extremely low-frequency or ELF-EMFs, 3 Hz-3 kHz). These EMFs do not have sufficient energy to directly cause ionization, and are therefore known as non-ionizing radiation. RF-EMFs at sufficient intensity cause tissue heating, which is the basis of operation of the microwave oven. However the question to be addressed here is human health effects secondary to exposures to non-ionizing EMFs at low intensities that do not cause measureable heating.

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* Corresponding author. Institute for Health and the Environment, University at Albany, Renneselaer, NY 12144, USA.
E-mail address: dcarpenter@albany.edu (D.O. Carpenter).
[1] These authors contributed equally to this work.
[2] Current address: The Environment and Cancer Research Foundation, Örebro, Sweden.

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The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer

Horst Eger, Klaus Uwe Hagen, Birgitt Lucas, Peter Vogel, Helmut Voit

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'Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz'

Summary

Following the call by Wolfram König, President of the Bundesamt für Strahlenschutz (Federal Agency for radiation protection), to all doctors of medicine to collaborate actively in the assessment of the risk posed by cellular radiation, the aim of our study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumors.

The basis of the data used for the survey were PC files of the case histories of patients between the years 1994 and 2004. While adhering to data protection, the personal data of almost 1,000 patients were evaluated for this study, which was completed without any external financial support. It is intended to continue the project in the form of a register.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier.

In the years 1999-2004, *ie* after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

Key words: cellular radiation, cellular transmitter antennas, malignant tumours

The rapid increase in the use of mobile telephony in the last few years has led to an increasing number of cell phone transmission masts being positioned in or near to residential areas. With this in mind, the president of the German governmental department for protection against electromagnetic radiation (Bundesamtes für Strahlenschutz) Wolfram König, has challenged all doctors to actively help in the work to estimate the risks from such cell phone masts. The goal of this investigation was therefore to prove whether on not people living near to cell phone masts have a higher risk of developing cancerous tumours.

The basic data was taken from the medical records held by the local medical authority (Krankenkasse) for the years 1994 to 2004. This material is stored on computer. In this voluntary study the records of roughly 1,000 patients from Naila (Oberfranken) were used, respecting the associated data protection laws. The results from this study show a significantly increased likelihood of developing cancer for the patients that have lived within 400 metres of the cell phone transmission mast (active since 1993) over the last ten years, in comparison to those patients that live further away. In addition, the patients that live within 400 metres tend to develop the cancers at a younger age. For the years 1999 to 2004 (*ie* after five or more years of living with the cell phone transmission mast), the risk of developing cancer for those living within 400 metres of the mast in comparison to those living outside this area, was three times as high.

Introduction

A series of studies available before this investigation provided strong evidence of health risks and increased cancer risk associated with physical proximity to radio transmission masts. Haider *et al.* reported in 1993 in the Moosbrunn study frequent psychovegetive symptoms below the current safety limit for electromagnetic waves (1). In 1995, Abelin *et al.* in the Swiss- Schwarzenburg study found dose dependent sleep problems (5:1) and depression (4:1) at a shortwave transmitter station that has been in operation since 1939 (2).

In many studies an increased risk of developing leukaemia has been found; in children near transmitter antennas for Radio and Television in Hawaii (3); increased cancer cases and general mortality in the area of Radio and Television transmitter antennas in Australia (4); and in England, 9 times more leukaemia cases were diagnosed in people who live in a nearby

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Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil ☆

Adilza C. Dode [a,b,e,*], Mônica M.D. Leão [c], Francisco de A.F. Tejo [d], Antônio C.R. Gomes [e], Daiana C. Dode [e,f], Michael C. Dode [e], Cristina W. Moreira [b], Vânia A. Condessa [b], Cláudia Albinatti [b], Waleska T. Caiaffa [g]

[a] Minas Methodist University Center Izabela Hendrix, Belo Horizonte City, Minas Gerais State, Brazil
[b] Municipal Government of Belo Horizonte, Municipal Health Department, Belo Horizonte City, Minas Gerais State, Brazil
[c] UFMG—Universidade Federal de Minas Gerais-Belo Horizonte, Environmental and Sanitary Engineering Department, Belo Horizonte City, Minas Gerais State, Brazil
[d] UFCG—Universidade Federal de Campina Grande, Center of Electrical Engineering and Informatics, Academic Unit of Electrical Engineering, Paraíba State, Brazil
[e] MRE Engenharia (Electromagnetic Radiations Measurement—Engineering), Belo Horizonte City, Minas Gerais State, Brazil
[f] Faculty of Medical Sciences, Medicine-Belo Horizonte, Belo Horizonte City, Minas Gerais State, Brazil
[g] UFMG—Universidade Federal de Minas Gerais-Belo Horizonte, Urban Health Observatory, Belo Horizonte City, Minas Gerais State, Brazil

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ABSTRACT

Pollution caused by the electromagnetic fields (EMFs) of radio frequencies (RF) generated by the telecommunication system is one of the greatest environmental problems of the twentieth century. The purpose of this research was to verify the existence of a spatial correlation between base station (BS) clusters and cases of deaths by neoplasia in the Belo Horizonte municipality, Minas Gerais state, Brazil, from 1996 to 2006 and to measure the human exposure levels to EMF where there is a major concentration of cellular telephone transmitter antennas. A descriptive spatial analysis of the BSs and the cases of death by neoplasia identified in the municipality was performed through an ecological–epidemiological approach, using georeferencing. The database employed in the survey was composed of three data banks: 1. death by neoplasia documented by the Health Municipal Department; 2. BSs documented in ANATEL ("Agência Nacional de Telecomunicações": 'Telecommunications National Agency'); and 3. census and demographic city population data obtained from official archives provided by IBGE ("Instituto Brasileiro de Geografia e Estatística": 'Brazilian Institute of Geography and Statistics'). The results show that approximately 856 BSs were installed through December 2006. Most (39.60%) of the BSs were located in the "Centro-Sul" ('Central-Southern') region of the municipality. Between 1996 and 2006, 7191 deaths by neoplasia occurred and within an area of 500 m from the BS, the mortality rate was 34.76 per 10,000 inhabitants. Outside of this area, a decrease in the number of deaths by neoplasia occurred. The greatest accumulated incidence was 5.83 per 1000 in the Central-Southern region and the lowest incidence was 2.05 per 1000 in the Barreiro region. During the environmental monitoring, the largest accumulated electric field measured was 12.4 V/m and the smallest was 0.4 V/m. The largest density power was 40.78 μW/cm^2, and the smallest was 0.04 μW/cm^2.

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1. Introduction

Mobile phone radio base stations (RBSs) are now found in cities and communities worldwide. They can be found near or even on top of homes, schools, hospitals, daycare centers and offices. In Brazil, the number of mobile phone users is estimated to be over 200 million and there are more than 5 billion users worldwide. In the municipality of Belo Horizonte, the capital of the state of Minas Gerais, there are approximately 1000 base stations (BSs) with 128.77 accesses by mobile phones per 100 inhabitants and in Brazil, there are 49,979 BSs licensed through April 2011 (ANATEL, 2011).

The non-ionizing electromagnetic radiation from the BSs is of low intensity compared to the current guidelines on human exposure limits. However, its emission is continuous. This raises concerns as to whether the health and well-being of people living or working close to the BSs are at risk Khurana et al., 2010; Alanko et al., 2008.

The *emission* of a BS is usually described by its effectively radiated power in watts (W), which describes the total amount of radiation emitted by the antenna of the BS. Their intensity, called the power density, is commonly measured in milliwatts per square centimeter (mW/cm^2) or microwatt per square centimeter (μW/cm^2) and it expresses the power per unit area impinging normally to the external surface of the subject. The *immission* (absorption) of the subject is measured by the specific absorption rate (SAR), which is reported in

☆ All the authors declare that they have no conflicts of interest.

* Corresponding author at: Rua Desembargador Assis Rocha, 279, Bairro Belvedere, 30320-250, Belo Horizonte (MG), Brazil. Tel.: +55 031 3286 1892.
E-mail addresses: adilzadode@terra.com.br (A.C. Dode), monica@desa.ufmg.br (M.M.D. Leão).

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Case Report

Case Report: The Microwave Syndrome after Installation of 5G Emphasizes the Need for Protection from Radiofrequency Radiation

Lennart Hardell[1*], Mona Nilsson[2]

[1]Department of Oncology, Orebro University Hospital, Sweden (retired), The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden

[2]Swedish Radiation Protection Foundation, Gredby 14, SE-178 92 Adelsö, Sweden

[*]**Corresponding author:** Lennart Hardell, Department of Oncology, Orebro University Hospital, Sweden (retired), The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden

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Abstract

In this case, report two previously healthy persons, a man aged 63 years and a woman aged 62 years, developed symptoms of the microwave syndrome after installation of a 5G base station for wireless communication on the roof above their apartment. A base station for previous telecommunication generation technology (3G/4G) was present at the same spot since several years. Very high radiofrequency (RF) radiation with maximum (highest measured peak value) levels of 354 000, 1 690 000, and >2 500 000 μW/m^2 were measured at three occasions in the bedroom located only 5 meters below the new 5G base station, compared to maximum (peak) 9 000 μW/m^2 prior to the 5G deployment. The rapidly emerging symptoms after the 5G deployment were typical for the microwave syndrome with e.g., neurological symptoms, tinnitus, fatigue, insomnia, emotional distress, skin disorders, and blood pressure variability. The symptoms were more pronounced in the woman. Due to the severity of symptoms, the couple left their dwelling and moved to a small office room with maximum (peak) RF radiation 3 500 μW/m^2. Within a couple of days, most of their symptoms alleviated or disappeared completely. This medical history can be regarded as a classic provocation test. The RF radiation levels in the apartment were well below the limit proposed to be "safe" below which no health effects would occur, recommended by the International Commission on Non-Ionizing Radiation (ICNIRP). These now presented symptoms of the microwave syndrome were caused by non-thermal effects from RF radiation and highlight that the ICNIRP guidelines used in most countries including Sweden do not protect human health. Guidelines based on all biological negative effects from RF radiation are urgently needed, as well as monitoring human health, not the least due to rapidly increasing levels of exposure.

Keywords: Base station; 5G; Radiofrequency radiation; Electromagnetic hypersensitivity; Microwave syndrome; Health

Introduction

In recent years, human exposure to pulse-modulated microwave radiation [also called radiofrequency (RF) radiation] from wireless technology has increased exponentially. Microwaves are frequencies in the range of 300 MHz to 300 GHz within the radiofrequency (RF) spectrum [1]. The increase is mainly a result of the expansion of 4G+ and 5G as well as an increased amount of consumer products based on technologies that emit microwave radiation.

In parallel with this exploding RF radiation exposure, regulations and so-called safety limits applicable to the permitted RF radiation in most countries are based on a severely outdated approach from the 1950s. These 'safety" limits (or guidelines) only protect people against harmful effects that occur as a result of acute heating, also called thermal effects. These occur when

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Physiological effects of millimeter-waves on skin and skin cells: an overview of the to-date published studies

Dariusz Leszczynski [1]

Affiliations
PMID: 32829319 DOI: 10.1515/reveh-2020-0056

Abstract

The currently ongoing deployment if the fifth generation of the wireless communication technology, the 5G technology, has reignited the health debate around the new kind of radiation that will be used/emitted by the 5G devices and networks - the millimeter-waves. The new aspect of the 5G technology, that is of concern to some of the future users, is that both, antennas and devices will be continuously in a very close proximity of the users' bodies. Skin is the only organ of the human body, besides the eyes, that will be directly exposed to the mm-waves of the 5G technology. However, the whole scientific evidence on the possible effects of millimeter-waves on skin and skin cells, currently consists of only some 99 studies. This clearly indicates that the scientific evidence concerning the possible effects of millimeter-waves on humans is insufficient to devise science-based exposure limits and to develop science-based human health policies. The sufficient research has not been done and, therefore, precautionary measures should be considered for the deployment of the 5G, before the sufficient number of quality research studies will be executed and health risk, or lack of it, scientifically established.

Keywords: 5G technology; limited deployment; millimeter-waves; precautionary approach; skin.

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EXPERIMENTAL BIOLOGY

Status of the Neuroendocrine System in Animals Chronically Exposed to Electromagnetic Fields of 5G Mobile Network Base Stations

S. Yu. Perov, N. B. Rubtsova, and O. V. Belaya

Translated from Byulleten' Eksperimental'noi Biologii i Meditsiny, Vol. 174, No. 8, pp. 249-252, August, 2022
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We studied the biological effect of chronic exposure to multifrequency electromagnetic fields simulating the effects of 5G NR/IMT-2020 mobile communication systems. Male Wistar rats were exposed to 24-h radiation (250 μW/cm^2) for 4 months. The exploratory activity of the animals and blood concentrations of ACTH and corticosterone were evaluated at the end of each month of exposure and 1 month after exposure. The results suggest that exposure to multifrequency electromagnetic field simulating the effects of 5G systems affected functional activity of the hypothalamus–pituitary–adrenal axis and was stressful in nature.

Key Words: electromagnetic field; neuroendocrine system; adrenocorticotropic hormone; corticosterone; 5G mobile communication systems

Anthropogenic radiofrequency electromagnetic fields (EMF) mainly generated by mobile communications base stations are an essential environmental factor. Many citizens are exposed by multifrequency EMF, a complex mixture of signals of different intensity, and this is the rule rather than the exception [1,2]. The problem of possible general effects of EMF of promising 5G NR/IMT-2020 standard base stations with level exceeding of national hygienic norms on the population has not yet been discussed in our country [3,4].

Single foreign epidemiological studies revealed no adverse effects associated with 5G systems EMF exposure on human health [5,6]. However, it should be accepted that experimental data on biological effects of EMF from 5G communication systems in available literature are more than limited, and the studies are fragmentary and do not cover the whole range of operation standards from units to tens of GHz [7]. All this shows the necessity of experimental study of possible adverse effects of 5G communication systems EMF, especially biological effects of long-term multifrequency exposure, on human health [8].

There are practically no published reports about the biological effect of EMF at ranges and generation modes corresponding to 5G NR/IMT-2020 standards on experimental animals. The latter necessitates experimental studies on animals for evaluation of the biological effects of EMF generated by 5G systems with levels that can be comparable to the possible threshold of adverse effects on humans. From this point of view, it is interesting to study CNS reactions to EMF exposure, which can cause changes in functional activity of the hypothalamic–pituitary system of animals [9-11].

The aim of this study was experimental evaluation of biological effect chronic exposure to EMF simulating the real 5G NR/IMT-2020 mobile communication systems base stations.

N. F. Izmerov Research Institute of Occupational Health, Moscow, Russia. ***Address for correspondence:*** perov@irioh.ru. S. Yu. Perov

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Review Article

Lennart Hardell* and Tarmo Koppel

Electromagnetic hypersensitivity close to mobile phone base stations – a case study in Stockholm, Sweden

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Abstract: A previously healthy worker developed symptoms assigned to electromagnetic hypersensitivity (EHS) after moving to an office with exposure to high levels of anthropogenic electromagnetic fields (EMFs). These symptoms consisted of e.g. headache, arthralgia, tinnitus, dizziness, memory loss, fatique, insomnia, transitory cardiovascular abnormalities, and skin lesions. Most of the symptoms were alleviated after 2 weeks sick leave. The highest radiofrequency (RF) field level at the working place was 1.72 V/m (7,852 μW/m^2). Maximum value for extremely low frequency electromagnetic field (ELF-EMF) from electric power at 50 Hz was measured to 285 nT (mean 241 nT). For electric train ELF-EMF at 16.7 Hz was measured to 383 nT (mean 76 nT). Exposure to EMFs at the working place could be the cause for developing EHS related symptoms. The association was strengthened by the symptom reduction outside the working place.

Keywords: electromagnetic hypersensitivity; EMF; radiofrequency radiation; symptoms.

Introduction

Exposure to extremely low frequency (ELF) electromagnetic fields (EMF) and radiofrequency (RF) EMF is in most cases involuntary and unknown to people. Both ELF-EMF and RF-EMF have been evaluated by IARC to be possible human carcinogens, Group 2B [1–3]. In fact EMFs should be regarded to be environmental pollutants that do not smell, have no taste and are invisible.

***Corresponding author: Lennart Hardell,** The Environment and Cancer Research Foundation, Studievägen 35, SE-702 17, Örebro, Sweden, E-mail: lennart.hardell@environmentandcancer.com
Tarmo Koppel, Tallinn University of Technology, Tallinn, Estonia, E-mail: tarmo.koppel@taltech.ee

Already in the 1970s the 'microwave syndrome' was described in the former Soviet Union [4]. Persons working with radar or radio equipment reported symptoms of fatigue, headache, dizziness, disturbed sleep, concentration and memory problems.

In the 1980s similar symptoms were reported among Swedish persons working in front of cathode ray tube monitors [5]. In Finns such symptoms were attributed to exposure to EMF [6]. This syndrome was termed electromagnetic hypersensitivity (EHS), although still without an International Classification of Diseases (ICD-code) [7].

EHS consists of a wide range of different symptoms that may vary from person to person. EMF sensitivity varies among individuals from mild to severe. The prevalence has been reported to be 1.5% in Sweden [8], 3.2% in California [9], 5% in Switzerland [10], and 13% in Taiwan [11].

We report here on a person who developed symptoms consistent with those described among EHS subjects. The symptoms developed at a work place with exposure to EMFs. Our hypothesis is that the symptoms may be attributed to that exposure. We obtained informed consent by the person to publish the symptoms and work history anonymously.

Methods

The subject attributed the development of EHS symptoms to her office room where she had been working one year since April 2018 for a total of 183 working days. As the source of the adverse health effects was unknown, the investigators devised a broad spectrum approach for EMF measurements, to include all possible sources of EMFs.

The room was thoroughly measured encompassing different types of electromagnetic fields, including:

- Extremely low frequency (ELF) magnetic field (MF)
- Intermediate frequency (IF) magnetic field (MF)
- Radiofrequency (RF) electromagnetic field.

Three types of measurements approaches were utilized characterizing:

- Spatial field distribution
- Temporal field dynamics
- Spectrum analysis of EMF

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T. Wu, T. S. Rappaport, C. M. Collins, "The Human Body and Millimeter-Wave Wireless Communication Systems: Interactions and Implications," accepted in *2015 IEEE International Conference on Communications (ICC)*, Jun. 2015.

The Human Body and Millimeter-Wave Wireless Communication Systems: Interactions and Implications

Ting Wu[1,2], Theodore S. Rappaport[1,2,3], Christopher M. Collins[1,3]
[1]NYU WIRELESS, [2]NYU Polytechnic School of Engineering, Brooklyn, NY 11201
[3]NYU Department of Radiology, 660 First Ave, New York, NY 10016
ting.wu@nyu.edu, tsr@nyu.edu, c.collins@nyumc.org

***Abstract*—With increasing interest in millimeter-wave wireless communications, investigations on interactions between the human body and millimeter-wave devices are becoming important. This paper gives examples of today's regulatory requirements, and provides an example for a 60 GHz transceiver. Also, the propagation characteristics of millimeter-waves in the presence of the human body are studied, and four models representing different body parts are considered to evaluate thermal effects of millimeter-wave radiation on the body. Simulation results show that about 34% to 42% of the incident power is reflected at the skin surface at 60 GHz. This paper shows that power density is not suitable to determine exposure compliance when millimeter wave devices are used very close to the body. A temperature-based technique for the evaluation of safety compliance is proposed in this paper.**

***Index Terms*—body area networks (BAN), radiation, health effects, millimeter-wave, mmWave heating, RF exposure.**

I. Introduction

THE millimeter-wave (mmWave) band is part of the radio frequency (RF) spectrum, comprised of frequencies between 30 GHz and 300 GHz, corresponding to a wavelength range of 10 to 1 mm. The photon energy of mmWaves ranges from 0.1 to 1.2 milli-electron volts (meV). Unlike ultraviolet, X-ray, and gamma radiation, mmWave radiation is non-ionizing, and the main safety concern is heating of the eyes and skin caused by the absorption of mmWave energy in the human body [1][2][3]. The massive amount of raw bandwidth and potential multi-Gigabit-per-second (Gbps) data rates in the mmWave band make it a promising candidate for future broadband mobile communication networks [3][4]. The increasing investigations on mmWave applications and technologies, particularly on wireless devices, have stimulated interest in understanding how propagation of mmWaves impact the human body, as well as the inquiry of potential health effects related to mmWave exposures.

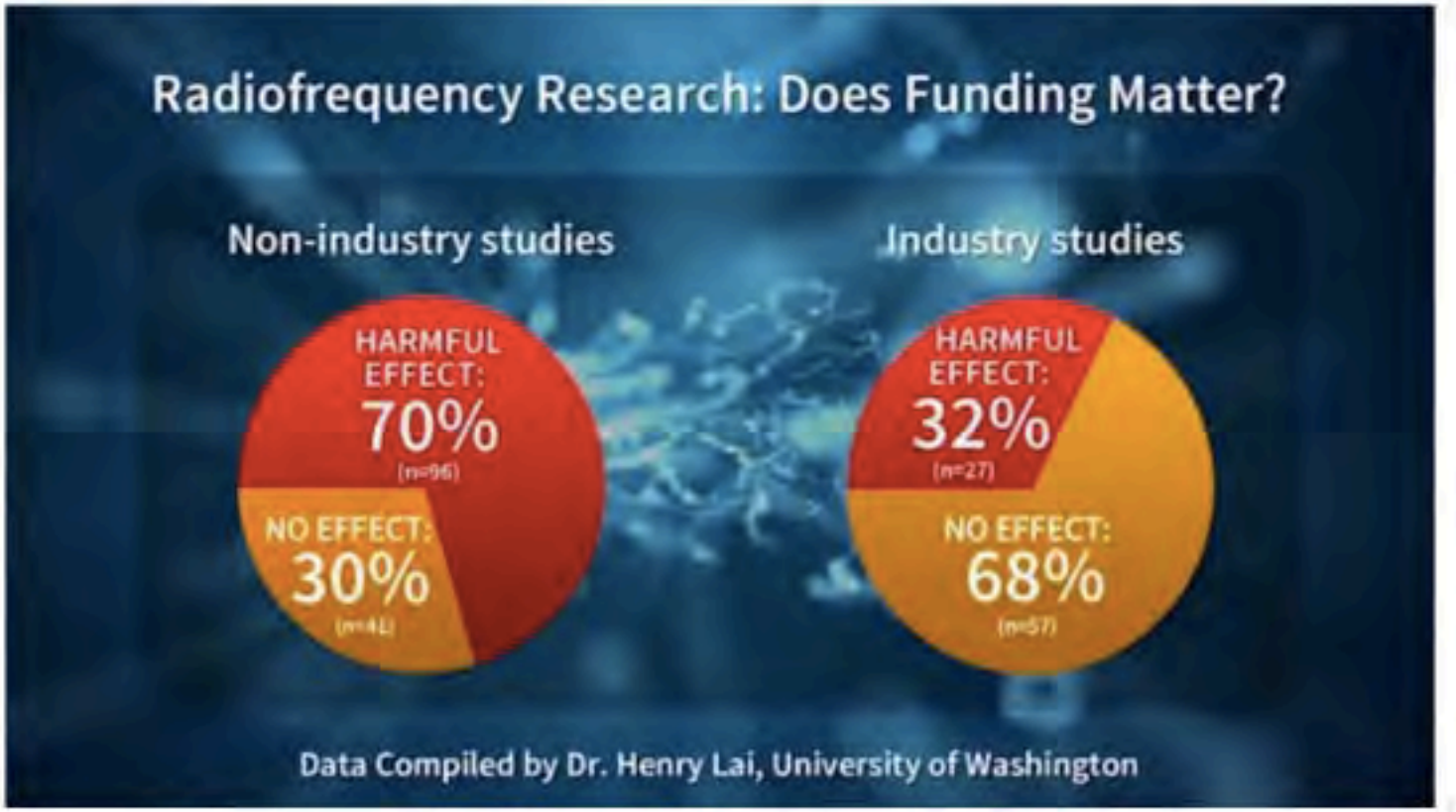
MmWave devices should be evaluated to comply with government exposure guidelines before they are introduced to the consumer market. At frequencies below 6 GHz for the Federal Communications Commission (FCC) or 10 GHz for the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the specific absorption rate (SAR) is used as a metric for exposure compliance determination. However, at higher frequencies, energy absorption is increasingly confined to the surface layers of the skin, and it is difficult to define a meaningful volume for SAR evaluation. Thus, power density (PD), rather than SAR, is currently preferred in determining compliance at above 6 GHz (FCC) or 10 GHz (ICNIRP) [1][2][3].

The ICNIRP specifies basic restrictions on PD to be 10 W/m^2 and 50 W/m^2 for the general public, and the occupational group, respectively, for frequencies between 10 and 300 GHz [1]. The limit values are to be averaged over any 20 cm^2 of exposed area and any $68/f^{1.05}$ minutes period (where f is in GHz), while the spatial peak power densities averaged over 1 cm^2 should not exceed 20 times the given limits, which are 200 W/m^2 and 1000 W/m^2, respectively.

The FCC adopts maximum permissible exposure (MPE) in terms of PD for frequencies between 6 and 100 GHz [5]. The numerical values of the FCC PD restrictions are also 10 W/m^2 and 50 W/m^2 for the general public, and occupational group, respectively, while the exposure area to be averaged for the FCC is equivalent to the vertical cross section of the human body (projected area) at a distance no closer than 20 cm from the field source. The averaging time is 6 minutes for occupational exposures, and 30 minutes for general population exposures.

Regarding localized peak power density, FCC OET Bulletin No.65 [6] states that "although the FCC did not explicitly adopt limits for peak power density, guidance on these types of exposure can be found in Section 4.4 of the ANSI/IEEE C95.1-1992 standard." The ANSI/IEEE C95.1-1992 standard specifies relaxation of PD limits for exposure of all parts of the body except the eyes and the testes [7]. For frequencies between 3 and 15 GHz, the averaging time is $90{,}000/f$ (where f is in MHz), and for frequencies between 15 and 300 GHz, the appropriate averaging time is $616{,}000/f^{1.2}$ minutes (where f is in MHz). For occupational/controlled exposures, the peak power density

Independent Studies vs. Industry Funded Research.



Most non-industry funded studies report harmful effects from RF radiation.

On the other hand, most industry-funded research doesn't report any effects.

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Propagation of THz irradiation energy through aqueous layers: Demolition of actin filaments in living cells

Shota Yamazaki[1]✉, Masahiko Harata[2], Yuya Ueno[2], Masaaki Tsubouchi[3], Keiji Konagaya[4], Yuichi Ogawa[4], Goro Isoyama[5], Chiko Otani[1] & Hiromichi Hoshina[1]✉

The effect of terahertz (THz) radiation on deep tissues of human body has been considered negligible due to strong absorption by water molecules. However, we observed that the energy of THz pulses transmits a millimeter thick in the aqueous solution, possibly as a shockwave, and demolishes actin filaments. Collapse of actin filament induced by THz irradiation was also observed in the living cells under an aqueous medium. We also confirmed that the viability of the cell was not affected under the exposure of THz pulses. The potential of THz waves as an invasive method to alter protein structure in the living cells is demonstrated.

Due to the development of terahertz (THz) light sources, industrial and medical applications have been proposed in this decades. Also, toxicity of THz radiation for human health has attracted keen interest among researchers working in this frequency region[1]. Two projects, the European THz-BRIDGE and the International EMF project in the SCENIHR[2], summarize recent studies about THz radiation effects for human body. For example, non-thermal impacts on DNA stability[3–5] was induced by THz wave, which could cause chromosomal aberrations in human lymphocytes[6]. The transcriptional activation of wound-responsive genes in mouse skin[7] and DNA damage in an artific al human 3D skin tissue model[8] have also been demonstrated. Most of those studies focus on epithelial and corneal cell lines, because THz photons are totally absorbed at the surface of the tissues due to the intense absorbance of liquid water in this frequency region.

However, if the THz radiation is converted to the other type of energy fl w which can propagate into water, irradiation of THz wave may cause damage inside the tissues. In fact, the THz photon energy is once absorbed on the body surface, and converted to the thermal and mechanical energies. We recently observed that THz pulses generate shockwaves at the surface of liquid water[9]. The generated shockwaves propagate several millimeters in depth. Similar phenomena may occur at the human body. The THz-induced shockwaves may induce mechanical stress to the biomolecules and change their morphology. Such indirect effects of the THz irradiation have not been investigated.

To reveal the effect of THz-induced shockwaves to the biological molecules, we focused on morphology of the actin proteins. Actin has two functional forms, monomeric globular (G)-actin and polymerized filamentous (F)-actin. The actin filament forms the elaborate cytoskeleton network, which plays crucial roles in cell shape, motility, and division[10]. One advantage of using actin is that we can easily obtain enough purifi d G-actin from tissues[11] to reconstruct polymerization reactions *in vitro*. Actin filaments can be directly observed by fluorescence microscopy by staining with silicon-rhodamine (SiR)-actin[12]. Because actin has pivotal roles in normal and pathological cell function, including transcriptional regulation, DNA repair, cancer cell metastasis, and gene reprogramming[13–16], various chemical compounds and regulatory proteins have been analyzed for research and therapeutic purposes[17]. In this study, we investigated the effect of THz-induced shockwaves on actin filaments

[1]RIKEN, Center for Advanced Photonics, 519-1399 Aramaki-Aoba, Aoba-ku, Sendai, Miyagi, 980-0845, Japan. [2]Laboratory of Molecular Biology, Graduate School of Agricultural Science, Tohoku University, 468-1 Aramaki-Aoba, Aoba-ku, Sendai, Miyagi, 980-0845, Japan. [3]Kansai Photon Science Institute, National Institutes for Quantum and Radiological Science and Technology, Kyoto, 619-0215, Japan. [4]Department of Physics, Graduate School of Science, Kyoto University, Kitashirakawa-oiwakecho, Sakyo-ku, Kyoto, 606-8502, Japan. [5]Institute of Scientific and Industrial Research, Osaka University, 8-1 Mihogaoka, Ibaraki, Osaka, 567-0047, Japan. ✉e-mail: shota.yamazaki.fc@riken.jp; hoshina@riken.jp

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Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102)☆

Anthony B. Miller[a,*], L. Lloyd Morgan[b], Iris Udasin[c], Devra Lee Davis[d,e]

[a] Dalla Lana School of Public Health, University of Toronto, Canada
[b] Environmental Health Trust, Berkeley, CA, United States
[c] Rutgers University School of Public Health, United States
[d] Environmental Health Trust, Teton Village, WY, United States
[e] Hebrew University of Jerusalem, Israel

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ABSTRACT

Epidemiology studies (case-control, cohort, time trend and case studies) published since the International Agency for Research on Cancer (IARC) 2011 categorization of radiofrequency radiation (RFR) from mobile phones and other wireless devices as a possible human carcinogen (Group 2B) are reviewed and summarized. Glioma is an important human cancer found to be associated with RFR in 9 case-control studies conducted in Sweden and France, as well as in some other countries. Increasing glioma incidence trends have been reported in the UK and other countries. Non-malignant endpoints linked include acoustic neuroma (vestibular Schwannoma) and meningioma. Because they allow more detailed consideration of exposure, case-control studies can be superior to cohort studies or other methods in evaluating potential risks for brain cancer. When considered with recent animal experimental evidence, the recent epidemiological studies strengthen and support the conclusion that RFR should be categorized as carcinogenic to humans (IARC Group 1). Opportunistic epidemiological studies are proposed that can be carried out through cross-sectional analyses of high, medium, and low mobile phone users with respect to hearing, vision, memory, reaction time, and other indicators that can easily be assessed through standardized computer-based tests. As exposure data are not uniformly available, billing records should be used whenever available to corroborate reported exposures.

1. Introduction

With rapidly increasing applications for wireless devices targeting populations of all ages, exposures to the associated radiofrequency radiation (RFR) are increasing in number and diversity. Radiation sources include communications devices such as mobile (cell) or cordless phones, laptops and tablets, baby monitors, wearable devices and associated infrastructure (e.g. routers, antennae on towers, and distributed antennae systems (DAS) that can employ directional couplers or wireless amplifiers to enhance accessibility). Thus, the technology entails direct and growing personal exposures to an expanding array of wireless transmitting devices (WTDs).

In 2011, a Working Group of the World Health Organization's International Agency for Research on Cancer (IARC) classified RFR as a possible human carcinogen (Group 2B) (IARC, 2013). In this paper we review the human epidemiology and some other relevant studies published since the IARC Working Group meeting.

1.1. Wireless phone types

The principal sources of exposure of humans to RFR are cell and cordless phones. The radiated power and technologies for cell phones have evolved over the years, as summarized in Table 1 (Hardell and Carlberg, 2015).

2. Case-control studies; glioma

Aydin et al. (2011) reported the results of CEFALO, a multicenter

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* Corresponding author.
E-mail addresses: ab.miller@utoronto.ca (A.B. Miller), lloyd.l.morgan@gmail.com (L.L. Morgan), iu22@eohsi.rutgers.edu (I. Udasin), ddavis@ehtrust.org (D.L. Davis).

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Human-made electromagnetic fields: Ion forced-oscillation and voltage-gated ion channel dysfunction, oxidative stress and DNA damage (Review)

DIMITRIS J. PANAGOPOULOS[1-3], ANDREAS KARABARBOUNIS[4], IGOR YAKYMENKO[5,6] and GEORGE P. CHROUSOS[2]

[1]Laboratory of Health Physics, Radiobiology and Cytogenetics, Institute of Nuclear and Radiological Sciences and Technology, Energy and Safety, National Center for Scientific Research 'Demokritos', 15310 Athens; [2]Choremeion Research Laboratory, Medical School, National and Kapodistrian University of Athens, 11527 Athens; [3]Electromagnetic Field-Biophysics Research Laboratory, 10681 Athens; [4]Department of Physics, Section of Nuclear and Particle Physics, National and Kapodistrian University of Athens, 15784 Athens, Greece; [5]Institute of Experimental Pathology, Oncology and Radiobiology of National Academy of Science of Ukraine, 03022 Kyiv; [6]Department of Public Health, Kyiv Medical University, 02000 Kyiv, Ukraine

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Abstract. Exposure of animals/biological samples to human-made electromagnetic fields (EMFs), especially in the extremely low frequency (ELF) band, and the microwave/radio frequency (RF) band which is always combined with ELF, may lead to DNA damage. DNA damage is connected with cell death, infertility and other pathologies, including cancer. ELF exposure from high-voltage power lines and complex RF exposure from wireless communication antennas/devices are linked to increased cancer risk. Almost all human-made RF EMFs include ELF components in the form of modulation, pulsing and random variability. Thus, in addition to polarization and coherence, the existence of ELFs is a common feature of almost all human-made EMFs. The present study reviews the DNA damage and related effects induced by human-made EMFs. The ion forced-oscillation mechanism for irregular gating of voltage-gated ion channels on cell membranes by polarized/coherent EMFs is extensively described. Dysfunction of ion channels disrupts intracellular ionic concentrations, which determine the cell's electrochemical balance and homeostasis. The present study shows how this can result in DNA damage through reactive oxygen species/free radical overproduction. Thus, a complete picture is provided of how human-made EMF exposure may indeed lead to DNA damage and related pathologies, including cancer. Moreover, it is suggested that the non-thermal biological effects attributed to RF EMFs are actually due to their ELF components.

Correspondence to: Dr Dimitris J. Panagopoulos, Laboratory of Health Physics, Radiobiology and Cytogenetics, Institute of Nuclear and Radiological Sciences and Technology, Energy and Safety, National Center for Scientific Research 'Demokritos', Patr. Grigoriou E' and 27 Neapoleos Street, Agia Paraskevi, 15310 Athens, Greece
E-mail: dpanagop@biol.uoa.gr

Abbreviations: DECT, digitally enhanced cordless telecommunications; ELF, extremely low frequency; EMF, electromagnetic field; MT, mobile telephony; OS, oxidative stress; RF, radio frequency; ROS, reactive oxygen species; ULF, ultra low frequency; VGICs, voltage-gated ion channels; VGCCs, voltage-gated calcium channels; WC, wireless communications; Wi-Fi, wireless fidelity; 2G/3G/4G/5G, second/third/fourth/fifth-generation of mobile telephony

Key words: EMF, ion forced-oscillation, VGICs, free radicals, OS, ROS, DNA damage, cancer

Contents

1. Introduction
2. Biophysical action of polarized/coherent EMFs resulting in voltage-gated ion channel (VGIC) dysfunction and disruption of cell electrochemical balance
3. Biochemical processes activated by irregular gating of VGICs, leading to DNA damage
4. Discussion

1. Introduction

Experimental and epidemiological findings connecting exposure of living organisms to ELF and complex RF human-made EMFs with genetic damage, infertility and cancer. There is a plethora of experimental findings connecting the *in vivo* or *in vitro* exposure of experimental animals or cells to extremely low frequency (ELF) (3-3000 Hz) or radio-frequency (RF)/microwave (300 kHz-300 GHz) electromagnetic fields (EMFs), with genetic damage/alterations

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5 G wireless telecommunications expansion: Public health and environmental implications☆

Cindy L. Russell

PO Box 7443, Menlo Park, CA 94026, USA

ARTICLE INFO

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ABSTRACT

The popularity, widespread use and increasing dependency on wireless technologies has spawned a telecommunications industrial revolution with increasing public exposure to broader and higher frequencies of the electromagnetic spectrum to transmit data through a variety of devices and infrastructure. On the horizon, a new generation of even shorter high frequency 5G wavelengths is being proposed to power the Internet of Things (IoT). The IoT promises us convenient and easy lifestyles with a massive 5G interconnected telecommunications network, however, the expansion of broadband with shorter wavelength radiofrequency radiation highlights the concern that health and safety issues remain unknown. Controversy continues with regards to harm from current 2G, 3G and 4G wireless technologies. 5G technologies are far less studied for human or environmental effects.

It is argued that the addition of this added high frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives.

Radiofrequency radiation (RF) is increasingly being recognized as a new form of environmental pollution. Like other common toxic exposures, the effects of radiofrequency electromagnetic radiation (RF EMR) will be problematic if not impossible to sort out epidemiologically as there no longer remains an unexposed control group. This is especially important considering these effects are likely magnified by synergistic toxic exposures and other common health risk behaviors. Effects can also be non-linear. Because this is the first generation to have cradle-to-grave lifespan exposure to this level of man-made microwave (RF EMR) radiofrequencies, it will be years or decades before the true health consequences are known. Precaution in the roll out of this new technology is strongly indicated.

This article will review relevant electromagnetic frequencies, exposure standards and current scientific literature on the health implications of 2G, 3G, 4G exposure, including some of the available literature on 5G frequencies. The question of what constitutes a public health issue will be raised, as well as the need for a precautionary approach in advancing new wireless technologies.

1. Introduction

The adoption of new 5G technology promises to give the public a transformative communication network with an explosion of speed, volume of data and number of devices with unlimited computing instantly to anyone in the world. High tech companies are already marketing the Internet of Things to businesses, healthcare systems, schools and the public. The promise to connect our phones and appliances, will virtually eliminate many day-to-day household and business functions including driving. This will, according to industry, create a superior, connected society and unprecedented economic growth. What is missing in this discussion is the maturing literature on adverse biological, physiological, and psychological health effects of the 2G, 3G, and 4G radiofrequencies we are already exposed to, in addition to indications from the scientific literature that 5G frequencies could also be hazardous.

Many important but unanswered questions merit serious consideration. Is the widespread deployment of this pervasive higher frequency small cell distributed antennae system in our cities and on our homes safe for humans and the environment? Will it add to the burden of chronic disease that costs our nation, according to the CDC, an estimated 2.3 trillion dollars annually (CDC, 2017)? Are we already digitally over connected, shrinking our gray matter and becoming a dysfunctional addicted nation because of it (Weng et al., 2012)? How

☆ The author has read and approved the paper and it has not been published previously nor is it being considered by any other peer-reviewed journal. The author has no conflicts of interest. There was no financial support for the research, design, analysis, interpretation or writing of this article nor for the decision to publish this article.

E-mail address: cindyleerussell@gmail.com.

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Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission

L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservisi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Strollo, A. Vornoli, F. Belpoggi*

Cesare Maltoni Cancer Research Center, Ramazzini Institute, Castello di Bentivoglio, via Saliceto 3, Bentivoglio, 40010 Bologna, Italy

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ABSTRACT

Background: In 2011, IARC classified radiofrequency radiation (RFR) as possible human carcinogen (Group 2B). According to IARC, animals studies, as well as epidemiological ones, showed limited evidence of carcinogenicity. In 2016, the NTP published the first results of its long-term bioassays on near field RFR, reporting increased incidence of malignant glial tumors of the brain and heart Schwannoma in rats exposed to GSM – and CDMA – modulated cell phone RFR. The tumors observed in the NTP study are of the type similar to the ones observed in some epidemiological studies of cell phone users.

Objectives: The Ramazzini Institute (RI) performed a life-span carcinogenic study on Sprague-Dawley rats to evaluate the carcinogenic effects of RFR in the situation of far field, reproducing the environmental exposure to RFR generated by 1.8 GHz GSM antenna of the radio base stations of mobile phone. This is the largest long-term study ever performed in rats on the health effects of RFR, including 2448 animals. In this article, we reported the final results regarding brain and heart tumors.

Methods: Male and female Sprague-Dawley rats were exposed from prenatal life until natural death to a 1.8 GHz GSM far field of 0, 5, 25, 50 V/m with a whole-body exposure for 19 h/day.

Results: A statistically significant increase in the incidence of heart Schwannomas was observed in treated male rats at the highest dose (50 V/m). Furthermore, an increase in the incidence of heart Schwann cells hyperplasia was observed in treated male and female rats at the highest dose (50 V/m), although this was not statistically significant. An increase in the incidence of malignant glial tumors was observed in treated female rats at the highest dose (50 V/m), although not statistically significant.

Conclusions: The RI findings on far field exposure to RFR are consistent with and reinforce the results of the NTP study on near field exposure, as both reported an increase in the incidence of tumors of the brain and heart in RFR-exposed Sprague-Dawley rats. These tumors are of the same histotype of those observed in some epidemiological studies on cell phone users. These experimental studies provide sufficient evidence to call for the re-evaluation of IARC conclusions regarding the carcinogenic potential of RFR in humans.

1. Introduction

Early warnings on the potential carcinogenic risks of mobile phone radiofrequency radiation (RFR) raised in the early 2000 when, for the first time, it was published that people using mobile phones had a significant increased risk to develop vestibular Schwannoma and brain tumors (Hardell et al., 2003, 2002). In 2011, the International Agency for Research on Cancer (IARC) classified RFR as possible human carcinogen (Group 2B) based on limited evidence both in humans and experimental animals (Baan et al., 2011; IARC, 2013). Two epidemiological case-control studies resulted more informative for the IARC evaluation, showing that the risk to develop brain tumors and vestibular Schwannoma was increased in people with the highest cumulative use of mobile phones, in people who had used mobile phones on the

* Corresponding author.
E-mail address: belpoggif@ramazzini.it (F. Belpoggi).

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Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations

Zothansiama, Mary Zosangzuali, Miriam Lalramdinpuii, and Ganesh Chandra Jagetia

Department of Zoology, Cancer and Radiation Biology Laboratory, Mizoram University, Aizawl, Mizoram, India

ABSTRACT

Radiofrequency radiations (RFRs) emitted by mobile phone base stations have raised concerns on its adverse impact on humans residing in the vicinity of mobile phone base stations. Therefore, the present study was envisaged to evaluate the effect of RFR on the DNA damage and antioxidant status in cultured human peripheral blood lymphocytes (HPBLs) of individuals residing in the vicinity of mobile phone base stations and comparing it with healthy controls. The study groups matched for various demographic data including age, gender, dietary pattern, smoking habit, alcohol consumption, duration of mobile phone use and average daily mobile phone use. The RF power density of the exposed individuals was significantly higher ($p < 0.0001$) when compared to the control group. The HPBLs were cultured and the DNA damage was assessed by cytokinesis blocked micronucleus (MN) assay in the binucleate lymphocytes. The analyses of data from the exposed group ($n = 40$), residing within a perimeter of 80 m of mobile base stations, showed significantly ($p < 0.0001$) higher frequency of micronuclei when compared to the control group, residing 300 m away from the mobile base station/s. The analysis of various antioxidants in the plasma of exposed individuals revealed a significant attrition in glutathione (GSH) concentration ($p < 0.01$), activities of catalase (CAT) ($p < 0.001$) and superoxide dismutase (SOD) ($p < 0.001$) and rise in lipid peroxidation (LOO) when compared to controls. Multiple linear regression analyses revealed a significant association among reduced GSH concentration ($p < 0.05$), CAT ($p < 0.001$) and SOD ($p < 0.001$) activities and elevated MN frequency ($p < 0.001$) and LOO ($p < 0.001$) with increasing RF power density.

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Introduction

The mobile phone base stations are one of the essential parts of mobile telecommunication as they transmit the signals in the form of radiofrequency radiations (RFRs) that are received by the mobile phones, acting as a two-way radio, i.e. transceiver (Kwan-Hoong, 2005), generally operating in the frequency range of 900 MHz to 1.9 GHz (Levitt and Lai, 2010). The ever-increasing subscription of mobile phones has led to a phenomenal increase in the mobile phone base stations required to cater to the needs of increasing demand of the mobile subscribers. For decades, there has been an increasing concern on the possible adverse effects of RFR on humans living near mobile phone base stations despite the fact that RFR spectrum are of low frequency (ARPANSA, 2011). There has been a link between the RFR exposures and several human health disorders including cancer, diabetes, cardiovascular and neurological diseases (Bortkiewicz et al., 2004; Eger et al., 2004; Havas, 2013; Lerchl et al., 2015; Wolf and Wolf, 2004). The International Agency for Research on Cancer (IARC, 2011) has classified RFR as a possible carcinogen to humans (group 2B), based on the increased risk for glioma, a malignant type of brain cancer associated with wireless phone use (Hardell et al., 2013).

RFR may change the fidelity of DNA as the increased incidence of cancer has been reported among those residing near mobile phone base stations (Abdel-Rassonl et al., 2007; Bortkiewicz et al., 2004; Cherry, 2000; Eger et al., 2004; Hardell et al., 1999; Hutter et al., 2006; Wolf and Wolf, 2004). RFR emitted from mobile base stations is also reported to increase the DNA strand breaks in lymphocytes of mobile phone users and individuals residing in the vicinity of a mobile base station/s (Gandhi and Anita, 2005; Gandhi et al., 2014). Exposure of human fibroblasts and rat granulosa cells to RFR (1800 MHz, SAR 1.2 or 2 W/kg) has been reported to induce DNA single- and double-strands breaks (Diem et al., 2005). Irreversible DNA damage was also reported in cultured human lens epithelial cells exposed to microwave generated by mobile phones (Sun et al., 2006). The adverse health effects of RFR are still debatable as many studies indicated above have found a positive correlation between the DNA

CONTACT Ganesh Chandra Jagetia gc.jagetia@gmail.com Department of Zoology, Mizoram University, Aizawl 796 004, Mizoram, India.
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Exposure to RF EMF From Array Antennas in 5G Mobile Communication Equipment

BJÖRN THORS[1], DAVIDE COLOMBI[1], ZHINONG YING[2], (Senior Member, IEEE), THOMAS BOLIN[2], AND CHRISTER TÖRNEVIK[1], (Member, IEEE)

[1]Ericsson Research, Ericsson AB, SE-16480 Stockholm, Sweden
[2]Network Technology Laboratory, Research and Technology, Sony Mobile Communications AB, SE-221 88 Lund, Sweden

Corresponding author: B. Thors (bjorn.thors@ericsson.com)

ABSTRACT In this paper, radio-frequency (RF) electromagnetic field (EMF) exposure evaluations are conducted in the frequency range 10–60 GHz for array antennas intended for user equipment (UE) and low-power radio base stations in 5G mobile communication systems. A systematic study based on numerical power density simulations considering effects of frequency, array size, array topology, distance to exposed part of human body, and beam steering range is presented whereby the maximum transmitted power to comply with RF EMF exposure limits specified by the International Commission on Non-Ionizing Radiation Protection, the US Federal Communications Commission, and the Institute of Electrical and Electronics Engineers is determined. The maximum transmitted power is related to the maximum equivalent isotropically radiated power to highlight the relevance of the output power restrictions for a communication channel. A comparison between the simulation and measurement data is provided for a canonical monopole antenna. For small distances, with the antennas transmitting directly toward the human body, it is found that the maximum transmitted power is significantly below the UE power levels used in existing third and fourth generation mobile communication systems. Results for other conceivable exposure scenarios based on technical solutions that could allow for larger output power levels are also discussed. The obtained results constitute valuable information for the design of future mobile communication systems and for the standardization of EMF compliance assessment procedures of 5G devices and equipment.

INDEX TERMS 5G mobile communication, antenna arrays, beam steering, mobile device, mobile user equipment, radio base station, RF EMF exposure.

I. INTRODUCTION

The total amount of mobile traffic is expected to increase dramatically in the coming years [1]. The next generation of wireless access systems (5G), set for commercial availability around 2020 [2], is expected to constitute a key enabler for the larger system capacity and higher data rates of the future. Various research activities are currently ongoing to lay the foundation for this new technology, see e.g. [3], [4], which apart from mobile broadband will involve a range of different use cases and challenging requirements on latency, security, reliability, availability, energy performance, and device cost [5]. In terms of spectrum, 5G systems will need to be able to operate over a very wide frequency range from below 1 GHz up to and including millimeter wave (mmW) frequencies [1]. The available spectrum above 10 GHz will be a key component to fulfill long-term traffic demands and to enable the very wide transmission bandwidths needed to provide the desired multi-Gbps data rates in an efficient manner [5].

Products emitting radio-frequency (RF) electromagnetic fields (EMF) need to be designed and tested to comply with relevant regulatory requirements and limits on human exposure to EMF [6]–[9]. The most widely adopted exposure limits worldwide are the guidelines specified by the International Commission on Non-Ionizing Radiation (ICNIRP) [7] in 1998. In the US, exposure limits specified by the Federal Communications Commission (FCC) are applicable [9]. The exposure limits published by the IEEE [10], [11] are of a more recent date but has so far not been adopted in any national regulations.

For the frequencies used by existing second, third, and fourth generation (2G, 3G, and 4G) mobile communication systems, basic restrictions on RF EMF exposure are specified in terms of the specific absorption rate (*SAR*) to prevent, with wide safety margins, from established adverse health effects associated with excessive localized tissue heating and whole-body heat stress [7], [9], [10]. At higher frequencies,

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Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health

Sultan Ayoub Meo, MBBS, PhD[1], Mohammed Almahmoud, MBBS[1], Qasem Alsultan, MBBS[1], Nawaf Alotaibi, MBBS[1], Ibrahim Alnajashi, MBBS[1], and Waseem M. Hajjar, MD, FRCS[2]

Abstract

The use of mobile phones has remarkably increased and become a basic need of daily life. Increasing subscriptions of mobile phones boost the installation of mobile phone base station towers (MPBSTs) in crowded commercial and residential areas including near school buildings. This study investigated the impact of exposure to radiofrequency electromagnetic field (RF-EMF) radiation generated by MPBSTs on cognitive functions. Two hundred and seventeen volunteer male students aged between 13 and 16 registered from two different intermediate schools: 124 students were from School 1 and 93 students were from School 2. The MPBSTs were located within 200 m from the school buildings. In School 1, RF-EMF was 2.010 μW/cm^2 with a frequency of 925 MHz and in School 2, RF-EMF was 10.021 μW/cm^2 with a frequency of 925 MHz. Students were exposed to EMFR for 6 hr a day, 5 days a week for a total period of 2 years. The Narda Safety Test Solution device SRM-3006 was used to measure RF-EMF in both schools, and cognitive functions tasks were measured by the Cambridge Neuropsychological Test Automated Battery (CANTAB). Significant impairment in Motor Screening Task (MOT; $p = .03$) and Spatial Working Memory (SWM) task ($p = .04$) was identified among the group of students who were exposed to high RF-EMF produced by MPBSTs. High exposure to RF-EMF produced by MPBSTs was associated with delayed fine and gross motor skills, spatial working memory, and attention in school adolescents compared to students who were exposed to low RF-EMF.

Keywords

Electromagnetic Field Radiation, Mobile Phones Base Station Tower, Cognitive function

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In recent years, tremendous developments in mobile phones have revolutionized the telecom industry by making telecommunication faster, economical, and more convenient (D'Silva, Swer, Anbalagan, & Bhargavan, 2014). With the introduction of new applications and multifunctional technology in mobile phones, the telecom industry is appealing to both youth and adults. The usage of mobile phones has dramatically increased, which is considered as a basic tool in daily life (Al-Khlaiwi & Meo, 2004). Worldwide, the number of subscriptions of mobile phones is about 7.52 billion. This number is more than the worldwide population, as many users own more than one mobile phone (World Bank, 2018). The extensive usage of cellular phones has led to the growing installation of mobile phone base station towers (MPBSTs) in crowded commercial and residential areas, which raises community concerns (Buckus et al., 2017; Meo et al., 2015; Wiedemann, Freudenstein, F., Böhmert, Wiart, & Croft, 2017; Zhang et al., 2017; Figure 1).

[1]Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia
[2]Department of Thoracic Surgery, College of Medicine, King Saud University, Riyadh, Saudi Arabia

Corresponding Author:
Prof. Sultan Ayoub Meo, MBBS, PhD, Professor and Consultant in Clinical Physiology, Department of Physiology, College of Medicine, King Saud University, PO Box 2925, Riyadh 11461, Kingdom of Saudi Arabia.
Email: sultanmeo@hotmail.com, smeo@ksu.edu.sa

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To Whom It May Concern:

Dear Sirs/Madams:

I am Scientist Emeritus and Former Director of the National Institute of Environmental Health Sciences and National Toxicology Program of the National Institutes of Health. I am currently a Scholar in Residence at the Nicholas School of the Environment at Duke University.

Wireless networks, cell towers and cell phones create radiofrequency radiation emissions. U.S. FCC limits for human exposure to radiofrequency were last reviewed in 1996 and based on the assumption that heating is the only harmful effect. Aware that the FCC's 1996 limits lacked the underpinning of solid scientific data regarding long term health effects, the FDA requested large-scale studies by the National Toxicology Program (NTP) and in 2018 the NTP studies found clear evidence of an association with cancer in male rats. Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies used even lower RFR lower exposures to approximate cell tower emissions and also found increases of the same tumor type. The NTP studies were carefully controlled to ensure exposures did not significantly heat the animals. The animal study findings in combination with human studies indicate adverse effects from non heating levels of radiofrequency.

I document the importance of the NTP findings of effects from non thermal exposures in my declaration in an Amicus Brief for the case Environmental Health Trust et al v. the FCC. The August 13, 2021 judgment ordered the FCC to address several issues including the health implications of long term exposures.

A mounting body of published studies associates radiofrequency radiation with adverse negative health effects. FCC limits need to be strengthened to protect the public, especially children and vulnerable populations, from long term exposures.

Linda S. Birnbaum, PhD
Scientist Emeritus and Former Director
National Institute of Environmental Health Sciences and National Toxicology Program
Scholar in Residence, Duke University, Former President, Society of Toxicology
Adjunct Professor, Yale University and UNC, Chapel Hill, Visiting Professor, Queensland University (Australia)

National Toxicology Program Radiofrequency Radiation
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Human Exposure to RF Fields in 5G Downlink

Imtiaz Nasim and Seungmo Kim
{in00206, seungmokim}@georgiasouthern.edu
Department of Electrical Engineering, Georgia Southern University
Statesboro, GA 30460, USA

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***Abstract*—While cellular communications in millimeter wave (mmW) bands have been attracting significant research interest, their potential harmful impacts on human health are not as significantly studied. Prior research on human exposure to radio frequency (RF) fields in a cellular communications system has been focused on uplink only due to the closer physical contact of a transmitter to a human body. However, this paper claims the necessity of thorough investigation on human exposure to downlink RF fields, as cellular systems deployed in mmW bands will entail (i) deployment of more transmitters due to smaller cell size and (ii) higher concentration of RF energy using a highly directional antenna. In this paper, we present human RF exposure levels in downlink of a Fifth Generation Wireless Systems (5G). Our results show that 5G downlink RF fields generate significantly higher power density (PD) and specific absorption rate (SAR) than a current cellular system. This paper also shows that SAR should also be taken into account for determining human RF exposure in the mmW downlink.**

***Index Terms*—5G; mmW; Downlink; Human RF exposure; PD; SAR.**

I. Introduction

It is acknowledged that exposure to RF has negative impacts on human body. The rapid proliferation of mobile telecommunications has occurred amidst controversy over whether the technology poses a risk to human health [1]. At mmW frequencies where future mobile telecommunications systems will likely operate, two changes that will likely occur have the potential to increase the concern on exposure of human users to RF fields. First, *larger numbers of transmitters* will operate. More base stations (BSs) will be deployed due to proliferation of small cells [2]-[4] and mobile devices accordingly. This will increase chance of human exposure to RF fields. Second, *narrower beams* will be used as a solution for the higher attenuation in higher frequency bands [3]-[7]. Very small wavelengths of mmW signals combined with advances in RF circuits enable very large numbers of miniaturized antennas. These multiple antenna systems can be used to form very high gains. Such higher concentration of RF energy will increase the potential to more deeply penetrate into a human body.

A. Related Work

This paper is motivated from the fact that prior work is not enough to address such potential increase in threats.

1) Measurement of Human RF Exposure: Being aware of the health hazards due to electromagnetic (EM) emissions in mmW spectrum, international agencies such as the Federal Communications Commission (FCC) [8] or the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [9] set the maximum radiation allowed to be introduced in the human body without causing any health concern. Possibilities of skin cancer due to RF emissions at higher frequency spectrum are reported [10]. Heating due to EM exposure in mmW is absorbed within the first few millimeters (mm) within the human skin; for instance, the heat is absorbed within 0.41 mm for 42.5 GHz [11]. The mmW induced burns are more likely to be conventional burns as like as a person touching a hot object as reported in [1]. The normal temperature for the skin outer surface is typically around 30 to 35°C. The pain detection threshold temperature for human skin is approximately 43°C as reported and any temperature over that limit can produce long-term injuries.

One problem is that the literature on the impact of cellular communications on human health is not mature enough. The three major quantities used to measure the intensity and effects of RF exposure are SAR, PD, and the steady state or transient temperature [12][13]. However, selection of an appropriate metric evaluating the human RF exposure still remains controversial. The FCC suggests PD as a metric measuring the human exposure to RF fields generated by devices operating at frequencies higher than 6 GHz [8], whereas a recent study suggested that the PD standard is not efficient to determine the health issues especially when devices are operating very close to human body in mmW [14]. Therefore, this paper examines the human RF exposure by using both PD and SAR.

2) Reduction of Human RF Exposure: Very few prior studies in the literature paid attention to human RF exposure in communications systems [1][14]-[17]. Propagation characteristics at different mmW bands and their thermal effects were investigated for discussion on health effects of RF exposure in mmW radiation [14]. Emission reduction scheme and models for SAR exposure constraints are studied in recent work [15][16].

However, health impacts of mmW RF emissions in *downlink* of a cellular communications system have not been studied so far, which this paper targets to discuss.

B. Contributions

Three contributions of this paper can be highlighted and distinguished from the prior art.

Firstly, this paper analyzes the human RF exposure in the *downlink*. All the prior work studied an uplink only, while paid almost no attention to suppression of RF fields generated by access points (APs) and BSs in a 5G nor Release 9 network,

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Brain proteome response following whole body exposure of mice to mobile phone or wireless DECT base radiation

Adamantia F. Fragopoulou[1], Athina Samara[2], Marianna H. Antonelou[1], Anta Xanthopoulou[3], Aggeliki Papadopoulou[3], Konstantinos Vougas[3], Eugenia Koutsogiannopoulou[2], Ema Anastasiadou[2], Dimitrios J. Stravopodis[1], George Th. Tsangaris[3] & Lukas H. Margaritis[1]

[1]Department of Cell Biology and Biophysics, Athens University, Athens, Greece, [2]Genetics and Gene Therapy Division, Center of Basic Research II, Biomedical Research Foundation of the Academy of Athens, Athens, Greece, and [3]Proteomics Research Unit, Center of Basic Research II, Biomedical Research Foundation of the Academy of Athens, Athens, Greece

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The objective of this study was to investigate the effects of two sources of electromagnetic fields (EMFs) on the proteome of cerebellum, hippocampus, and frontal lobe in Balb/c mice following long-term whole body irradiation. Three equally divided groups of animals (6 animals/group) were used; the first group was exposed to a typical mobile phone, at a SAR level range of 0.17–0.37 W/kg for 3 h daily for 8 months, the second group was exposed to a wireless DECT base (Digital Enhanced Cordless Telecommunications/Telephone) at a SAR level range of 0.012–0.028 W/kg for 8 h/day also for 8 months and the third group comprised the sham-exposed animals. Comparative proteomics analysis revealed that long-term irradiation from both EMF sources altered significantly ($p < 0.05$) the expression of 143 proteins in total (as low as 0.003 fold downregulation up to 114 fold overexpression). Several neural function related proteins (i.e., Glial Fibrillary Acidic Protein (GFAP), Alpha-synuclein, Glia Maturation Factor beta (GMF), and apolipoprotein E (apoE)), heat shock proteins, and cytoskeletal proteins (i.e., Neurofilaments and tropomodulin) are included in this list as well as proteins of the brain metabolism (i.e., Aspartate aminotransferase, Glutamate dehydrogenase) to nearly all brain regions studied. Western blot analysis on selected proteins confirmed the proteomics data. The observed protein expression changes may be related to brain plasticity alterations, indicative of oxidative stress in the nervous

Authors' contributions: AFF and LHM conceived the concept and design of the experiments, made the literature survey and the final biologically valid interpretation of the EMF impact upon the brain, wrote and finalized the manuscript. AFF carried out all animal handling, welfare, EMF exposure, part of brain dissection and immunoassays. AS performed the brain dissection and brain regions' separation, contributed to the non-EMF writing of the manuscript and together with MHA, EK and EA carried out a part of the immunoassays and contributed to the data evaluation related to neuroproteomics. AX, AP and KV were involved in 2-DE experiments, Maldi ToF/MS, protein identification and statistical analysis. DJS participated in the conception of the design and contributed to the interpretation and evaluation of the overall data. GThT participated in the experimental design and experimental protocols optimization, coordinated the proteomics study, carried out the overall differential proteomics analysis and data evaluation and contributed to the proteomics writing of the manuscript. All authors read and approved the final manuscript.

Address correspondence to Lukas H. Margaritis, Adamantia F. Fragopoulou, Department of Cell Biology and Biophysics, Faculty of Biology, Athens University, Panepistimiopolis, 15784 Athens, Greece. E-mails: lmargar@biol.uoa.gr, madofrag@biol.uoa.gr

Health Effects of Mobile Tower Radiation on Human — Case Study

Lalrinthara Pachuau*, Zaithanzauva Pachuau
Dept. of Physics, Mizoram University, Tanhril, India.

* Corresponding author. Tel.: +91-9862358768; email: rinapachuau@yahoo.com
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Abstract: In the present paper, we presented the study of complaints on thirteen (13) different health symptoms faced by inhabitants living near mobile tower – Global System for Mobile Communication (GSM 900 & 1800) and those inhabitants living in the area where there is no mobile tower. The study was conducted in fourteen different localities in Aizawl city and four different localities outside Aizawl city in the year 2014 & 2015. Questionnaires were conducted in all the localities. Power densities were measured in different places in all the localities. Health complaints between the localities were compared with that of the locality where there is no mobile tower. It was found that power density is much higher in the area where there is mobile tower than the area where there is no mobile tower. Questionnaire responses from all the localities were statistically analysed and compared by performing t-test. Out of the thirteen (13) different symptoms studied it was found that the comparisons are statistically significant with $p < 0.05$ in six symptoms. Significant Health complaints start to occur when average power density of the locality is more than 2.145 mW/m^2. Women were statistically more affected ($p < 0.05$) than male. It was found that there was strong positive correlation between power density and health complaints with R^2 value 0.853.

Key words: Health symptoms, power density, RF radiation.

1. Introduction

The introduction in the 1990s of mobile phone using the digital Global System for Mobile Communication (GSM) bandwidths 900 and 1800 megahertz (MHz) and the subsequent introduction of the Universal Mobile Telecommunications System (UMTS) have led to widespread use of this technology. This development has raised public concerns and substantial controversy about the potential health effects of the radiofrequency electromagnetic field emissions of this technology [1]. It is believed that mobile phones produce RF energy of non-ionizing radiation which is too low to heat the body's tissues, and hence is unlikely to have the same impact on human health as those produced by ionizing radiations such as X-rays [2]. A small portion of the population attributes non specific symptoms of ill health, such as sleep disturbance, headache, fatigue etc. Ref. [3] to exposure to electromagnetic fields. This phenomenon is described as electromagnetic hypersensitivity or 'idiopathic environmental intolerance with attribution to electromagnetic fields [4]. Additionally, individuals who are hypersensitive to electromagnetic fields often claim to be able to perceive radiofrequency electromagnetic fields in their daily life [5]. With the significant increase in mobile phone usage, possible health risks related to RF exposure have become the subject of considerable attention [6].

People are generally exposed to mobile tower radiation under far-fields conditions, i.e. radiation from a

Electromagnetic fields, 5G and health: what about the precautionary principle?

John William Frank

Usher Institute, University of Edinburgh, Edinburgh, UK

Correspondence to
Professor John William Frank; john.frank@ed.ac.uk

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ABSTRACT

New fifth generation (5G) telecommunications systems, now being rolled out globally, have become the subject of a fierce controversy. Some health protection agencies and their scientific advisory committees have concluded that there is no conclusive scientific evidence of harm. Several recent reviews by independent scientists, however, suggest that there is significant uncertainty on this question, with rapidly emerging evidence of potentially harmful biological effects from radio frequency electromagnetic field (RF-EMF) exposures, at the levels 5G roll-out will entail. This essay identifies four relevant sources of scientific uncertainty and concern: (1) lack of clarity about precisely what technology is included in 5G; (2) a rapidly accumulating body of laboratory studies documenting disruptive in vitro and in vivo effects of RF-EMFs—but one with many gaps in it; (3) an almost total lack (as yet) of high-quality epidemiological studies of adverse human health effects from 5G EMF exposure specifically, but rapidly emerging epidemiological evidence of such effects from past generations of RF-EMF exposure; (4) persistent allegations that some national telecommunications regulatory authorities do not base their RF-EMF safety policies on the latest science, related to unmanaged conflicts of interest. The author, an experienced epidemiologist, concludes that one cannot dismiss the growing health concerns about RF-EMFs, especially in an era when higher population levels of exposure are occurring widely, due to the spatially dense transmitters which 5G systems require. Based on the precautionary principle, the author echoes the calls of others for a moratorium on the further roll-out of 5G systems globally, pending more conclusive research on their safety.

BACKGROUND

Fifth generation (5G) technology is being widely promoted by politicians, government officials, and private sector interests.[1–3] They contend that its advent will bring clear economic and lifestyle benefits, through massive increases in wireless and mobile connectivity at home, work, school and in the community. Examples of these 5G benefits include driverless vehicles and 'The Internet of Things'—automated and continuous communication between the machines in our daily lives.[4 5] On the other hand, the public health response to this wave of communications innovation has become a sense of deep concern, related to widespread scientific uncertainties, as well as a lack of use of existing evidence, in the current international safety guidelines for 5G and related radio frequency electromagnetic field (RF-EMF) exposures.[5–8] This commentary sets out the reasons for such concern.

WHAT IS 5G AND WHY IS IT DIFFERENT FROM PAST EMF EXPOSURES?

Developed over just the last decade, radio frequency (wireless) transmission systems in the 5G category are being rolled out throughout the world. These systems will massively increase the volume, speed and spatial reach of digital data transfer.[4–6] The four successive previous generations (1G, 2G, 3G and 4G) of wireless transmission systems were deployed initially for wireless and mobile phones (1980s and 1990s), followed by WiFi (2000s), and then smart metres and the Internet of Things (2010s). Each successive generation of transmission systems has used higher frequencies of electromagnetic waves to carry ever-larger volumes of data, faster, in more ubiquitous locations. 5G is widely acknowledged to be a step change in this sequence, since it additionally uses much higher frequency (3 to 300 GHz) radio waves than in the past. 5G will also make use of very new—and thus relatively unevaluated, in terms of safety—supportive technology (including pulsing, beaming, phased arrays and massive input/massive output (MIMO)—see below) to enable this higher data transmission capacity.[4–6]

However—unlike prior generations of wireless transmission systems—5G ultrahigh-frequency waves are easily interrupted by vegetation foliage (and building walls, often requiring additional signal boosting within each building). This inherent fragility of 5G high-frequency waves means that transmission boosting 'cell' antennae are generally required every 100–300 m or less—far more spatially dense than the miles-apart transmission masts required for older 2G, 3G and 4G technology using lower frequency waves.[4–6]

This dense transmission network is also required in order to achieve the 'everywhere/anytime' connectivity promised by 5G developers, and necessitated by new technology such as driverless cars, which must never be out of internet contact, for safety reasons. Critics of 5G agree[6–8]—but its supporters do not[9 10]—that the overall population levels of exposure to RF-EMFs will be greatly increased by the 5G roll-out. One compelling argument for that view is the 'inverse square law' of EMF exposure: intensity varies as the inverse of the square of the distance from the emitting source.[11] With plans afoot internationally to put a 5G booster antenna on 'every second or third lamp-post', it is difficult to believe that overall population exposures will not increase substantially. Existing 4G

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systems can service up to 4000 radio frequency using devices per square kilometre; 5G systems will connect up to one million devices per square kilometre—greatly increasing the speed of data transfer (by a factor of 10) and the volume of data transmitted (by a factor of 1000).[6]

THE CURRENT CONTROVERSY

International health protection agencies and their scientific advisory bodies have published several reviews over the last decade, of varying scientific quality, of the research evidence regarding potential adverse biological and health effects of RF-EMFs.[5 12–15] These reviews—by Health Protection England,[12] the International Agency for Research on Cancer (IARC),[13] an Expert European Union (EU) Committee[14] and the International Commission on Non-Ionising Radiation Protection (ICNIRP)[15]—have, with one exception, not converged around a strong warning about such effects. IARC is the outlier in this respect, having determined in 2011 that EMFs are 'possibly carcinogenic to humans'.[13] Meanwhile, independent radiation and health scientists have published serious concerns about the current roll-out of 5G transmission systems.[6–8 16–18] Their reasoning is twofold: (1) these systems have an unprecedented potential to create human and non-human RF-EMF exposures orders of magnitude more intense (eg, in terms of 'power flux density') than was the case only a few decades ago (16); (2) there is a remarkable dearth of evidence on the safety of 5G-specific EMF emissions, but a growing body of research suggestive of harms from other RF-EMF exposures, which have been studied for much longer.[6–8 17 18]

Moreover, a growing number of engineers, scientists, and doctors internationally have been calling on governments to raise their safety standards for RF-EMFs, commission more and better research, and hold off on further increases in public exposure, pending clearer evidence of safety.[18–21] Some politicians have listened: France, Israel, Cyprus and Russia have banned WiFi in preschool and restricted its use in primary schools. Belgium has banned the sale of mobile phones to children under seven. In response to such concerns, several jurisdictions have recently blocked the installation of 5G antennae systems in their communities: Brussels, Florence, Rome, as well as Glastonbury, Frome and Totnes in the UK; and widespread anti-5G campaigns are now emerging in Australia, North America and elsewhere.[21]

Some countries have lowered allowable RF-EMF exposure levels far below those permitted in the UK and USA. Powerwatch, a non-profit, independent organisation in the UK, has published comparisons of international recommendations on permitted maximum exposure levels to EMFs.[22] Those comparisons show that the highest permitted RF-EMF exposures which are used globally, as the basis for national safety guidelines, are those used in the USA, the UK and most of the EU. These exposure limits are derived from the recommendations to WHO in 1998 (recently updated, but essentially not changed, in March 2020) by the ICNIRP.[15] These international comparisons show that the safety limit for RF-EMF exposure set by ICNIRP is 10-fold higher than that set by the next most liberal guidelines, found in Israel and India, and 100-or-more-fold higher than the limits set by other guidelines, spanning 14 EU jurisdictions as well as China. As discussed in detail below, one reason that ICNIRP's permitted exposures are so high is that they are based solely on the acute thermogenic (heat-producing) effects of RF-EMF in animal tissues; this is unlike more conservative jurisdictions' guidelines, which are based on a wider variety of biological and health effects documented in recent decades, including effects resulting from chronic rather than acute exposures, and effects not mediated by thermogenesis.

KEY CONTENTIOUS ISSUES AND SCIENTIFIC UNCERTAINTIES

Lack of clarity about precisely what sorts of EMFs will result from 5G roll-out

A striking feature of this public controversy is that various commentators—even those with advanced training in telecommunications physics and engineering—inconsistently refer to quite different specific technologies when they discuss the pros and cons of '5G'. American authors tend to state that the 5G system roll outs already underway in that part of the world are using very high-frequency (24–100 GHz)/short-wavelength RF transmission—so-called 'millimetre range' waves.[6] However, some UK/EU industry websites[9] state that 'no new frequencies are required' (at present) beyond those already in use in existing 4G mobile networks, WiFi, smart metres. However, independent authors commenting on current private sector plans in the EU, to extend 5G networks more widely in the future, tell a different story.[23 24] These commentaries imply that the use of millimetre wave frequencies—about which we have very few conclusive studies of human health effects—is already planned and inevitable in the EU, and eventually globally, in order to accommodate anticipated consumer requirements—especially the 'Internet of Things' and driverless vehicles. Tellingly, the Guardian (one of the UK's most respected newspapers) reported last year[25] that UK lamp posts were becoming the subject of expensive legal battles, over 'who can charge what' for mounting 5G booster cell antennae on them. Cash-strapped Local Councils had hoped to profit from such charges to telecom companies. These companies have taken local governments to court to block those charges. The USA provides a cautionary tale in this respect: nearly 25 years ago national legislation there took local authorities completely out of the telecommunications regulatory system, leaving local 5G installation and similar decisions entirely in the hands of central authorities—that is, the Federal Communications Commission.[6]

Equally inconsistently described in writings about 5G is the complex set of special signal modulations, pulses, polarisation, phased arrays and novel equipment designs—for example, 'massive MIMO antennas'—which represent the cutting edge technologies that accompany 5G system installation—many of them proprietary. As some commentators on potential health effects from such exposures have pointed out, it is highly likely that each of these many forms of transmission causes somewhat different biological effects—making sound, comprehensive and up-to-date research on those effects virtually impossible.[5–7 26 27]

In short, '5G systems' is not a consistently defined term. This confusion has not helped clarify the health and safety issues surrounding 5G roll outs internationally.

An emerging preponderance of laboratory studies indicating RF-EMFs' disruptive biological effects: with many knowledge gaps

The lack of a consistent definition of '5G' matters enormously. This is clearly demonstrated in a sophisticated recent review of the laboratory science evidence of RF-EMF effects in diverse biological systems.[26] That review shows that the existing scientific literature on the biological effects of more recently developed technology is quite limited, in that there is hardly any study replication—the hallmark of reliable research. We often have only one extant study of any given biological effect of a specified combination of radio frequencies, modulation and

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pulse patterns. The literature that does exist identifies remarkably heterogeneous biological effects, across hundreds of such specific RF-EMF exposure patterns. Furthermore, a comprehensive Canadian review of the same evidence states that some of the new RF-EMF technologies—such as innovations in radio frequency 'pulsing,' 'polarisation' and 'modulation'—are so new that biological scientists have not been able to keep up—that is, no studies yet exist of these new technologies' biological effects.[27]

These recent reviews of laboratory (ie, non-epidemiological) studies of the biological effects of RF-EMFs do identify diverse, multibody system effects, operating by a range of physicochemical pathways which are not mediated by thermogenesis.[6 8 26 27] The reviewers document a growing body of evidence that RF-EMF exposures produce effects spanning reproductive/teratogenic, oncological, neuropsychiatric, skin, eye and immunological body systems. In addition, there are many fundamental effects at the subcellular level, in terms of oxidation, DNA alteration, gene expression and bacterial antibiotic resistance. Particularly striking is a 2018 study from Israel documenting the capacity of the sweat ducts in human skin to act as 'helical antennae' receptive to 5G frequencies of RF-EMF. When sweat ducts are exposed to these RF-EMFs, there are remote systemic effects, through the skin's established capacity to secrete and send hormones and other signals to the entire body.[28] This report alters one's sense of the potential risks from such high frequency waves, since they have long been thought to be 'inherently less dangerous', because they are largely absorbed in the top few millimetres of exposed tissue (thus limiting any adverse effects, in theory, to the skin or eye).

Finally, it is instructive to look at the two widely cited NIH toxicological studies of specific EMFs' effects on thousands of rodents,[29 30] conducted by experienced and highly respected laboratory scientists at a world-leading institution. Since their publication in 2018, epidemiologists and other scientists have pointed out several methodological weaknesses in the conduct and analysis of these studies that make their unequivocal interpretation almost impossible, particularly in terms of their relevance to human health: excessive statistical inference testing of multiple (over 1000) hypotheses, without appropriate adjustment of p values considered 'statistically significant'; reporting of results 'often ignoring statistical tests'; failure to explain major internal inconsistencies of findings across EMF doses, tumour types and rodent sexes; use of experimental EMF exposures far in excess of any known human ones; uncontrolled confounding by direct thermogenesis effects—the list goes on.[31 32]

In short, laboratory studies of EMF exposure are fraught with both internal and external validity issues, and cannot replace high-quality human epidemiological studies—though, as we will now discuss, these are also hard to come by.

Lack of conclusive human epidemiological studies of 5G-specific health effects (but increasing epidemiological evidence of serious health effects from previous generations of RF-EMF exposures)

Canada's most senior cancer epidemiologist, Miller *et al* have last year summarised the human epidemiological evidence[33] linking human breast and brain tumours, male reproductive outcomes and child neurodevelopmental conditions to RF-EMF exposures resulting from the use of past generations of transmission systems. Critically, this evidence is not about exposure to the high radio frequency/short wavelength 5G systems. These systems are too newly deployed to have been extensively studied, especially by the highest-quality epidemiological study designs for establishing evidence of causation: prospective cohort studies. Such studies typically require decades of follow-up to detect delayed health effects, such as most cancers.

Miller *et al* find compelling evidence of carcinogenesis, especially in the brain and acoustic nerve, as well as the breast, from strong RF-EMF exposures to previous generations of mobile phone transmissions. Perhaps the most convincing evidence they cite comes from the oldest and most-often-maligned study design—case reports. While admittedly old-fashioned, case reports can, when they involve pathognomonic effects (ie, pathological features absolutely specific to a particular exposure) provide useful evidence of exposure/outcome specificity—a valuable but often unobtainable epidemiological criterion for inferring causation, according to the standard epidemiological criteria first enunciated by Sir Austin Bradford Hill over 50 years ago.[34 35] Strikingly localised breast tumours, of unusual morphology, have been diagnosed in several women with particularly strong exposures to previous generations of mobile phones: they habitually placed their phones in their bras, on the same side of the body where the tumour has developed. Miller *et al* call for an urgent update of the last (2011) review of EMFs and cancer by the International Agency for Research on Cancer.[13] They predict that such an update would now rate RF-EMFs as, at minimum, 'probable' (not merely 'possible' as in 2011) carcinogens, based on current evidence.

Persistent allegations of unscientific bases for existing health protection guidelines on RF-EMFs and unmanaged conflicts of interest on expert advisory panels

A senior epidemiologist from Sweden, Hardell, has repeatedly published in peer-reviewed journals detailed allegations regarding the main WHO scientific advisory body on EMF health effects and safety—the previously mentioned ICNIRP. Hardell contends that ICNIRP's membership includes over-representation of vested interests, especially the giant multinational telecommunications firms who are heavily invested in the roll out of 5G systems internationally.[36 37] ICNIRP has long been influential in EMF regulation: its scientific recommendations to WHO were first issued in 1998, updated in 2009, and revised and updated again in March 2020.[15] Hardell points out that ICNIRP's pro-industry bias may explain its continued reliance only on studies of the thermogenic (heat-producing) effect of RF-EMFs in biological tissues: these studies would be expected to paint an overly benign picture of RF-EMF safety. This narrow ICNIRP focus flies in the face of published reviews by independent scientists (6, 8, 13, 26, 27) citing compelling research evidence, accumulating steadily over the last few decades, of non-thermogenic adverse effects of RF-EMFs, affecting diverse human and animal subcellular function, tissues and organ systems (see above). In detailed, almost lawyer-like publications,[36 37] Hardell fastidiously documents the ICNIRP's 20 years of dogged defiance, in the face of widespread criticism by other scientists, that the scientific base for their recommendations remains dated and narrow, rendering their guidelines on 'safe' RF-EMF exposure unsafe.

The most damning evidence adduced by Hardell is a table of the cross-appointments held by six members of the WHO Monograph Group, across five major international advisory panels on the health effects of non-ionising radiation [36 – page 408]. Hardell also describes these scientists' strong personal links to the telecommunications industry, a situation likely arising from the fact that the ICNIRP itself is a 'private organisation (non-governmental organisation; NGO) based in Germany. New

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expert members can only be elected by members of ICNIRP.' Hardell contrasts the ICNIRP's reports to the publications of the 'BioInitiative 2012'[38] group, of nearly 30 international experts in this field, whose operations are not only wholly independent of any such 'vested interests,' but also entirely transparent. The current version (March 2020) of the BioInitiative 2012 website[38] provides detailed descriptions of 988 peer-reviewed scientific studies of adverse potential health and biological effects of EMFs arising from RF and similar non-ionising sources. The vast majority (84.6%) of these 988 studies document disruptive biological effects from such EMFs, almost all of them operating via non-thermogenic pathways. (This writer would have preferred to see more 'critical appraisal' of the quality of the studies than the BioInitiative 2012 website provides. However, the major effort entailed in assembling this massive body of scientific evidence, and updating it regularly since 2012, is impressive).

Finally, Carpenter has recently published a well-researched analysis of how source of funding correlates with study findings, across many peer-reviewed publications over the last few decades, of the relationship between various kinds of EMF exposure and several cancers.[39] He shows convincingly that studies funded by private sector entities, with strong vested interests in maintaining their current use of the sources of EMFs under study, tend to find no association—whereas studies funded by public sector or independent sources find the opposite. As Carpenter points out, this suggests that many systematic reviews and meta-analyses in this field, having failed to correct for this 'source of funding bias,' likely underestimated the evidence for causation.

CONCLUSIONS AND RECOMMENDATION

In assessing causal evidence in environmental epidemiology, Bradford Hill himself pointed out that 'the whole picture matters;' he argued against prioritising any subset of his famous nine criteria for causation. One's overall assessment of the likelihood that an exposure causes a health condition should take into account a wide variety of evidence, including 'biological plausibility'.[34 35] After reviewing the evidence cited above, the writer, an experienced physician-epidemiologist, is convinced that RF-EMFs may well have serious human health effects. While there is also increasing scientific evidence for RF-EMF effects of ecological concern in other species,[6–8 16–18 23] both plant and animal, these have not been reviewed here, for reasons of space and the author's disciplinary limitations. In addition, there is convincing evidence, cited above, that several nations' regulatory apparatus, for telecommunications innovations such as the 5G roll-out, is not fit for purpose. Indeed, significant elements in that apparatus appear to have been captured by vested interests. Every society's public health—and especially the health of those most likely to be susceptible to the hazard in question (in the case of EMFs, children and pregnant women)—needs to be protected by evidence-based regulations, free from significant bias.

Finally, this commentary would be remiss if it did not mention a widely circulating conspiracy theory, suggesting that 5G and related EMF exposures somehow contributed to the creation or spread of the current COVID-19 pandemic. There are knowledgeable commentators' reports on the web debunking this theory, and no respectable scientist or publication has backed it.[40 41] Indeed, combatting it is widely viewed by the scientific community as critical to dealing with the pandemic, as conspiracy theorists holding this view have already carried out violent attacks on mobile phone transmission facilities and other symbolic targets, distracting the public and authorities at a time when pandemic control actions are paramount.[42] This writer completely supports that view of the broader scientific community: the theory that 5G and related EMFs have contributed to the pandemic is baseless.

It follows that, for the current 5G roll-out, there is a sound basis for invoking 'the precautionary principle'.[43] This is the environmental and occupation health principle by which significant doubt about the safety of a new and potentially widespread human exposure should be a reason to call a moratorium on that exposure, pending adequate scientific investigation of its suspected adverse health effects. In short, one should 'err on the side of caution'. In the case of 5G transmission systems, there is no compelling public health or safety rationale for their rapid deployment. The main gains being promised are either economic (for some parties only, not necessarily with widely distributed financial benefits across the population) or related to increased consumer convenience. Until we know more about what we are getting into, from a health and ecological point of view, those putative gains need to wait.

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ORCID iD

John William Frank http://orcid.org/0000-0003-3912-4214

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Case Report

How does long term exposure to base stations and mobile phones affect human hormone profiles?

Emad F. Eskander *, Selim F. Estefan, Ahmed A. Abd-Rabou

Hormones Department, Medical Research Division, National Research Centre, Cairo, Egypt

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ABSTRACT

Objectives: This study is concerned with assessing the role of exposure to radio frequency radiation (RFR) emitted either from mobiles or base stations and its relations with human's hormone profiles.

Design and methods: All volunteers' samples were collected for hormonal analysis.

Results: This study showed significant decrease in volunteers' ACTH, cortisol, thyroid hormones, prolactin for young females, and testosterone levels.

Conclusion: The present study revealed that high RFR effects on pituitary–adrenal axis.

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Introduction

Because of the increase in the usage of wireless communication devices of mobile phones in recent years, there is an anxious concern on the possible hazardous effects of prolonged exposure to radio frequency radiation (RFR) [1]. In considering the biological effects of RFR, the intensity and frequency of the radiation and exposure duration are important determinants of the responses.

It has been reported that exposure to RFR could affect the nervous system [2]. Hardell et al. found that cell phone users had an increased risk of malignant gliomas [3]. Subjecting human spermatozoa to RFR showed decrease in sperms motility and vitality and increase in DNA fragmentation [4]. The authors hypothesize that the high sporadic incidence of the clinical symptoms of the autoimmune multiple Sclerosis disease [5] may be a result of long exposure to RFR from mobiles.

This study is concerned with assessing the effect of RFR emitted from mobile phones and base stations on human hormone profiles, with anticipation to offer recommendations to assure health care and safety for humans continuously exposed to radio frequency radiation.

Design and methods

Study subjects

This study was conducted for 6 years on 82 mobile phone volunteers with age ranges 14–22 years ($n=41$) and 25–60 years ($n=41$). Those users were divided into three subgroups according to the time of their exposure to RFR: (weak $n=19$), (moderate $n=9$), and (strong $n=13$) per day, in addition to 20 negative control subjects.

On the other hand, volunteers exposed to RFR emitted from base stations ($n=34$) were selected with age ranges 14–22 years ($n=17$), and 25–60 years ($n=17$) and living at distances 20–100 m and 100–500 m apart from the base station. Additional 10 subjects of each age range living at a distance more than 500 m apart from the base station were considered as negative control group.

The source of the RFR (base stations or mobile phones) was GSM-950 MHz magnetic field and the ICNIRP-Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic field (up to 300 GHz) (International Commission on Non-Ionizing Radiation Protection). The present study was approved by the Ethics Committee of National Research Centre.

Volunteers inclusion criteria

Volunteers participated in the study fulfilled the following inclusion criteria: age 14–60 years, mobile phone users, or living at distances 20–100 m and 100–500 m apart from the base station.

* Corresponding author at: Hormones Department, Medical Research Division, National Research Centre, Cairo, 12622, Egypt. Fax: +20 2 33370931.
E-mail address: gysi_pharma@yahoo.com (E.F. Eskander).

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REVIEW

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Threshold of radiofrequency electromagnetic field effect on human brain

Hiie Hinrikus, Jaanus Lass, and Maie Bachmann

Tallinn University of Technology, Tallinn, Estonia

ABSTRACT

Purpose: This review aims to estimate the threshold of radiofrequency electromagnetic field (RF EMF) effects on human brain based on analyses of published research results. To clarify the threshold of the RF EMF effects, two approaches have been applied: (1) the analyses of restrictions in sensitivity for different steps of the physical model of low-level RF EMF mechanism and (2) the analyses of experimental data to clarify the dependence of the RF EMF effect on exposure level based on the results of published original neurophysiological and behavioral human studies for 15 years 2007–2021.

Conclusions: The analyses of the physical model of nonthermal mechanisms of RF EMF effect leads to conclusion that no principal threshold of the effect can be determined. According to the review of experimental data, the rate of detected RF EMF effects is 76.7% in resting EEG studies, 41.7% in sleep EEG and 38.5% in behavioral studies. The changes in EEG probably appear earlier than alterations in behavior become evident. The lowest level of RF EMF at which the effect in EEG was detected is 2.45 V/m (SAR = 0.003 W/kg). There is a preliminary indication that the dependence of the effect on the level of exposure follows rather field strength than SAR alterations. However, no sufficient data are available for clarifying linearity-nonlinearity of the dependence of effect on the level of RF EMF. The finding that only part of people are sensitive to RF EMF exposure can be related to immunity to radiation or hypersensitivity. The changes in EEG caused by RF EMF appeared similar in the majority of analyzed studies and similar to these in depression. The possible causal relationship between RF EMF effect and depression among young people is highly important problem.

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Low-level RF EMF; nonthermal model; threshold; linearity; depression

Introduction

The world population has been exposed to man-made coherent electromagnetic radiation, different from the natural radiation emitted by the Sun, over a very long period of time without remarkable effects on health. The people are adapted to the level of radio and TV broadcasting radiofrequency electromagnetic field (RF EMF) about 0.1 V/m. During recent decades, the applications of mobile telecommunication technology have drastically changed the situation. The sources of RF EMF have moved closer to people and the levels of exposure are much higher. The current guidelines recommend health protection limits up to 61 V/m (ICNIRP 2020). Hundreds of studies have detected biological RF EMF effects in humans, animals and cells at the levels of exposure much less than existing health protection limits. According to the Ericsson Mobility Report, the number of mobile subscriptions by technology is over eight billion in 2020 (Ericsson Mobility Report 2020). This number is higher than the world population. The wide applications of RF EMF rise concern about possible consequences on health.

The increased oxidative stress caused by RF EMF exposure has been reported in many animal and cellular studies (Schuermann and Mevissen 2021). The relevant consequences on health (genome stability, immune system, neurodegeneration, reproduction) are likely. The radiofrequency electromagnetic field was classified as possibly carcinogenic to humans (class 2B) by the International Agency for Research on Cancer (IARC 2013).

The RF EMF effects on brain bioelectrical activity, cognition and behavior, not obligatory related to genome instability, have been a topic of interest over the past decades. The neurophysiological effects on humans have been detected in many experimental studies but the results are controversial (Valentini et al. 2007; Marino and Carruba 2009; Kwon and Hämäläinen 2011). The large variations in applied methods, different frequencies, levels of exposure and modulation parameters cause high diversity of the effects and results. The recent cohort study does not provide sufficient confirmation about the correlation between more extensive use of mobile phones and the reported symptoms nor sleep quality (Auvinen et al. 2019; Tettamanti et al. 2020). It is complicated to determine causal relationship between RF EMF biological effects and its health consequences due to diversity of exposure conditions and numerous concomitant other factors.

CONTACT Hiie Hinrikus hiie.hinrikus@gmail.com Department of Health Technologies, Tallinn University of Technology, Tallinn, Estonia.
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Radiation Analysis in a Gradual 5G Network Deployment Strategy

Ahmad M. El-Hajj
Electrical & Computer Eng. Department
Beirut Arab University
Beirut, Lebanon
a.elhajj@bau.edu.lb

Tarek Naous
Electrical & Computer Eng. Department
Beirut Arab University
Beirut, Lebanon
tareknaous@ieee.org

***Abstract*—In a world where many overlapping 2G, 3G, and 4G electromagnetic radiation sources already exist, concerns regarding the potential increase in these radiation levels following the roll-out of 5G networks are growing. The deployment of 5G is expected to increase power density levels drastically, given the limitations of mmWave communications that impose a notably higher number of base stations to cover a given area of interest. In this paper, we propose a gradual deployment strategy of a 5G network for a small area in downtown Austin, Texas, using the already existing 4G LTE sites of the area. The radiated power density of the proposed 5G network is then analyzed according to several electromagnetic field (EMF) exposure limits and compared to the radiation levels of the same area where only the LTE network is present. Simulation results for the selected area demonstrate the significant increase in radiation levels resulting from the addition of 5G cell towers.**

***Index Terms*—5G, Network Planning, Radiation Analysis**

I. Introduction

The notably large bandwidth available in the millimeter-wave (mmWave) band and the potential multi-gigabit-per-second (Gbps) data rates that can be achieved for future communication services have made mmWave communications a key part of Fifth Generation (5G) mobile networks. Despite the promising advantages of millimeter wave communications in terms of improved quality of service requirements, its usage for the 5G wireless standards comes at significant costs. First, working with such high frequencies will reduce coverage ranges of base transceiver stations (BTS). For proper coverage of an area, a densification of 5G BTSs is required to achieve the same coverage provided for this same area by today's 4G BTSs. Also, high propagation loss and increased signal blockage occurs, motivating the introduction of multi-antenna approaches such as Massive MIMO [1], [2].

This potential addition of a large number of transmitters gives rise to another problem that needs to be considered, which is the increase in radiation levels in the rolled-out 5G network. Although these transmissions are non-ionizing radiations, they cause thermal heating at the eyes and skin level. Extensive heating for long periods of time is when adverse health effects may occur. These health concerns have stimulated interest in the biological safety of mmWave transmissions. In this respect, several exposure limits have been specified in standards and regulations developed by commissions and organizations that many governments will rely on when future 5G networks are deployed. However, these regulations have contradicting limits, many of which have remained the same before the year 2000. Therefore, designing a 5G network with radiation levels that complies with all the safety limits is a difficult task given the current regulations.

Despite the ongoing standardization of 5G technology, several works in the literature have presented 5G network deployment studies. The cost and coverage implications of deploying a 5G network in Britain has been presented in [3] where it was shown that full coverage had exponentially rising costs due to network densification. Additional 5G network designs for different cities were presented in [4]–[6] without any consideration for the constraints of electromagnetic radiations or the implications of the environment in mmWave propagation. Network design has been studied under such radiation constraints in [7], [8] but for 4G networks. Power density assessment of 5G cellular nodes in an indoor environment has been presented in [9] where results showed that the peak power density remained below the specified threshold and can thus be deemed safe for the general public. However, not all of the guidelines and exposure limits were considered in this work and the simulation did not represent a real-world scenario.

To the best of our knowledge, no work has provided a thorough analysis of the deployment of 5G networks in terms of its impact on the increase in radiation levels. Existing work in the literature has either focused on the cost (e.g., [3]) or radiation levels for older standards (e.g., [7]). To this end, this paper presents a mmWave-based 5G network deployment strategy given pre-existing LTE nodes in a small geographical area in Austin, Texas. We then approximate the power density levels that would be experienced in such outdoor environments and analyze their variations and compliance with the specified exposure limits for different transmission powers and transmit antenna gains. We also compare this radiated power density in the deployed 5G network to the power density levels of the same area when only the pre-existing LTE BTSs are present.

The rest of this paper is organized as follows: Section II presents the 5G simulation environment considered in this work. The proposed deployment strategy of the 5G network in a small area in downtown Austin, Texas is presented in Section III. Radiation analysis of the deployed network is performed

in Section IV. Concluding remarks follow in Section V.

II. 5G Environment Setup

A. Pathloss Model

The close-in free space reference distance (CI) path loss model [10] is considered. It is defined by the following equation:

$$PL^{CI}(f,d)[\text{dB}] = FSPL(f,1m) + 10n\log_{10}\left(\frac{d}{d_0}\right) + X_\sigma^{CI} \tag{1}$$

where the free space path loss (FSPL) for a frequency of operation f is given by:

$$FSPL(f,1m) = 20\log_{10}\left(\frac{4\pi f}{c}\right) \tag{2}$$

The CI path loss model can be rewritten as:

$$PL^{CI}(f,d)[\text{dB}] = 20\log_{10}\left(\frac{4\pi f}{c}\right) + 10n\log_{10}\left(\frac{d}{d_0}\right) + X_\sigma^{CI} \tag{3}$$

where:

- n: is the single model parameter or the path loss exponent
- d_0**:** is the reference distance taken as 1 meter
- d: is the distance in meters between the BTS and the mobile station
- X_σ^{CI}: a zero mean Gaussian random variable with standard deviation σ in dB. It represents large scale channel fluctuations due to shadow fading (SF). The standard deviation of this random variable is given by:

$$\begin{aligned}\sigma^{CI} &= \sqrt{\sum X_\sigma^{CI^2}/N} \\ &= \sqrt{(PL^{CI} - FSPL - n10\log_{10}(d))/N}\end{aligned} \tag{4}$$

where N represents the number of measured path loss data points

The values for parameters n and SF vary from one scenario to another. Table I presents the values of these model parameters in different environmental setups, which have been obtained by ray tracing and measurements in [11].

TABLE I: CI Model parameters for different environments [12]

Scenario	CI Model Parameters
UMa-LOS	n = 2.0, SF = 4.1 dB
UMa-NLOS	n = 3.0, SF = 6.8 dB
UMi-S.C.-LOS	n = 1.98, SF = 3.1 dB
UMi-S.C.-NLOS	n = 3.19, SF = 8.2 dB
UMi-O.S.-LOS	n = 1.85, SF = 4.2 dB
UMi-O.S.-NLOS	n = 2.89, SF = 7.1 dB

UMa: denotes Urban Macrocell (Tx Heights $>$ 25 m), **UMi:** denotes Urban Microcell (Tx Heights $<$ 25 m), **LOS:** denotes line-of-sight, **NLOS:** denotes no line-of-sight, **S.C.:** denotes Street Canyon, **O.C.:** denotes Open Square

B. mmWave Specific Attenuation Factors

In mmWave propagation, attenuation due to atmospheric and weather conditions constitutes an important factor to consider [13]. Specifically, we will consider oxygen attenuation $O(d)$ and rain attenuation $R(d)$, which are both dependant on the separation distance d. Oxygen attenuation has been observed to be equal 16dB/km in [14], and hence can be obtained by the following:

$$O(d)[\text{dB}] = \frac{16d}{1000} = 0.016d \tag{5}$$

The rain attenuation factor depends on the climate of the zone under study. The International Telecommunication Union (ITU) have segmented these zones and provide measurements for the rain rates of each zone [15]. Based on these measurements and considering that the area under study in this paper will be in Austin, Texas, the rain attenuation rate will be taken to be 3.5 dB/Km. This loss can then be obtained using:

$$R(d)[\text{dB}] = \frac{3.5d}{1000} = 0.0035d \tag{6}$$

C. Link Budget Estimation

The link budget equation upon which the cell radius will be estimated can now be defined as:

$$P_{Rx}[\text{dBm}] = EIRP[\text{dBm}] - PL^{CI} - O(d) - R(d) + G_{Rx} \tag{7}$$

where P_{Rx} is the power received by the mobile station, G_{Rx} is the antenna gain in dBi of the mobile station, and the effective isotropic radiated power (EIRP) is given by:

$$EIRP[\text{dBm}] = P_{Tx} + G_{Tx} - L_{Tx} \tag{8}$$

where P_{Tx} is the transmission power in dBm of the BTS, G_{Tx} is the transmitting antenna gain in dBi, and L_{Tx} is the cable loss in dB due to possible antenna mismatch. Table II lists the values chosen for each parameter of the link budget equation.

TABLE II: Simulation Parameters

Parameter	Value
Frequency f	28 GHz
Max EIRP	43 dBm
Antenna Gain G_{Tx}	24 dBi
Transmission Power P_{Tx}	19 dBm
Receiver Antenna Gain G_{Rx}	0 dBi
Cable Losses L_{Tx}	0 dB

D. Identifying Cell Ranges

By using the link budget equation in (7) and considering the simulation parameters given in Table II, the separation distance can be found for several receiver sensitivities. The calculated distance constitutes the cell range for a given BTS that satisfies the received power requirement. These calculations are summarized in Table III. A main observation is that the resulting cell ranges become significantly smaller when the

receiver sensitivity is higher. Cell ranges that are too small (below 10 meters) are not considered since such small ranges are not desirable for real deployment.

III. Network Deployment

We now consider a small geographical area in downtown Austin, Texas, to deploy the 5G network. A diagrammatic view of our proposed strategy is shown in Fig. 1. The selected area is shown in Fig. 2(a) and delimited in red on the map of Fig. 2(b). This area already contains several locations where LTE sites are already built and which will be the starting points of the gradual 5G network deployment strategy. The initial LTE cell tower locations are obtained from an online cell tower database (www.opencellid.org). We consider a worst case scenario where no line-of-sight components are available.

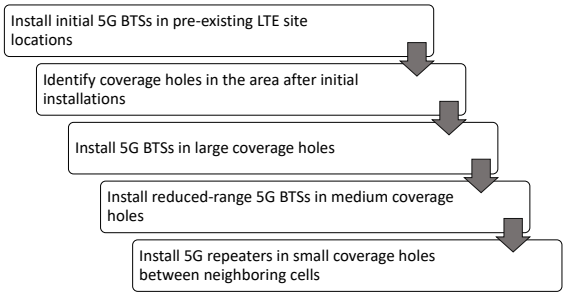
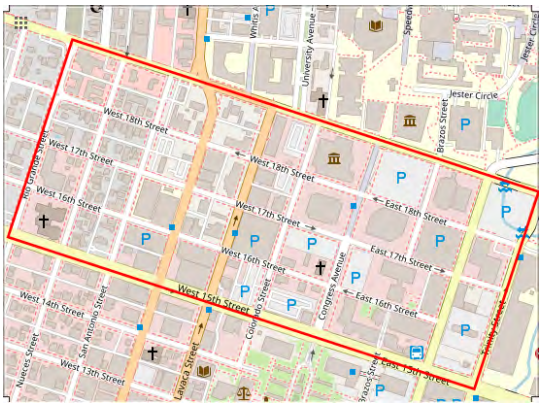


Fig. 1: Gradual Deployment Strategy

The first step of deployment starts by building 5G BTSs in the areas where LTE BTSs already exist, a technique known as co-siting. The main aim of co-siting is to reduce capital expenditures (CapEx) required to erect the 5G sites and minimize the operational expenditures (OpEx) needed to sustain their operation. UMa-NLOS towers will be placed in these locations. The receiver sensitivity is considered to be -78 dBm which, according to Table III, sets the cell range of each UMa to be 53 meters. The coverage of the initial BTSs installed is shown in Fig. 3, after slightly changing the location of the BTS within the same area it is built on, which may be any building rooftop, to lessen interference and provide better coverage. It can be noticed that these initial cells do not provide coverage to the whole area due to the small cell range of each BTS. Theoretically, this range can be increased but would demand the EIRP to be increased above the allowed limit of 43 dBm, by increasing the transmission power and selecting a higher-gain massive MIMO antenna configuration

The next step is the identification of coverage holes, as shown in Fig. 4. Large coverage holes are can be noticed, where several UMa towers can be distributed to provide good coverage. Smaller coverage hole are also be identified. Some of these holes are very small areas between neighboring cells where 5G repeaters, such as the one described in [16], can be placed to cover these small holes. Other small holes are not small enough to be fixed merely by the placement of a repeater, and are neither too big to place a BTS with a cell

(a)



(b)

Fig. 2: Geographical area of interest in Austin, Texas (a) Satellite View (b) Map View

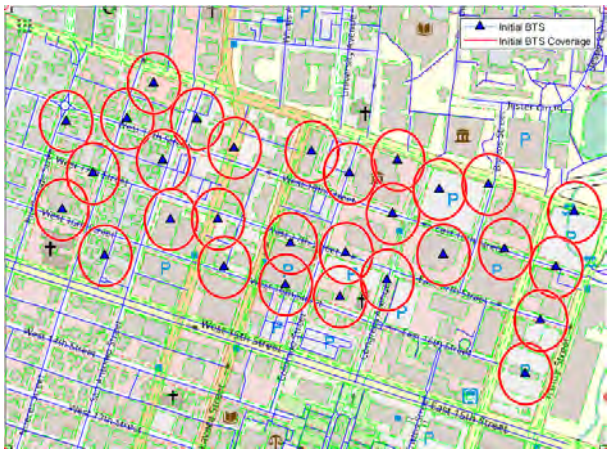


Fig. 3: Coverage of initial 5G BTSs built at the locations of pre-existing LTE cell towers

range of 53 meters. In such locations, reduced-range towers can be placed to provide coverage. The coverage range for these towers can be shrinked by reducing transmission power and choosing smaller MIMO antennas. We calculate the cell range for the reduced-range BTS towers to be approximately 30 meters and estimate the coverage of the 5G repeater to be 15 meters. The final design of the deployed 5G network is shown in Fig. 5. It can be observed that the deployment of a 5G network in an area as small as the one presented requires a densification of cell towers and signal repeaters, which in turn will cause much more radiation.

TABLE III: Calculated Cell Ranges for Several Receiver Sensitivities in Various Environments

	Cell Range (meters) for EIRP = 43 dBm					
Receiver Sensitivity	**UMa-LOS**	**UMa-NLOS**	**UMi-S.C.-LOS**	**UMi-S.C.-NLOS**	**UMi-O.S.-LOS**	**UMi-O.S.-NLOS**
-78 dBm	302	53	334	38.5	385	60
-70 dBm	165	29.7	186	22.3	216	33
-65 dBm	105.5	22	120	15.7	139	22.5
-60 dBm	65	14.1	74.5	11	85	15.3
-55 dBm	38.5	×	44.5	×	55	×
-50 dBm	22.6	×	26	×	27	×
-47 dBm	16.2	×	18.6	×	20	×

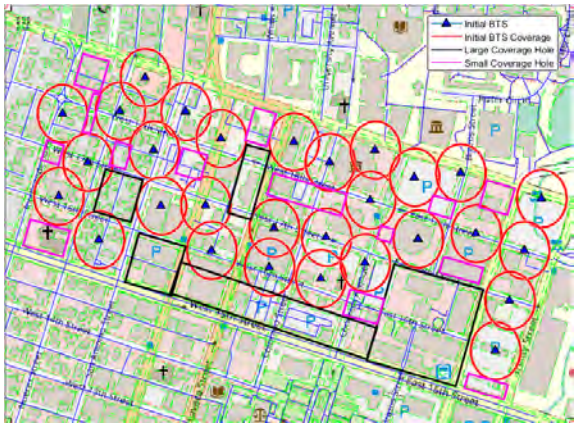


Fig. 4: Coverage holes identified after initial BTS installations

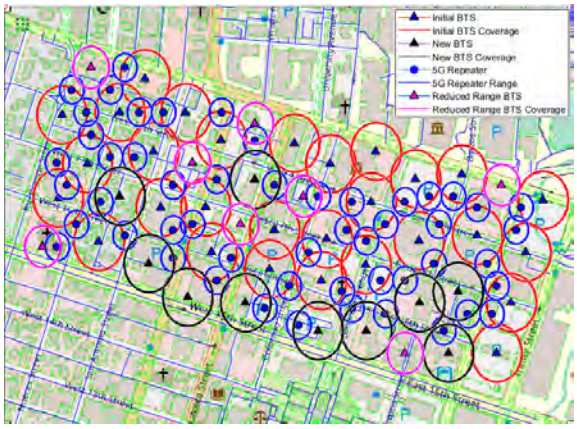


Fig. 5: Deployed 5G Network

IV. Radiation Analysis

A. Exposure Limits

Although mmWave radiation is non-ionizing, the absorption of mmWave energy in the human body causes heating to the skin and eyes. This has caused serious concerns in terms of potential health risks that might come along with the introduction of 5G networks [17]. For this reason, before introducing mmWave devices into the market, they need to comply to several exposure limits that have been specified in several standards and specifications. The specific absorption rate (SAR) has often been used as the metric to determine exposure compliance. The SAR measures the amount of energy absorbed by the human body while using a mobile phone. However, at high frequencies, this absorption is restricted to the skin level and thus it would be difficult to use the SAR as a measure for exposure limits at mmWave frequencies. The power density (P_D) measured in W/m^2 has been the preferred metric in the mmWave domain.

For the frequency range of 2 to 300 GHz, the IEEE C95.1-2019 standard [18] specifies a limit power density value of 10 W/m^2 in restricted environment and 50 W/m^2 in unrestricted environments. These correspond to an averaging time of 30 minutes. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020 guidelines for limiting exposure to electromagnetic fields [19] specify the general public exposure limit at 10 W/m^2 for frequencies between 2 and 300 GHz with the averaging time being 30 minutes. Similar limits are specified by the Federal Communications Commission (FCC) in [20] where a restriction of 10 W/m^2 for the general public has been set. In contrast, the institute for building biology and sustainability (IBN) in Germany have specified the exposure limit to be less than 0.1 $\mu W/m^2$ in their 2015 Standard of Building Biology Measurement Technique (SBM-2015) [21], which is a million-fold lower than what is specified by the aforementioned guidelines. This suggests that negative health effects can occur at levels much lower than 10 W/m^2. Finally, the Chinese ministry of health [22] have set the power density exposure limit to 0.1 W/m^2.

TABLE IV: General Public Power Density Restrictions for the Frequency Range of 2 to 300 GHz

	IEEE C95.1-2019	ICNIRP	FCC	China	SBM-2015
P_D Limit (W/m^2)	10	10	10	0.1	10^{-6}

B. Power Density Assessment

The power density P_D radiated by a transmit antenna can be expressed at a far-field distance d using the following:

$$P_D = \frac{G_{Tx} P_{Tx}}{4\pi d^2} \tag{9}$$

The far-field distance is defined as the Fraunhofer distance expressed by:

$$d_{far-field} = \frac{2D^2}{\lambda} \tag{10}$$

where D is the largest dimension of the antenna and λ is the wavelength that corresponds to a frequency of operation. For distances less than the far-field distance, the power density cannot be computed using (9) and there would be a need to resort to numerical modeling methods such as the finite element method or finite-difference time domain.

C. Results

Fig. 6 shows the value of the power density for several choices of transmission power and transmit antenna gain in the distance range of 1 to 5 meters. For the proposed 5G network, we considered a transmission power of 19 dBm and a transmit antenna gain of 24 dBi. This corresponds to a value of 1.59 W/m^2 at 1 meters which drops to 0.06 W/m^2 at 5 meters. These values comply with the limits set by IEEE, ICNIRP, and FCC, since they are much lower than 10 W/m^2, but do not comply with SBM-2015 and Chinese Ministry of Health regulations. Fig. 7 shows the variations of the power density over the range of 20 to 50 meters. At 50 meters, which is at proximity of the cell edge, the power density drops further to $6.35 \times 10^{-4} W/m^2$ which is still much higher than the limit of the SBM-2015 guidelines. As shown in both Fig. 6 and Fig. 7, increasing the transmission power or choosing an antenna with a higher gain leads to an increase in the radiated power density. To comply with the limit set by China, the total EIRP needs to be dropped to achieve a power density below 0.1 W/m^2 which comes at the expense of a reduced cell range (below 50 meters). This makes it more difficult to plan cost-efficient 5G networks.

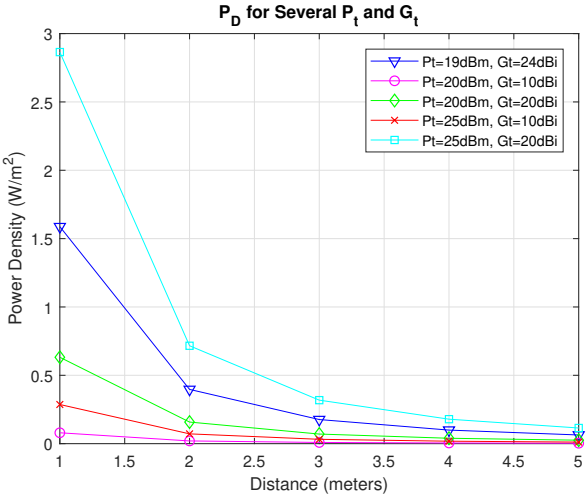


Fig. 6: Power Densities for Several Transmission Powers and Antenna Gains for the range of 1 to 5 meters

Cumulative Distribution Function (CDF) plots for the power density levels experienced in both the pre-existing LTE network and the newly deployed 5G network are shown in Fig. 8. The additional radiations imposed by the 5G network significantly increase the probability of being exposed to power density levels of more than 0.5 W/m^2 and that could reach up to the range of 2 to 2.5 W/m^2, while such power

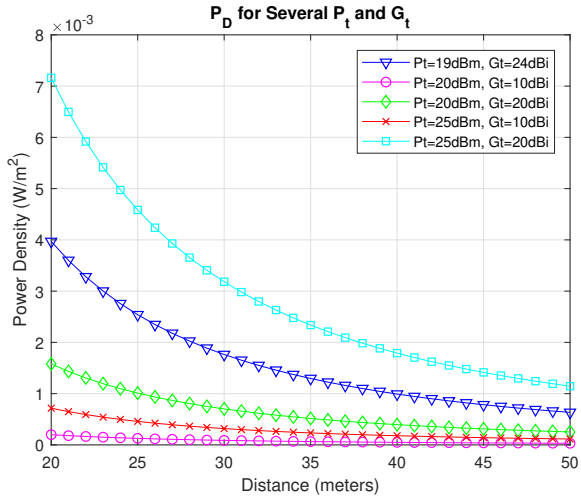


Fig. 7: Power Densities for Several Transmission Powers and Antenna Gains for the range of 20 to 50 meters

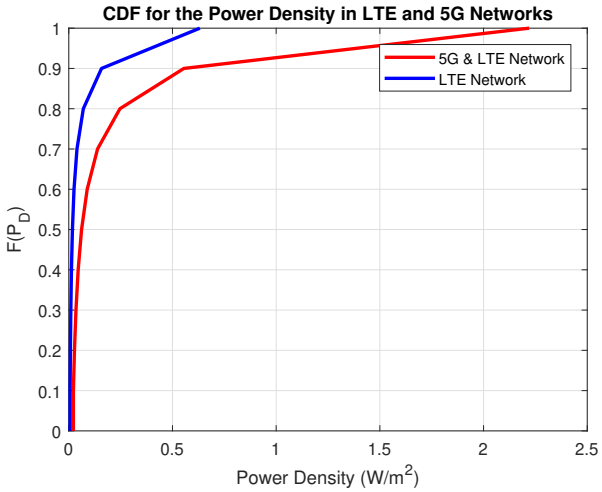


Fig. 8: CDF for the power densities levels for both pre-existing LTE and deployed 5G network

density levels were not experienced in the pre-existing LTE network. This is why the CDF of the power density in the pre-exisitng LTE network reaches the limiting factor of 1 for a power density around 0.65 W/m^2

Fig. 9 shows a heat-map representing the radiated power by the LTE BTSs in the area under study before deploying the 5G network, where a simplified path loss model [23] is considered for an urban macrocell. In Fig. 10, a similar heat-map is shown after the deployment of the 5G network. The remarkable increase in radiation levels after integrating 5G infrastructure with the original LTE network can be easily observed through the predominance of the red color in the heat map.

The presented results clearly show that the potential radiation levels that will be reached upon the roll out of 5G networks do not comply with all of the aforementioned

exposure limits. This suggests that 5G mobile networks can not yet be classified as safe for the public, and demands serious considerations before using mmWave communications for 5G networks, given the potential harms it could afflict on the public. This paves the way to the consideration of hybrid transmission techniques including traditional electromagnetic waves, free-space optics and visible light communication

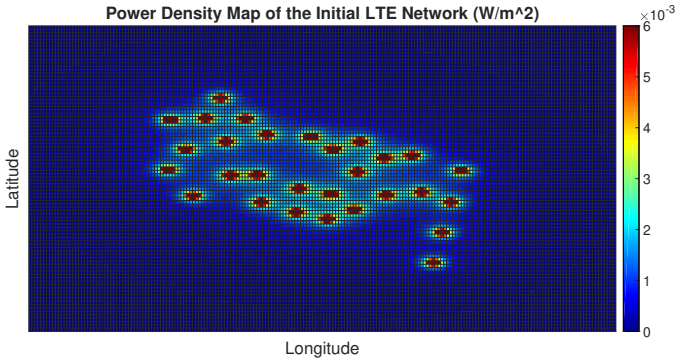


Fig. 9: Power Density Map of the Initial LTE Network

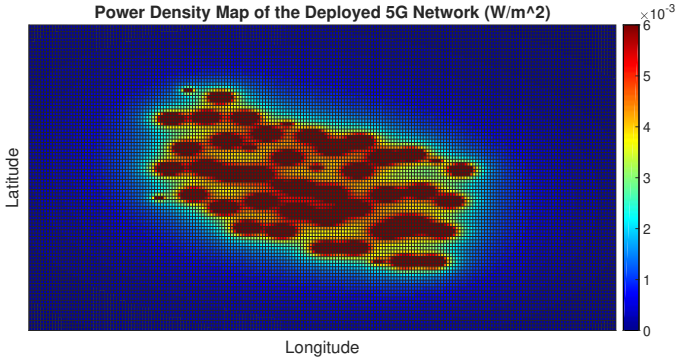


Fig. 10: Power Density Map of the Deployed 5G Network

V. Conclusion

This paper presented an analysis of the radiation levels in a deployed 5G network in an urban outdoor environment. Under the constraints of exposure limits, several challenges face the design and planning of such radiation aware 5G networks. Cell ranges need to be reduced to comply with the maximum allowed radiated power, requiring the densification of small cells in small areas and making it more costly to deploy these radiation-aware 5G networks. Although in this work we considered the maximum allowed EIRP prior to network deployment, results showed power density levels that do not satisfy all the exposure limits set by several sources. In this regard, a positive impact can be imposed by radiation-aware 5G networks on several levels. On a governmental level, the exposure limits for the power density need to be revised using today's data and approaches to bridge the gap between the thresholds specified by the different institutes and commissions. On a technological and scientific level, the radiation exposure constraint can open the door for innovative 5G solutions targeted to limit the health risks and economic barriers associated with this problem. This work can be extended by developing an analytical framework to efficiently rank and rate different cell allocation alternatives to minimize the potential radiations given a carefully chosen list of key performance indicators.

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Cureus

Open Access Review Article

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An Exploration of the Effects of Radiofrequency Radiation Emitted by Mobile Phones and Extremely Low Frequency Radiation on Thyroid Hormones and Thyroid Gland Histopathology

Tasnim Alkayyali [1], Olive Ochuba [2], Kosha Srivastava [3], Jasmine K. Sandhu [4], Christine Joseph [4], Sheila W. Ruo [5], Ashish Jain [2], Ahsan Waqar [4], Sujan Poudel [3]

1. Pathology, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA 2. Internal Medicine, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA 3. Neurology, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA 4. Family Medicine, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA 5. General Surgery, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA

Corresponding author: Tasnim Alkayyali, kayyali.tasnim@gmail.com

Abstract

The use of mobile phones has widely increased over the last two decades. Mobile phones produce a radiofrequency electromagnetic field (RF-EMF), a form of non-ionizing radiation. In contrast to the ionizing radiation proven to cause DNA damage, the harmful effects of non-ionizing radiation on the human body have not been discovered yet. The thyroid gland is among the most susceptible organs to mobile phone radiation due to its location in the anterior neck. Our purpose in this literature review is to explore the effects of the electromagnetic field (EMF), especially radiofrequency emitted from mobile phones, on thyroid hormones and thyroid gland histopathology. We searched PubMed and Google Scholar databases for relevant studies published after the year 2000, using the following keywords: ‘cell phones', ‘mobile phones', ‘telephones', ‘electromagnetic fields', ‘radiofrequency radiation', ‘microwaves', ‘thyroid gland', ‘thyroid hormones', and ‘thyroid cancer'. Our review revealed that mobile phone radiofrequency radiation (RFR) might be associated with thyroid gland insufficiency and alterations in serum thyroid hormone levels, with a possible disruption in the hypothalamic-pituitary-thyroid axis. The review also showed histopathological changes in the thyroid gland follicles after exposure of rats to non-ionizing radiation. The results were directly related to the amount and duration of exposure to EMF radiation. Further human studies exploring thyroid gland hormones, microscopic morphology, and thyroid cancer are highly recommended for future researches.

Categories: Endocrinology/Diabetes/Metabolism, Pathology, Radiology
Keywords: mobile phones, cell phones, electromagnetic field, radiofrequency, microwaves, low-frequency radiation, thyroid hormones, thyroid gland, thyroid cancer

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Introduction And Background

'I do not doubt in my mind that, at present, the greatest polluting element in the earth’s environment is the proliferation of electromagnetic fields (EMFs),' said Dr. Robert O. Becker (1923 – 2008), a researcher from the United States (US) in electromedicine and a Nobel Prize winner [1]. In 2021, mobile phone subscriptions surpassed eight billion users worldwide, and the number is expected to increase to 8.8 billion by 2026 [2]. Mobile phones use EMFs with frequencies ranging from 450-3800 MHz [3]. The EMF comprises both an electric field and a magnetic field; the electric field is produced between positive and negative electric charges and, in contrast, a magnetic field can be generated by the movement of electrons, known as electric current [4]. Electromagnetic waves are classified based on their frequencies, i.e., the number of cycles per second, measured in Hertz (Hz) [4]. High-frequency EMFs (HF-EMFs), including gamma rays, X-rays, and higher ultraviolet lights, are forms of ionizing radiation, therefore, capable of breaking the DNA bonds of human cells [5].

Non-ionizing forms of radiation include lower frequencies on the electromagnetic spectrum and are not proven to cause DNA damage directly (Figure *1*). Examples of extremely low frequency-EMFs (ELF-EMF) include electricity from power sockets at homes, power lines, and electrical devices such as hair dryers [5]. Radiofrequency-EMF (RF-EMF) is also a subtype of non-ionizing radiation with frequencies ranging from 30 kHz-300 GHz [6]. Radiofrequency-based technology has increased dramatically over the last few decades; it includes mobile phones, computer monitors, tablets, radio and television broadcasting antenna towers, wireless fidelity (Wi-Fi), radars, MRI, and microwave ovens [6].

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International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure

An introduction to the International EMF Scientist Appeal

The current issue of the European Journal of Oncology contains a document the "International EMF Scientist Appeal" (EMFscientist.org) that addresses the concerns of 215 scientists from 40 nations about the adverse health effects on the human population exposed to non-ionizing electromagnetic fields (EMF) from extremely-low frequency to radiofrequency. The Appeal has been submitted to the United Nations, to two of its sub-agencies, the World Health Organization (WHO) and the United Nations Environmental Programme (UNEP), and to all UN Member Nations.

We note that the overall weight of evidence reported in peer-reviewed, scientific studies strongly supports greater precautionary measures be taken to reduce or eliminate EMF exposure.

Coordinating and Advisory Committee for the "International EMF Scientist Appeal" (Martin Blank, Magda Havas, Elizabeth Kelley, Henry Lai, and Joel Moskowitz). We can be reached through Elizabeth Kelley at info@EMFscientist.org.

To: His Excellency Ban Ki-moon, Secretary-General of the United Nations;
Honorable Dr. Margaret Chan, Director-General of the World Health Organization; Honorable Achim Steiner, Executive Director of the U.N. Environmental Programme; U.N. Member Nations

Summary. We are scientists engaged in the study of biological and health effects of non-ionizing electromagnetic fields (EMF). Based upon peer-reviewed, published research, we have serious concerns regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices. These include–but are not limited to–radiofrequency radiation (RFR) emitting devices, such as cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors as well as electric devices and infra-structures used in the delivery of electricity that generate extremely-low frequency electromagnetic field (ELF EMF).

Scientific basis for our common concerns

Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being

in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.

These findings justify our appeal to the United Nations (UN) and, all member States in the world, to encourage the World Health Organization (WHO) to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about health risks, particularly risk to children and fetal development. By not taking action, the WHO is failing to fulfill its role as the preeminent international public health agency.

Inadequate non-ionizing EMF international guidelines

The various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) established in 1998 the "Guidelines For Limiting Exposure To Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)" (1). These guidelines are accepted by the WHO and numerous countries around the world. The WHO is calling for all nations to adopt the ICNIRP guidelines to encourage international harmonization of standards. In 2009, the ICNIRP released a statement saying that it was reaffirming its 1998 guidelines, as in their opinion, the scientific literature published since that time "has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields (2). ICNIRP continues to the present day to make these assertions, in spite of growing scientific evidence to the contrary. It is our opinion that, because the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, they are insufficient to protect public health.

The WHO adopted the International Agency for Research on Cancer (IARC) classification of extremely low frequency electromagnetic field (ELF EMF) in 2002 (3) and radiofrequency radiation (RFR) in 2011 (4). This classification states that EMF is a *possible human carcinogen (Group 2B)*. Despite both IARC findings, the WHO continues to maintain that there is insufficient evidence to justify lowering these quantitative exposure limits.

Since there is controversy about a rationale for setting standards to avoid adverse health effects, we recommend that the United Nations Environmental Programme (UNEP) convene and fund an independent multidisciplinary committee to explore the pros and cons of alternatives to current practices that could substantially lower human exposures to RF and ELF fields. The deliberations of this group should be conducted in a transparent and impartial way. Although it is essential that industry be involved and cooperate in this process, industry should not be allowed to bias its processes or conclusions. This group should provide their analysis to the UN and the WHO to guide precautionary action.

Collectively we also request that:

1. children and pregnant women be protected;
2. guidelines and regulatory standards be strengthened;
3. manufacturers be encouraged to develop safer technology;
4. utilities responsible for the generation, transmission, distribution, and monitoring of electricity maintain adequate power quality and ensure proper electrical wiring to minimize harmful ground current;
5. the public be fully informed about the potential health risks from electromagnetic energy and taught harm reduction strategies;
6. medical professionals be educated about the biological effects of electromagnetic energy and be provided training on treatment of patients with electromagnetic sensitivity;
7. governments fund training and research on electromagnetic fields and health that is independent of industry and mandate industry cooperation with researchers;

Bioelectromagnetics 18:455–461 (1997)

RF Radiation–Induced Changes in the Prenatal Development of Mice

Ioannis N. Magras[1]* and Thomas D. Xenos[2]

[1]*Department of Anatomy, Histology, and Embryology, School of Veterinary Medicine, Aristotle University of Thessaloniki, Thessalonike, Greece*
[2]*Department of Telecommunications, School of Electrical Engineering and Computer Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece*

The possible effects of radiofrequency (RF) radiation on prenatal development has been investigated in mice. This study consisted of RF level measurements and in vivo experiments at several places around an ''antenna park.'' At these locations RF power densities between 168 nW/cm^2 and 1053 nW/cm^2 were measured. Twelve pairs of mice, divided in two groups, were placed in locations of different power densities and were repeatedly mated five times. One hundred eighteen newborns were collected. They were measured, weighed, and examined macro- and microscopically. A progressive decrease in the number of newborns per dam was observed, which ended in irreversible infertility. The prenatal development of the newborns, however, evaluated by the crown-rump length, the body weight, and the number of the lumbar, sacral, and coccygeal vertebrae, was improved. *Bioelectromagnetics 18:455–461, 1997.* © 1997 Wiley-Liss, Inc.

Key words: RF radiation effects; prenatal development; mice development

Five years ago the ''antenna-park of Thessaloniki'' progressively developed on the top of the nearby mountain Chortiatis, 1.5 km away from a small village of the same name. Today, almost 100 commercial TV and FM-radio broadcasting transmitters in the VHF and the UHF bands are situated there. The antennas are installed on towers well visible from a large part of the village. Living so close to the antennae and the vast amount of RF power they transmit, which is of the order of 300 kW, the people of the village Chortiatis, anxious for their health, encouraged the author to undertake a research program.

The hypothesis that RF radiation may adversely affect the health of the animal organism is still under consideration in public and scientific forums. One of the critical issues seems to be the RF effects on the reproductive process [Chernoff et al., 1992]. Numerous studies dealing with this subject ended up with seemingly contradictory results. Therefore, an ''in vivo'' study on experimental animals sensitive to RF radiation, was chosen. Based on the relevant literature, this research investigated RF radiation effects on the reproductive system, particularly on prenatal development. The mouse was selected as the experimental animal, because it is easily manipulated in the environment in which the experiments had to take place. Of course, experimenting at the mountain sites, far from the easily controlled laboratory conditions, might add a certain amount of uncertainty; therefore, these experiments should be considered preliminary.

MATERIALS AND METHODS

We used a total of 36 mice (18 females and 18 males), 2 months old and sexually mature (BALB/c/f breed colony). Breeding colony virgin males and females were obtained from the ''Theageneion Anticancer Institute of Thessaloniki.'' The use of these experimental animals was approved by the Veterinary Service of the Municipality of Thessaloniki, according to the provisions of the laws 1197/81 and 2015/92 and the Presidential Decree 160/91 of the Greek Democracy. Upon arrival, all experimental animals were quarantined for 2 weeks to discover and to allow them to acclimatise the mountain environment, an altitude ranging between 570 (position h) and 730 m (position d) above sea level. All the mice were healthy at the end of this period and showed no signs of illness during

*Correspondence to: Ioannis N. Magras, Department of Anatomy, Histology, and Embryology, School of Veterinary Medicine, Aristotle University of Thessaloniki, 540-06 Thessaloniki, Greece.

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The human skin as a sub-THz receiver – Does 5G pose a danger to it or not?

Noa Betzalel[a], Paul Ben Ishai[a,b], Yuri Feldman[a,*]

[a] Department of Applied Physics, The Rachel and Selim Benin School of Engineering and Computer Science, The Hebrew University of Jerusalem, Edmond J. Safra Campus, Jerusalem 91904, Israel

[b] Department of Physics, Ariel University, Ariel 40700, Israel

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Sweat duct

ABSTRACT

In the interaction of microwave radiation and human beings, the skin is traditionally considered as just an absorbing sponge stratum filled with water. In previous works, we showed that this view is flawed when we demonstrated that the coiled portion of the sweat duct in upper skin layer is regarded as a helical antenna in the sub-THz band. Experimentally we showed that the reflectance of the human skin in the sub-THz region depends on the intensity of perspiration, i.e. sweat duct's conductivity, and correlates with levels of human stress (physical, mental and emotional). Later on, we detected circular dichroism in the reflectance from the skin, a signature of the axial mode of a helical antenna. The full ramifications of what these findings represent in the human condition are still unclear. We also revealed correlation of electrocardiography (ECG) parameters to the sub-THz reflection coefficient of human skin. In a recent work, we developed a unique simulation tool of human skin, taking into account the skin multi-layer structure together with the helical segment of the sweat duct embedded in it. The presence of the sweat duct led to a high specific absorption rate (SAR) of the skin in extremely high frequency band. In this paper, we summarize the physical evidence for this phenomenon and consider its implication for the future exploitation of the electromagnetic spectrum by wireless communication. Starting from July 2016 the US Federal Communications Commission (FCC) has adopted new rules for wireless broadband operations above 24 GHz (5 G). This trend of exploitation is predicted to expand to higher frequencies in the sub-THz region. One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.

1. Introduction

The world is galloping towards a bright new future, or at least so industry would like us to think. The advent of 5 G promises unforetold connectivity and unparalleled integration with the virtual world (Agiwal et al., 2016). Technology will interact with almost every aspect of our daily lives (Boccardi et al., 2014), as well as expose us to rich and varied data streaming on our cellular and Wi-Fi devices. While all of this may be true it comes with a price tag. To afford such heavy data traffic we must accept an expansion in data channels (Ben Ishai et al., 2016), something that is not possible in the currently used frequency channels, and an attendant explosion in base stations (Ge et al., 2016). This is the rational to move to 5 G, a FCC standard, which will start at 28 GHz (FCC Report 16–89), soon utilize frequencies up to 60 GHz and may eventually reach the sub - Terahertz range (FCC 50–50 Report).

Industry has assumed that there will be no health risks from this advance (T. Wu et al., 2015a, 2015b) and consequently it has based its planning on the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), published in 1998 (Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). International Commission on Non-Ionizing Radiation Protection," 1998). This recommendation limits exposure in the 5 G range to a power density of 10 W/m^2 for the general public and to 50 W/m^2 for occupational exposure ("Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). International Commission on Non-Ionizing Radiation Protection," 1998).

However, in recent years concerns have surfaced about possible non-thermal biological effects, and ensuing health issues, arising from cellular electromagnetic radiation (Adams et al., 2014; Blank and Goodman, 2009; Darbandi et al., 2017; Hardell and Sage, 2008; Liu et al., 2013; Panagopoulos, 2017; Sage and Carpenter, 2009; Terzi et al., 2016). These should raise a red flag for the implementation of the 5 G standard. One reason being that the modality of our interaction

* Corresponding author.
E-mail address: yurif@mail.huji.ac.il (Y. Feldman).

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INCREASED INCIDENCE OF CANCER NEAR A CELL-PHONE TRANSMITTER STATION.

RONNI WOLF MD[1]

DANNY WOLF MD[2]

From:

The Dermatology Unit, Kaplan Medical Center, Rechovot, and the Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, ISRAEL.

The Pediatric Outpatient Clinic, Hasharon Region, Kupat Holim, ISRAEL.

Running title: Cancer near a cell-phone transmitter station.

Address for correspondence: Ronni Wolf, MD, Dermatology Unit, Kaplan Medical Center, Rechovot 76100, ISRAEL.
Fax 972-9-9560978. E-mail: wolf_r@netvision.net.il

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Increased Incidence of Cancer near a Cell-Phone Transmitter Station
by Ronni Wolf and Danny Wolf

Abstract

Significant concern has been raised about possible health effects from exposure to radiofrequency (RF) electromagnetic fields, especially after the rapid introduction of mobile telecommunications systems. Parents are especially concerned with the possibility that children might develop cancer after exposure to the RF emissions from mobile telephone base stations erected in or near schools. The few epidemiologic studies that did report on cancer incidence in relation to RF radiation have generally presented negative or inconsistent results, and thus emphasize the need for more studies that should investigate cohorts with high RF exposure for changes in cancer incidence. The aim of this study is to investigate whether there is an increased cancer incidence in populations, living in a small area, and exposed to RF radiation from a cell-phone transmitter station.

This is an epidemiologic assessment, to determine whether the incidence of cancer cases among individuals exposed to a cell-phone transmitter station is different from that expected in Israel, in Netanya, or as compared to people who lived in a nearby area. Participants are people (n=622) living in the area near a cell-phone transmitter station for 3-7 years who were patients of one health clinic (of DW). The exposure began 1 year before the start of the study when the station first came into service. A second cohort of individuals (n=1222) who get their medical services in a clinic located nearby with very closely matched, environment, workplace and occupational characteristics was used for comparison.

In the area of exposure (area A) eight cases of different kinds of cancer were diagnosed in a period of only one year. This rate of cancers was compared both with the rate of 31 cases per 10,000 per year in the general population and the 2/1222 rate recorded in the nearby clinic (area B). Relative cancer rates for females were 10.5 for area A, 0.6 for area B and 1 for the whole town of Netanya. Cancer incidence of women in area A was thus significantly higher ($p<0.0001$) compared with that of area B and the whole city. A comparison of the relative risk revealed that there were 4.15 times more cases in area A than in the entire population.

The study indicates an association between increased incidence of cancer and living in proximity to a cell-phone transmitter station.

ARIEL UNIVERSITY

September 08, 2017

The Honorable Jerry Brown
Governor, State of California
c/o State Capitol, Suite 1173
Sacramento, CA 95814

RE: SB 649 (Hueso) – Small Cell Wireless Facilities

Honorable Governor Brown,

I have recently learned of proposed Bill SB 649 regarding the streamlining of small cell wireless facilities.

As a member of the Physics department of Ariel University, and before that the Hebrew University of Jerusalem, I have studied the subtle effects of electromagnetic radiation on biology and biological materials. I have published more than 50 articles in the field of Dielectrics (the study of the interaction of materials with radio waves), including many on the interaction of cellular frequencies with biological materials such as proteins and blood. My last article investigated the interaction of 5G electromagnetic radiation with human skin.[1] One could argue that I have a certain amount of expertise.

In light of our work and a growing number of publications showing the frequency range of 5G can have serious biological effects, we believe that current efforts to accelerate the implementation of 5G should be delayed until additional studies are made to assess the critical impact on human health.

It is not for me to lecture to elected officials on how cities should develop technologically, nor is it for me to try and stop the juggernaut that is the cellular industry. However, I would like to point out to you important information on the possible public health implications of the explosion in unregulated cellular phone and wireless device use.

The term "health" has never featured too heavily in the lexicon of the Cellular Industry. It has been assumed, conveniently, that any possible effects on the human anatomy from the use of cell phones would be only mild heating. And that this is something that the body could easily deal with. As a consequence, the governing safety limits were set in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) based on the premise that if radiofrequency radiation limits protected human tissue from overheating, then the public was adequately protected. They considered that the effect to humans would at most cause the agitation of water inside cellular tissues that would dissipate as heat, similar to what a microwave oven does, but at far lower energies.

The trouble is that our knowledge has progressed in the last 19 years and we now understand that the interaction of microwave energy and our tissues is far more subtle. There is increasing evidence of non-thermal biological consequences arising from our interaction with cellular phone radiation. A few examples; in 2014 a team from the University of Exeter, UK published a report linking the effect of

[1] Betzalel, Noa, Yuri Feldman and Paul Ben Ishai. "The Modeling of the Absorbance of Sub-THz Radiation by Human Skin." *IEEE Transactions on Terahertz Science and Technology* PP.99 (2017): 1-9. doi: 10.1109/TTHZ.2017.2736345.

+972.3.9066111
Ariel 40700, Israel

ARIEL UNIVERSITY

cellular phones on declining sperm quality.[2] They based their research on over 1492 subjects from around the world. In 2009, Columbia University showed that radio frequencies were leading to stress in living cells.[3] This in turn seriously affects their ability to perform, as particular cellular pathways were disrupted. Further evidence along this direction was provided by a group from the University of Rennes.[4] I can add plenty more examples, but I think that it is summed up by a recent public announcement. Advisors to the World Health Organization International Agency for Research on Cancer (WHO/IARC), themselves well versed in radio frequencies and in cancer, have publicly stated that evidence has been met to classify cellular radiation as meeting scientific criteria for a Group 1 carcinogenic agent to humans.[5,6]

As I said above, it is not my job and neither is it realistic for me to stop the placing of thousands of antennas throughout your state. But it is my job to point out the health hazard to you before you make such a momentous decision.

Yours sincerely

Dr. Paul Ben Ishai
Department of Physics
Ariel University

CC
Tom Dyer, Chief Deputy Legislative Affairs Secretary

[2] Adams, J.A., et al. "Effect of mobile telephones on sperm quality: a systematic review and meta-analysis." *Environment International* 70 (2014): 106-12. doi: 10.1016/j.envint.2014.04.015.

[3] Blank, M. and R. Goodman. "Electromagnetic fields stress living cells." *Pathophysiology* 16.2-3 (2009): 71-8. doi: 10.1016/j.pathophys.2009.01.006.

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doi: 10.1371/journal.pone.0109435

[5] "Cancer Expert Declares Cell Phone and Wireless Radiation As Carcinogenic to Humans." Environmental Health Trust (2017). https://ehtrust.org/cancer-expert-declares-cell-phone-wireless-radiation-carcinogenic-humans/

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+972.3.9066111
Ariel 40700, Israel

Evaluation of the Genotoxicity of Cell Phone Radiofrequency Radiation in Male and Female Rats and Mice Following Subchronic Exposure

Stephanie L. Smith-Roe[1], Michael E. Wyde[1], Matthew D. Stout[1], John W. Winters[2], Cheryl A. Hobbs[2], Kim G. Shepard[2], Amanda S. Green[2], Grace E. Kissling[1], Raymond R. Tice[1], John R. Bucher[1], Kristine L. Witt[1]

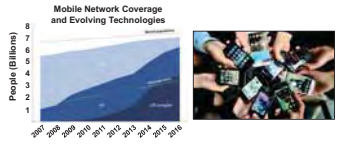
[1]Division of the National Toxicology Program/NIEHS, RTP, NC 27709, USA; [2] Integrated Laboratory Systems, Inc., RTP, NC, 27709, USA

Abstract

The National Toxicology Program tested the two common radiofrequency radiation (RFR) modulations emitted by cellular telephones in a 2-year rodent cancer bioassay that included additional animal cohorts for interim assessments of genotoxicity endpoints. Male and female Sprague Dawley rats and B6C3F1/N mice were exposed from gestation day 5 or postnatal day 35, respectively, to code division multiple access (CDMA) or global system for mobile (GSM) modulations semi-continuously for 18 h/day in 10 min intervals in reverberation chambers at specific absorption rates (SAR) of 1.5, 3, or 6 W/kg (rats) or 2.5, 5, or 10 W/kg (mice). Rats and mice were exposed at 900 MHz or 1900 MHz, respectively. The interim cohorts, 5 animals per treatment group, were examined after 19 (rats) or 13 (mice) weeks of exposure for evidence of RFR-induced genotoxicity. DNA damage was assessed in three brain regions (frontal cortex, hippocampus, and cerebellum), and in liver cells and blood leukocytes using the comet assay. Chromosomal damage was assessed in peripheral blood erythrocytes using the micronucleus assay. DNA damage was significantly increased in the frontal cortex of male mice (both modulations), peripheral leukocytes of female mice (CDMA only), and hippocampus of male rats (CDMA only). DNA damage was nominally elevated in several other tissues of RFR-exposed rats, although statistical significance was not achieved. No significant increases in micronucleated red blood cells were observed in rats or mice. These results suggest that exposure to RFR has the potential to induce measurable DNA damage under certain exposure conditions.

Introduction

- Cellular telephone use is nearly ubiquitous world-wide: cell phone subscriptions were estimated at 6.9 billion in 2014.



- Cell phones transmit radiofrequency radiation (RFR) signals; RFR is a form of electromagnetic radiation.
- Whether exposure to RFR via cell phones can cause cancer, particularly brain cancer, in humans has been of concern. IARC classified radiofrequency electromagnetic fields (RF-EMF), as "possibly carcinogenic to humans (Group 2B)," based on limited evidence in experimental animals and insufficient evidence in humans to support a conclusion on the association between RF-EMF and cancer.
- Results of previous rodent cancer and genotoxicity studies of varying RFR exposures and durations are inconsistent and inconclusive, and many of these studies used experimental protocols with significant limitations. Hence, there is still much uncertainty about the possible adverse effects of RFR, as reflected by the IARC classification.
- The Food and Drug Administration (FDA) Center for Device and Radiation Health nominated Radiofrequency Radiation Emissions of Wireless Communication Devices to the NTP as a high priority nomination in 1999.
- To help inform human health risk assessments, the NTP conducted a 2-year rodent cancer bioassay of the modulations of RFR most commonly emitted by cell phones.
- Genotoxicity testing was conducted using subsets of rats and mice exposed under the same experimental design as the cancer bioassay, albeit for shorter durations.

Study Design, Materials & Methods

Study Design

Male and Female Sprague Dawley Rats (5 rats per exposure group)
- 19 weeks of exposure beginning ~gestational day 5
- 1.5, 3.0, or 6.0 W/kg CDMA or GSM (900 MHz)
- One sham control for each sex

Male and Female B6C3F1/N Mice (5 mice per exposure group)
- 13 weeks of exposure beginning ~postnatal day 35
- 2.5, 5.0, or 10.0 W/kg GSM or CDMA (1900 MHz)
- One sham control for each sex

Whole Body Exposure

Please see Capstick et al. (2017) and Gong et al. (2017) for extensive details

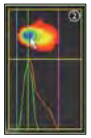
- Daily from 11:00 AM to 2:00 PM and 3:40 PM to 7:00 AM
- RFR cycled on and off every 10 min during exposure periods
  - Total duration of exposure of 9 h 10 min per 24 h period
- An upper limit of 1 °C (1.8 °F) was set as an acceptable increase in body temperature. In 5- and 28-day pilot studies, significant increases in body temperature were rare in rats and mice exposed to 6 or 10 W/kg, respectively (either modulation), and such increases, when they occurred, were < 1 °C. Body temperatue increases > 1 °C were expected to be highly unlikely in this study (Wyde et al., submitted)

RFR Exposure Facility at Illinois Industrial Research Institute (ITRI)

- Reverberation chambers and animal housing were developed in collaboration with the National Institute of Standards and Technology (NIST) and the Foundation for Research on Information Technologies in Society (IT'IS).
- Reverberation chambers created uniform fields of RFR and shielded animals from all other sources of RFR.
- Field uniformity was achieved by installing excitation antennas with rotating horizontal and vertical reflective surface paddles to ensure even distribution of statistically homogenous RFR fields.
- Cages, cage racks, and materials used to deliver food and water were designed to minimize interference with RFR exposure; e.g., specialized lixits were developed to prevent drinking tubes from acting as antennas for RFR.
- RFR field intensity, uniformity, quality of modulation, and numerous other parameters were validated by NIST.
- Consistency of exposure was monitored in real time by IT'IS.

Comet Assay

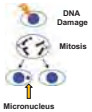
Frontal cortex, hippocampus, cerebellum, liver, and peripheral blood were analyzed in the comet assay. Single-cell suspensions were diluted in agarose and layered onto CometSlides™. Slides were incubated overnight in lysing solution at 4 °C, then treated with cold alkali solution for 20 min to allow DNA unwinding. Slides were then subjected to electrophoresis for 20 min. After staining with SYBR® Gold, slides were coded to mask treatment and scored using Comet Assay IV Imaging Software. DNA migration was measured in 100 non-overlapping comet images per animal/tissue and reported as % Tail DNA. Hedgehogs (HH; all DNA appears by visual inspection to be in the tail) were scored as a separate category.



Comet Assay IV imaging software identifies the left edge of the head of the comet and flips it to construct the right edge. % Tail DNA is calculated by dividing the fluorescence intensity of the tail by the total fluorescence intensity of the entire comet figure.

Micronucleus Assay

Flow cytometric analysis was performed using MicroFlow^{PLUS} Kit reagents and a FACSCalibur™ system. Reticulocytes (RET) and mature erythrocytes (E) were analyzed for micronuclei (MN). For each sample, ~20,000 RET were analyzed and ~1 x 10^6 mature erythrocytes were enumerated concurrently, allowing for calculation of the %RET among total erythrocytes as a measure of bone marrow toxicity. The protocol was consistent with OECD Guideline 474.



Micronucleus (broken chromosomes or whole chromosome loss)

Results for MN-RETs, MN-Es, and %PCEs were negative for both species, both sexes, and both RFR modulations (data not shown).

Figure 1

Two Approaches for Scoring Comets

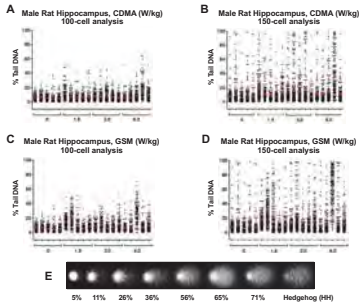


Fig. 1A, C: Comets were selected by a scorer (blind to treatment) for analysis *via* software to determine % Tail DNA. 100 cells were analyzed per animal/tissue and HH – identified by visual inspection – were tabulated but excluded from analysis. However, using this approach, % Tail DNA rarely exceeded 65%, yet for some tissues %HH values were markedly elevated. **Fig. 1B, D**: OECD TG 489 (OECD, 2014) recommends analyzing 150 cells. To be consistent with this new recommendation, and due to inter-animal variability observed in rats, rat slides were re-analyzed using this method; all scorable cells were analyzed with imaging software (i.e., visual inspection alone was not used to eliminate HH). This approach revealed a broader spectrum of DNA damage (Fig. 1B & D). There were few changes in statistically significant results based on scoring 100 vs. 150 cells. **Fig. 1E**: Representative images of DNA migration in the comet assay (% Tail DNA) from male rat frontal cortex.

Figure 2

Positive Results

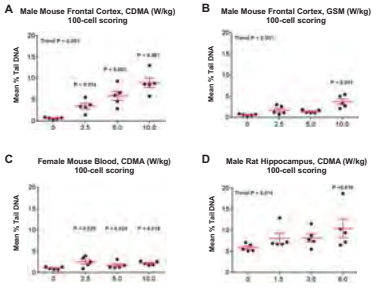
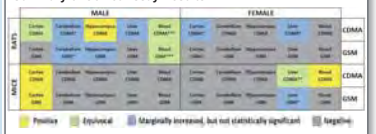


Fig. 2A-D: Of the 40 tissues examined (5 tissues, 2 species, 2 sexes, 2 modulations) using the 100-cell scoring approach, 4 showed positive results using the following criteria: significant trend test ($P < 0.025$) and at least one significant dose group ($P < 0.025$); or at least 2 significant dose groups. Similar results were obtained for these tissues when data were analyzed using the 150-cell method except for male rat hippocampus (means of all exposed groups were greater than the control, but did not reach statistical significance).

Tissues from rats tended to show greater inter-animal variability than those from mice. This inter-animal variability may reflect the genetic diversity of this outbred rat stock. However, % Tail DNA values from different tissues from the same rat rarely correlated, suggesting inter-tissue variability as well.

Figure 3

Summary of Comet Assay Results



Positive: Significant trend test ($P < 0.025$) and at least one significant dose group ($P < 0.025$); or at least 2 significant dose groups. **Equivocal**: Either a significant trend test or one significant dose group. **Marginally increased**: Means of all exposed groups were higher than the control and P values approached statistical significance. **Negative**: none of the above.

In summary, 8/40 tissues exhibited some degree of effect from RFR exposure when assessed using the 100-cell scoring approach. Five tissues exhibited marginal, but statistically non-significant increases when assessed using the 150-cell scoring approach (*). Female mouse liver (CDMA) went from marginal to an equivocal call using the 150-cell scoring approach (**). Two tissues, male rat blood (CDMA and GSM), went from negative to equivocal calls using the 150-cell scoring approach (***).

Conclusions

- When considering both scoring methods, 15/40 of the tissues examined showed some indication of response (positive, equivocal, or increases in % Tail DNA in the absence of statistical significance) in the comet assay. The comet assay is a hazard identification assay, and the damage detected by the assay represents a snapshot of the kinetics of DNA damage and repair processes.
- In the 2-year bioassay, a low incidence of malignant gliomas of the brain was observed in male, but not female, rats exposed to CDMA or GSM in the 2-year cancer bioassay (Wyde et al. 2016). Results are not yet available for mice. Considering that male rat brain tissue was more affected by RFR in the comet assay compared to female rats and male and female mice, it will be of interest to see whether there is a correlation between the comet assay results and the complete findings from the cancer bioassay.
- High exposure levels of RFR can cause hyperthermia in rats and mice, and hyperthermia is known to cause genotoxic effects in both the comet and micronucleus assays; however, the exposures used in the 2-year cancer bioassay (and therefore the genetic toxicity studies) were carefully selected, based on pilot study data, to avoid thermal effects.
- The mechanism by which RFR could induce biological effects other than by increasing body temperature is a matter of intense speculation. The NTP is currently in the process of acquiring smaller RFR whole body exposure chambers for follow-up studies. Initial studies will aim to explore potential mechanisms underlying the observed DNA damage in the comet assay and explore other biomarkers of genetic damage.

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Gong et al. (2017) Life-time dosimetric assessment for mice and rats exposed in reverberation chambers for the two-year NTP cancer bioassay study on cell phone radiation. *IEEE Trans Electromag Compat, in press.*

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Wyde et al. (submitted) Design and validation of the National Toxicology Program's Cell Phone Radiofrequency Radiation Reverberation Chamber Exposure System. *Bioelectromagnetics.*

Dependence of non-thermal biological effects of microwaves on physical and biological variables: implications for reproducibility and safety standards

Igor Y Belyaev
Laboratory of Molecular Genetics, Cancer Research Institute, Bratislava, Slovak Republic
Laboratory of Radiobiology, General Physics Institute, Russian Academy of Science, Moscow, Russia
Department of Genetic and Cellular Toxicology, Stockholm University, Stockholm, Sweden

Abstract

Diverse biological responses, including adverse health effects, to non-thermal (NT) microwaves (MW) have been described by many research groups all over the world. The aim of this paper is to provide an overview of the complex dependence of these effects on various physical and biological parameters, which must be controlled in replication studies.
Besides well-known dependencies on carrier frequency and modulation, emerging data suggest dependencies of NT MW effects on polarization, intermittence and coherence time of exposure, static magnetic field, electromagnetic stray fields, genotype, gender, physiological and individual traits, cell density during exposure. Data also indicate that duration of exposure may be as important as power density (PD) and specific absorption rate (SAR). Further evaluation of these dependencies are needed for understanding the mechanisms by which NT MW affect biological systems, planning *in vivo* and epidemiological studies, developing medical treatments, setting safety standards, and minimizing the adverse effects of MW from mobile communication.

***Key words*: non-thermal effects of microwaves, mobile (cellular) phones, safety standards.**

List of abbreviations:
Anomalous viscosity time dependence (AVTD); blood-brain barrier (BBB); catalase (CAT); Digital Enhanced (former European) Cordless Telecommunications (DECT); circularly polarized (CP); continuous wave (CW); Digital Advanced Mobile Phone System (DAMPS); discontinuous transmission (DTX); electroencephalographic (EEG); electromagnetic field (EMF); embryonic stem (ES) cells; ethidium bromide (EtBr); extremely low frequency (ELF); Gaussian Minimum Shift Keying (GMSK); Ginkgo biloba (Gb); Global System for Mobile Communication (GSM); glutathione peroxidase (GSH-Px); International Commission for Non-Ionizing Radiation Protection (ICNIRP); linearly polarized (LP); malondialdehyde (MDA); micronucleus (MN) assay; microwaves (MWs); N-acetyl-beta-d-glucosaminidase (NAG); nitric oxide (NO); non-thermal (NT); ornithine decarboxylase (ODC); phorbol ester 12-myristate 13-acetate (PMA); phosphorylated H2AX histone (γ-H2AX); power density (PD);

Address: Igor Y Belyaev, Ph D, D Sc. Cancer Research Institute, Slovak Academy of Sciences, Vlárska 7, 833 91 Bratislava, Slovak Republic - Tel: +421 259327322 - Fax: +421 259327305
E-mail: Igor.Belyaev@gmt.su.se

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Toxicology Letters

journal homepage: www.elsevier.com/locate/toxlet

Toxicology and cellular mechanisms of electromagnetic fields (EMF)-Health aspects of exposure to EMF Emitted by wireless mobile systems and emerging technologies

S12-01
Two-year oncogenicity evaluations of cell phone radiofrequency radiation in Sprague-Dawley rats and B6C3F1 mice

David McCormick

IIT Research Institute, Chicago, IL, United States

Epidemiology data concerning possible health effects of exposure to radiofrequency fields (RF) are conflicting. For this reason, well-designed and controlled studies in predictive laboratory animal models provide the best prospective opportunity to identify effects of RF exposure that may translate into human health hazards. The U.S. National Toxicology Program supported a program in our laboratory to identify and characterize effects of acute, subchronic, and chronic exposure to non-thermal levels of RF in Sprague-Dawley rats and B6C3F1 mice. Five-day pilot studies were performed to identify the maximum Specific Absorption Ratios (SARs) to which juvenile, adult, and pregnant rodents can be exposed without increasing body temperature by >1.0 °C. Subsequent subchronic (ten-week) toxicity studies failed to identify any toxicologically significant effects of non-thermal RF on survival, body weight, clinical signs, hematology, or gross or microscopic pathology. Two-year studies were performed to determine if exposure to non-thermal levels of RF increases the incidence of neoplasia in any site. Male rats exposed to RF demonstrated significantly increased incidences of glioma (brain) and schwannoma (heart); these increases were not seen in female rats or in either sex of mice. Gliomas and schwannomas have been identified in some epidemiology studies as possible RF-induced neoplasms. Considering (a) the conflicting results of RF epidemiology studies and (b) the lack of generally accepted biophysical or molecular mechanisms through which RF could induce or promote neoplasia, data from animal bioassays will play a central role in "weight-of-the-evidence" assessments of the possible health effects of RF exposure.

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Wi-Fi is an important threat to human health☆

Martin L. Pall

Washington State University, 638 NE 41st Avenue, Portland, OR 97232-3312, USA

ARTICLE INFO

Keywords:
Electromagnetic field (EMF)
Brain impact
Testis/sperm count and quality
Impact of pulsation and polarization
Activation of voltage-gated calcium channels
Wi-Fi or WiFi

ABSTRACT

Repeated Wi-Fi studies show that Wi-Fi causes oxidative stress, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload. Each of these effects are also caused by exposures to other microwave frequency EMFs, with each such effect being documented in from 10 to 16 reviews. Therefore, each of these seven EMF effects are established effects of Wi-Fi and of other microwave frequency EMFs. Each of these seven is also produced by downstream effects of the main action of such EMFs, voltage-gated calcium channel (VGCC) activation. While VGCC activation via EMF interaction with the VGCC voltage sensor seems to be the predominant mechanism of action of EMFs, other mechanisms appear to have minor roles. Minor roles include activation of other voltage-gated ion channels, calcium cyclotron resonance and the geomagnetic magnetoreception mechanism. Five properties of non-thermal EMF effects are discussed. These are that pulsed EMFs are, in most cases, more active than are non-pulsed EMFs; artificial EMFs are polarized and such polarized EMFs are much more active than non-polarized EMFs; dose-response curves are non-linear and non-monotone; EMF effects are often cumulative; and EMFs may impact young people more than adults. These general findings and data presented earlier on Wi-Fi effects were used to assess the Foster and Moulder (F&M) review of Wi-Fi. The F&M study claimed that there were seven important studies of Wi-Fi that each showed no effect. However, none of these were Wi-Fi studies, with each differing from genuine Wi-Fi in three distinct ways. F&M could, at most conclude that there was no statistically significant evidence of an effect. The tiny numbers studied in each of these seven F&M-linked studies show that each of them lack power to make any substantive conclusions. In conclusion, there are seven repeatedly found Wi-Fi effects which have also been shown to be caused by other similar EMF exposures. Each of the seven should be considered, therefore, as established effects of Wi-Fi.

1. Introduction

Wi-Fi (also known as WiFi or WLAN) is a wireless network involving at least one Wi-Fi antenna connected to the internet and a series of computers, laptops and/or other wireless devices communicating wirelessly with the Wi-Fi antenna. In this way, each such wireless communication device can communicate wirelessly with the internet. All the studies reviewed here were of Wi-Fi using the 2.4 GHz band, although there is also a 5 GHz band reserved for possible Wi-Fi use.

Telecommunications industry-linked individuals and groups have claimed that there are no and cannot possibly be any health impacts of Wi-Fi (Foster and Moulder, 2013; Berezow and Bloom, 2017). However with Wi-Fi exposures becoming more and more common and with many of our exposures being without our consent, there is much concern about possible Wi-Fi health effects. This paper is not focused on anecdotal reports but rather on 23 controlled, scientific studies of such health-related effects in animals, cells including human cells in culture and in human beings (Table 1).

Each of the effects reported above in from 2 to 11 studies, have an extensive literature for their occurrence in response to various other non-thermal microwave frequency EMFs, discussed in detail below. These include (see Table 1) findings that Wi-Fi exposures produce impacts on the testis leading to lowered male fertility; oxidative stress; apoptosis (a process that has an important causal role in neurodegenerative disease); cellular DNA damage (a process causing cancer and germ line mutations); neuropsychiatric changes including EEG changes; hormonal changes.

The discussion here focuses on those Wi-Fi effects which have been found by multiple Wi-Fi studies and have been previously confirmed by non-thermal exposures to other microwave frequency EMFs. The 1971/72 U.S. Office of Naval Medical Research study (Glaser, 1971) reported the following changes related to testis or sperm: 1. Decreased testosterone leading to lowered testis size. 2. Histological changes in testicular epithelial structure. 3. Gross testicular histological changes. 4.

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E-mail address: martin_pall@wsu.edu.

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June 26, 2017

The Honorable Cecilia Agular-Curry, Chair
Assembly Local Gov't Commission
Room 157, 1020 N Street
Sacramento, CA 95814

RE: SB 649 (Hueso) – Small Cell Wireless Facilities - -OPPOSE

Dear Chair Agular-Curry:

Environmental Working Group (EWG) opposes SB 649 by Senator Hueso. This bill would make the installation of small cell wireless facilities, such as those used to facilitate 5G networks, ministerial rather than discretionary at the local government level.

The health impacts of cellular transmissions have been debated more and more passionately the last ten years because there are studies that raise real concerns about the effects of radio frequency (RF) energy or radiation on humans. This is why EWG sponsored two bills by former Senator Leno (SB 1212 in 2010 and SB 932 in 2011) that would have required sellers of cell phones to inform consumers that minimizing exposure to cell phone radiation is prudent and in fact recommended by cell phone manufacturers in their included manuals.

Studies on the health impacts of cell phones and their transmission infrastructure are continuing. As new information becomes available, local government ought to be able to use it to help guide their decision-making, including locational issues such as proximity to homes, school, and hospitals. EWG believes that allowing cities and counties to weigh the potential impacts of transmission networks before permits are issued for their construction is essential and SB 649 would prevent them from doing so. And, if more definitive health concerns arise, state law would have to be changed in order to give local governments the flexiblity to do their due diligence.

For these reasons, we must oppose SB 649 and urge a "no" vote in the Local Government Committee.

Sincerely,

Bill Allayaud

Bill Allayaud
California Director of Government Affairs
Environmental Working Group

cc: Senator Hueso

SB 649 Would Eliminate the Ability of Communities to Promote their Interests and Priorities.

It is important to remember that the rights-of-way that providers use to build out their networks are **owned by communities and managed by municipalities**.[1] Currently, if a phone or broadband provider wants access to a local community's right-of-way, it can negotiate with that community for a franchise, paying fair-market value for that access. Additionally, communities can currently negotiate with providers to advance community priorities and interests in exchange for access to community-owned rights of way. For example, if a provider seeks access to build out its network in a high-income area, a community could grant access to that in exchange for that providers' providing high-speed broadband to anchor institutions in lower-income areas. SB 649 would eliminate communities' ability to manage their rights-of-way, unduly interfering with those communities' right to self-determination.

SB 649 Would Allow Providers to Use Community-Owned Property without Paying Just Compensation.

Phone and broadband providers already reap windfall profits from Californians. SB 649 limits communities to charging set prices and fees for access to their rights-of-way. These artificial restrictions distort the market and force consumers to subsidize providers' costs. SB 649 prevents communities from getting full market value in exchange for access to rights-of-way. Accordingly, SB 649 increases the power of providers to extract profits from local communities that already face monopoly or near-monopoly prices.

Greenlining supports any legislative measure that increases the availability of advanced communications services to communities of color. Unfortunately, SB 649 is not such a measure. The bill promises to widen the digital divide, place control over community-owned property in the hands of providers, and fail to compensate communities fairly. Accordingly, Greenlining OPPOSES SB 649.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Stephanie Chen
Energy & Telecommunications Policy Director

[1] Frederick E. Ellrodd III & Nicholas P. Miller, Property Rights, Federalism, and Public Rights-of-Way (2003) 26 Seattle Univ. Law. Rev. 475, 477.

Alliance of Nurses for Healthy Environments

June 26, 2017

The Honorable Cecilia Agular-Curry,
Chair Assembly Local Gov't Commission
Room 157, 1020 N Street Sacramento,
CA 95814

RE: SB 649 (Hueso) – Small Cell Wireless Facilities - - OPPOSE

Dear Chair Agular-Curry:

I am a Professor of Public Health at the University of San Francisco and a Board Member of the national Alliance of Nurses for Healthy Environments. I am very concerned about moving forward with expanding the use of small-scale wireless technologies at the same time that there is mounting evidence of the potential for health risks from the associated radio frequency energy and radiation, particularly to children. The Alliance of Nurses for Healthy Environments ascribes to the precautionary principle as it applies to human health. We firmly believe that early warnings in the scientific literature should be heeded and that our policy development should reflect the synthesis of the best and latest scientific evidence.

At this point in time, we oppose SB 649 and believe that we need an exhaustive review of the science before we allow significant expansion of small cell wireless facilities, such as those to facilitate 5G networks. The results of the literature review should inform our policies. We must be sure that vulnerable populations such as pregnant women and young children will not be unduly harmed from their proximity to unnecessary radio frequency energy. It is important that we continue to examine what constitutes a safe distance and how we can continue to pivot when more information becomes available. We are concerned that the passage of SB 649 will entrench us in a policy for which we have insufficient assurances and which, if passed, will require the burden of effort to reverse.

For these reasons, we oppose SB 649 and urge a "no" vote in the Local Government Committee.

Thank you for considering our concerns.

Sincerely,

Barbara Sattler, RN, MPH, DrPH, FAAN
Board Member

August 15, 2017

The Honorable Cecilia Aguiar-Curry
Chair, Assembly Local Government Committee
State Capitol Building, Room 5144
Sacramento, CA 95814

SB 649 (Hueso)- Wireless Telecommunications Facilities- OPPOSE

Chair Aguiar-Curry,

On behalf of the undersigned, we write to register our opposition to SB 649 (Hueso) which would prohibit local discretionary review of "small cell" wireless antennas , including equipment collocated on existing structures or located on new "poles, structures, or non-pole structures," including those within the public right-of-way and buildings. The proposal preempts adopted local land use plans by mandating that "small cells" be allowed in all zones as a use by-right, including all residential zones. Because of this, this proposal essentially provides a CEQA exemption for installation of these facilities, undermining the ability for communities to comment and register their concerns associated with previously mentioned installation. These "small cell" installations not only can cause an aesthetic blight, but can release levels of radiation that we don't yet know conclusively the health impacts they can impose of humans, especially developing bodies and minds of children. These small cell boxes could pop up anywhere: grocery stores, outside school, playgrounds, communal places, with no requirement to mitigate effects or understand potential environmental and health hazards.

For these reasons, we urge your "no" vote in committee.

Thank you,

Jena Price, Legislative Affairs Manager
California League of Conservation Voters

Kyle Jones, Legislative Associate
Sierra Club California

Jane Williams, Executive Director
California Communities Against Toxics

ENVIRONMENTAL HEALTH TRUST
892 Arlington Av. Berkeley, CA, 94707 (307) 200-9358
www.ehtrust.org

June 28, 2017

The Honorable Cecilia Aguiar-Curry
Chair of the Local Government Committee
1020 N Street, Room 157
Sacramento, CA 95814

RE: SB 649 (Hueso) – Small Cell Wireless Facilities — OPPOSE

Dear Chair Aguiar-Curry:

As a nonprofit research and policy organization dedicated to identifying and reducing environmental health hazards, Environmental Health Trust (EHT) writes to advise you of serious scientific grounds to reject SB 649 as advanced by Senator Hueso. I have personally served as an expert advisor to the California Department of Health as well as the San Francisco and Berkeley City governments on matters relevant to this bill. EHT has been honored to work with California government and scientists for over a decade. At the invitation of the Israel Institute for Advanced Study of the Hebrew University of Jerusalem, EHT recently organized and chaired an Expert Forum on Wireless Radiation and Health, bringing together scientists and engineers from more than ten high tech nations. Reflecting these efforts, EHT provides independent scientific research and advice on avoidable environmental health hazards to local, state and national governments.

SB 649 will pave the way for widespread introduction of 5G microwave wireless radiation frequency (RF) that has never been tested for its impact of public health or the environment. Other RF microwave radiation such as that used by cellphones and other wireless devices has been classified as a 'possible carcinogen' by the International Agency for Research on Cancer in 2011 and more recently dubbed a 'probable carcinogen,' by expert researchers looking at newer information in 2015.[1, 2, 3] In addition, this bill could result in the loss of hundreds of millions of dollars in local revenue, as the San Francisco Chronicle noted today.

By ignoring growing scientific evidence of harm, the bill effectively will ensure the widespread exposures of millions of Californians to an agent that growing numbers of scientists and nations consider a serious

[1] World Health Organization. "IARC classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans," WHO, Press Release, no. 208, 2011.
[2] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. "Non-ionizing radiation, Part 2: Radiofrequency electromagnetic fields." *IARC Monographs On The Evaluation of Carcinogenic Risks to Humans*, vol. 102, pt. 2, 2013.
[3] Morgan, L. Lloyd, et al. "Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A)." *International Journal of Oncology,* vol. 46, no. 5, 2015, 1865-71.

health threat. Recently, studies have found that the frequencies which will be used in 5G and other future technologies can have harmful effects[4], as Dr. Cindy Russell, Vice President of Community Health for the Santa Clara Medical Association noted.[5] As articulated in their state Constitution, California cities and counties have a duty to protect the health and safety of their residents.

EHT has a longstanding history of research and policy advice to state, local and national governments regarding strategies to reduce disease and promote health by avoiding environmental health hazards. Our organization opposes the broad scale installation of untested wireless antennas and associated electrical equipment close to humans and through critical wildlife habitat and corridors. Both federal and local zoning controls are needed to assure that cellular equipment are installed to avoid significant and serious safety threats of electrical shock, fire, and radio frequency (RF) microwave radiation exposures, as well as chronic impacts on public health and the environment.

Consistent with public health concepts of preventing harm by reducing exposure to suspected carcinogens, EHT opposes the usurpation and preemption of local authority that will allow federal and state authorities to place what state reports of the bill indicate can be thirty thousand new radiating 5G cell antennas on city and county utility, light poles, and other right of ways in close proximity to city and county workers, children, residents and visitors. In some cases towers will need to be sited every 100 feet with antennas at a height of 30 feet or less. Local authority and duty should not be overridden by preemptive federal or state policies such as SB 649 which disregards scientific evidence on this matter as outlined below.

Regarding potential health risks from RF a number of corporations advise their shareholders that they face serious risks from RF. For instance, Crown Castle's 2016 10-K ANNUAL REPORT, states that,

> *"If radio frequency emissions from wireless handsets or equipment on our wireless infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues. The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us...If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters."*

Most wireless companies from AT&T to Nokia to T Mobile to Verizon Wireless have issued similar warnings to their shareholders.

Regarding public health impacts, recently released research findings from the premiere test program of the National Institute of Environmental Health Sciences (NIEHS) add to the body of scientific evidence

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[4] Feldman, Yuri, et al. "Human Skin as Arrays of Helical Antennas in the Millimeter and Submillimeter Wave Range." *Physical Review Letters*, vol. 100, no. 128102, 2008.

[5] Russell, Cindy. "A 5G Wireless Future: Will it give us a Smart Nation or Contribute to an Unhealthy One?" Santa Clara Bulletin, Jan./Feb. 2017.

indicating that RF microwave radiation can be harmful. The 10 year $25 million NIEHS National Toxicology Program's Studies of the Toxicology and Carcinogenicity Cell Phone Radiation reports that RF produced increases rates of highly malignant very rare tumors: gliomas of the brain and schwannomas of the heart.[6] These experimental findings are consistent with human studies showing increased rates of gliomas and acoustic neuromas (schwann cells) among humans exposed to cell phone radiation. In addition to increased cancers, the NTP study also reported that prenatally exposed animals produced offspring with lower birth weight and evidence of direct genetic damage.

Since the 2011 WHO/IARC classification, the peer reviewed research connecting microwave exposure to cancer has significantly strengthened. In 2015, a study replicated a 2010 experiment that found that weak cell phone signals significantly promote the growth of tumors in mice, and that toxic chemical exposures combine with RF to more than double the tumor response.[7,8] The Ramazzini Institute is engaged in similar research with RF that is 1000 less than the NTP exposures—set to mimic radiation exposure levels caused by network equipment (e.g., cell tower antenna emissions).

Consistent with the NTP findings, the Ramazzini Institute team report significantly lower litter weights, as presented at the January 2017 Conference on Wireless and Health at Israel Institute for Advanced Study, Hebrew University of Jerusalem.[9] Findings of effects at such low levels is indication of the capability of low level electromagnetic radiation exposure to result in biological effects.

Other studies finding serious increased risk of glioma in regular cell phone users are of special relevance. In 2014, a French national study linked higher cell phone exposure to increased glioma in cell phone users.[10] A newly published research report in the *American Journal of Epidemiology* finds that Canadians who have used cell phones for 558 hours or more have more than a doubled risk of brain cancer.[11] Previous published re-analysis of the multi country Interphone study data has found stronger positive associations to glioma risk among long term users and heavy users and a statistically significant association between where tumors were located and how much radiation an individual received from their phone.[12,13]

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[6] Wyde, Michael, et al. "Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure)." *bioRxiv,* no. 055699, 2016.

[7] Lerchl, Alexander, et al. "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." *Biochemical and Biophysical Research Communications,* vol. 459, no. 4, 2015, pp. 585-90.

[8] Tillmann, Thomas, et al. "Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model." *International Journal of Radiation Biology,* vol. 86, no. 7, 2010, pp. 529-41.

[9] Belpoggi, Fiorella. "Recent findings on wireless radiation and health from the Ramazzini Institute could reinforce the NTP results." *Conference on Wireless and Health*, 2017.

[10] Coureau, Gaëlle, et al. "Mobile phone use and brain tumours in the CERENAT case-control study." *Occupational Environmental Medicine,* vol. 71, no. 7, 2014, pp. 514-22.

[11] Momoli, F., et al. "Probabilistic multiple-bias modelling applied to the Canadian data from the INTERPHONE study of mobile phone use and risk of glioma, meningioma, acoustic neuroma, and parotid gland tumors." *American Journal of Epidemiology*, 2017.

[12] Turner, Michelle C., et al. "Investigation of bias related to differences between case and control interview dates in five INTERPHONE countries." *Annals of Epidemiology,* vol. 26, 12, 2016, pp. 827-32.

More recently, research carried out by physicists in Israel and others have shown that the higher millimeter wave frequencies to be used in 5G applications uniquely interacts with sweat ducts of the human skin which can then function as antennas to amplify signals. This work extends studies first produced in 1986.[14] The potential long-term impact of such stimulation on precancerous skin growths should be evaluated carefully, including potential super-growth of bacteria.[15] A lecture by Paul Ben-Ishai, PhD, and published research on this issue can be found on the 2017 Conference website.[16, 17, 18]

Cancer is not the only health concern presented by wireless devices and infrastructure. Impacts on reproduction and brain development have also been repeatedly reported in the peer reviewed literature in addition to a myriad of other adverse effects.[19, 20, 21, 22]

In light of these developments showing growing evidence of the biological impact of RF, it is imperative that new infrastructure and 5G not be introduced widely into commerce at this time. The State of California needs to critically consider the potential impact of massive new and possibly carcinogenic wireless exposures to their population. Before introducing additional untested wireless technology into the environment, it is necessary to:

- model exposures to infants, children and pregnant women;
- conduct experimental tests on exposures' impacts on wildlife; and
- evaluate impacts on human systems through in vitro and in vivo toxicology

In 2015, the International EMF Scientist Appeal, now signed by over 225 scientists from 41 nations, was submitted to the Secretary-General of the United Nations, the Director-General of the World Health Organization and U.N. Member Nations urging the development of more protective guidelines for EMF (including RF-EMF), encouraging precautionary measures, and calling for education of the public about

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[13] Grell, Kathrine, et al. "The intracranial distribution of gliomas in relation to exposure from mobile phones: analyses from the INTERPHONE study." *American Journal of Epidemiology*, vol. 184, no. 11, 2016, pp. 818-28.
[14] Gandhi OP, Riazi A. "Absorption of millimeter waves by human beings and its biological implications." *IEEE Transactions on Microwave Theory and Techniques*, vol. 34, no. 2, 1986, pp. 228-235.
[15] Soghomonyan D, K. Trchounian and A. Trchounian. "Millimeter waves or extremely high frequency electromagnetic fields in the environment: what are their effects on bacteria?" Applied Microbiology and Biotechnology, vol. 100, no. 11, 2016, pp. 4761-71.
[16] Feldman, Yuri and Paul Ben-Ishai. "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems." *Conference on Wireless and Health*, 2017.
[17] Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. "Circular polarization induced by the three-dimensional chiral structure of human sweat ducts." *Physical Review E*, vol. 89, no. 042715, 2014.
[18] Feldman, Yuri, et al. "Human Skin as Arrays of Helical Antennas in the Millimeter and Submillimeter Wave Range." *Physical Review Letters*, vol. 100, no. 128102, 2008.
[19] Adams, Jessica A., et al. "Effect of mobile telephones on sperm quality: a systematic review and meta-analysis." *Environment International,* 70, 2014, pp. 106-112.
[20] Deshmukh, P.S., et al. "Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation." *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.
[21] Aldad, T.S., et al. "Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice." *Scientific Reports,* vol. 2, no. 312, 2012.
[22] Sonmez, O.F., et al. "Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field." *Brain Research,* vol. 1356, 2010, pp. 95-101.

health risks, particularly risks to children and fetal development.[23] Most recently, the EMF Scientists have submitted Comments to the FCC asking the FCC to critically consider the potential impact of the 5th generation wireless infrastructure on the health and safety of the U.S. population before proceeding to deploy this infrastructure.

California firefighters have lobbied to protect themselves and successfully received exemption on health grounds from the installation of these cell towers. Similarly cities and counties should be given the needed local controls to protect their citizens from the health and safety risks of these installations. As currently envisioned, transmitters can be placed in close proximity to bedrooms and schools without consideration of the health of their occupants. Research is critically needed to evaluate the public health and environmental impacts of proposed wireless facilities before deployment.

Worldwide, governments are acting to minimize exposures to children as they are most vulnerable. For example, the Supreme Court of India upheld the High Court of the State of Rajasthan's decision to remove all cell towers from the vicinity of schools, hospitals and playgrounds because of radiation "hazardous to life." In Chile, the 2012 "Antennae Law" prohibits cell antennae/towers in "sensitive areas".[24] Please learn more about international policy actions such as these in our online briefing.[25]

The assumption that all wireless technology is safe has been shown through recent studies to be incorrect. EHT strongly opposes the widespread installation of 5G antennas and towers and believes that the state should move forward on its commitment to support the installation of fiber optic cables buried in the ground to every business, home, school, and hospital in California. We urge the state not to ignore this evidence of harm from RF. Please vote "no" vote on SB 649 and uphold the rights of local government to protect public health and the environment.

Sincerely,

Devra Davis, PhD, MPH
Fellow, American College of Epidemiology
Visiting Prof. Hebrew Univ. Hadassah Medical Center & Ondokuz Mayis Univ. Medical School
Associate Editor, *Frontiers in Radiation and Health*
President, Environmental Health Trust

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[23] Blank, M., et al. "International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure." *European Journal of Oncology,* vol. 20, no. 3/4, 2015, pp. 180-2.

[24] "New communications antenna law in Chile." *Communications Law: Newsletter of the International Bar Association Legal Practice Division*, vol. 20, no. 1, 2013, pp. 14-16.

[25] "International Policy Briefing: Cautionary Policy on Radiofrequency Radiation Actions by Governments, Health Authorities and Schools Worldwide." Environmental Health Trust, 2017.

July 26, 2017

The Honorable Ben Hueso
Member of the California State Senate
Room 4035, State Capitol
Sacramento, CA 95814

RE: SB 649 (Hueso) – Small Cell Wireless Facilities - OPPOSE

Dear Senator Hueso:

Environmental Working Group (EWG) respectfully opposes your SB 649, which would make the installation of small cell wireless facilities, such as those used to facilitate 5G networks, ministerial rather than discretionary at the local government level.

The health impacts of cellular transmissions have been debated for over ten years because there are studies that raise real concerns about the effects of radio frequency radiation on humans. This is why EWG sponsored two bills by former Senator Leno, SB 1212 (2010) and SB 932 (2011) that would have required sellers of cell phones to inform consumers to minimize exposure to cell phone radiation by reading the manual that comes with the phone, as this is in fact recommended by cell phone manufacturers in their included manuals.

Studies on the health impacts of cell phones and their transmission infrastructure are continuing, but there is already adequate existing sound science for government to proceed with caution on the roll-out of the new technology. In particular, the results of the $25 million National Toxicology Program study (2016) that showed tumors in rats caused by a typical amount of heavy cell phone use are to be reckoned with. And, most of the past science has analyzed older cellular technology like 2G and 4G, so we are moving into uncharted waters with 5G with its different wavelengths and energy levels.

Local governments must be able to evaluate science and respond to the wishes of their citizens and neighborhoods before permits are issued for this technology and SB 649 short-circuits that process. This includes important decisions about locating the technology near homes, schools, and hospitals. We simply cannot rely upon the word of the FCC (in terms of safety standards) to protect the health of Californians.

For these reasons, EWG will be urging a "no" vote for the Assembly floor. We will be writing a separate letter to the Assembly Appropriations Committee on fiscal concerns.

Sincerely,

Bill Allayaud

Bill Allayaud
California Director of Government Affairs
Environmental Working Group

Martin Pall, PhD

August 7, 2017

Dear California Legislators,

I am Dr. Martin Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences at Washington State University. I am a published and widely cited scientist on the biological effects of electromagnetic fields and speak internationally on this topic. I am particularly expert in how wireless radiation impacts the electrical systems in our bodies. I have published 7 studies showing there exists exquisite sensitivity to electromagnetic fields (EMFs) in the voltage sensor in each cell, such that the force impacting our cells at the voltage sensor has massive impact on the biology on the cells of our bodies [1-7]. These papers are discussed in over 360,000 web sites which can be easily found by Googling (Martin Pall electromagnetic). I received my PhD at Caltech, one of the top scientific institutions in the world.

EMFs act by activating channels in the membrane that surrounds each of our cells, called voltage-gated calcium channels (VGCCs). The EMFs put forces on the voltage sensor that controls the VGCCs of about 7.2 million times greater than the forces on other charged groups in our cells [4,6,7]. This is why weak EMFs have such large biological effects on the cells of our bodies! EMFs works this way not only on human and diverse animal cells [1-7] but also in plant cells [7] so that this is a universal or near universal mechanism of action.

Thousands of published studies show biological and health effects from electromagnetic fields. We now know the mechanism that can explain these effects. The mechanism is a function of the electromagnetics of each cell—not solely about heating effects from the radiation (on which present FCC guidelines are based).

This new understanding [1-7] means we can debunk the claims of the wireless industry that there cannot be a mechanism for effects produced by these weak EMFs. The 20 years plus of industry propaganda claims are false. Rather the thousands of studies showing diverse health impacts of these EMFs can be explained. We now have a mechanism, one that is supported by both the biology and the physics, both of which are pointing in exactly the same direction. I am sending as a separate document a list of 134 reviews, each of which provides from 12 to over a thousand individual citations showing health impacts of low intensity EMFs, EMFs that the telecommunications industry claims cannot have such effects. **These 134 reviews and thousands of primary scientific papers they cite show that the industry propaganda has no scientific support whatsoever.**

The consensus among independent scientists on this is further confirmed by the 2015 (and later) appeal made to the United Nations and member states, stating that the current EMF safety guidelines are inadequate because they do not take into consideration non-thermal effects. This was signed by 225 scientists from 41 countries, each of whom had

published peer reviewed studies on EMF health effects – a total of 2,000 papers published in this area by the signers, a substantial fraction of the total publications in this area.

According to industry, the forces electromagnetic fields place on electrically-charged groups in the cell are too weak to produce biological effects. However, the unique structural properties of the voltage-gated calcium channel (VGCC) protein can, it turns out, explain why the force on a cell's voltage sensor from low-intensity EMFs are millions of times stronger than are the forces on singly-charged groups elsewhere in the cell.

It would be a disaster for the health of Californians to be exposed to the antennas envisioned in SB.649. The State of California would be making a grave mistake to proceed with supporting the commercial interests of the wireless industry with this legislation. **Legislators would best pause to understand the gravity of the biological effects, and the ramifications for physical and mental health, as well as consequences from continual damage to human DNA, and learn the facts from scientists who are independent of the wireless industry, not from the industry lobbyists who have a gigantic conflict of interest.**

VGCC activation in cells produced by low intensity EMFs can explain long-reported findings that electromagnetic fields and a wide range of biological changes and health effects. The first 6 of these (see below) were well documented 46 years ago in the U.S. Office of Naval Medical Research report, published in 1971 [8]. The others that follow have been extensively documented subsequently in the peer-reviewed scientific literature:
1) Various neurological/neuropsychiatric effects, including changes in brain structure and function, changes in various types of psychological responses and changes in behavior.
2) At least eight different endocrine (hormonal) effects.
3) Cardiac effects influencing the electrical control of the heart, including changes in ECGs, producing arrhythmias, changes that can be life threatening.
4) Chromosome breaks and other changes in chromosome structure.
5) Histological changes in the testes.
6) Cell death (what is now called apoptosis, a process important in neurodegenerative diseases).
7) Lowered male fertility including lowered sperm quality and function and also lowered female fertility (less studied).
8) Oxidative stress.
9) Changes in calcium fluxes and calcium signaling.
10) Cellular DNA damage including single strand breaks and double strand breaks in cellular DNA and also 8-OHdG in cellular DNA.
11) Cancer which is likely to involve these DNA changes but also increased rates of tumor promotion-like events.
12) Therapeutic effects including stimulation of bone growth.
13) Cataract formation (previously thought to be thermal, now known not to be).
14) Breakdown of the blood-brain barrier.
15) Melatonin depletion and sleep disruption.

They may be low intensity but with regard to the VGCCs, electromagnetic fields can have a tremendously powerful impact on the cells of our bodies. Furthermore, published studies showing that calcium channel blocker drugs block or greatly lower biological effects from electromagnetic fields confirm there is a VGCC activation mechanism that is causing various effects. Higher frequency electromagnetic fields from 5G technologies on the horizon pose even greater biological concern than those to which we are exposed today. We should be moving, instead, to wired technologies at every opportunity, based on what we know in science today, not expanding and supporting the proliferation of wireless.

I want to make several additional points very clear:

1. The Physics and the Biology are both pointing in the same direction. Both show that EMFs act primarily via activating the VGCCs in the cells of our bodies.
2. DNA damage known to be produced by these EMFs occur in human sperm and may also occur in human eggs, leading to large increases in mutation in any children born. It is thought that an increase in mutation frequency of 2.5 to 3-fold will lead to extinction because of accumulation of large numbers of damaging mutations. We may already be over this level, and if so, simply continuing our current exposures will lead to eventual extinction. Further increases in exposures will be more rapidly self-destructive.
3. Pulsed EMFs are, in most cases, more biologically active and therefore more dangerous than are non-pulsed (continuous wave) EMFs. All cordless communication devices communicate via pulsations, because it is the pulsations that carry the information communicated. All the industry claims of safety are based on a theory (only thermal effects) that was known to be wrong back in 1971 [8] – and that was before many thousands of additional studies were published providing massive confirmation that industry claims are false.
4. The industry is trying to move to much higher frequencies because these much higher frequencies allow much higher pulsations and therefore much higher transmission of information. However, these higher pulsation rates make these ultra-high devices vastly more dangerous. This is part of the reasons why it is so important to vote down SB.649.
5. None of our wireless communication devices are ever tested biologically for safety – not cell phone towers, not cell phones, not Wi-Fi, not cordless phones, not smart meters and certainly not 5G phones, or radar units in cars – before they are put out to irradiate an unsuspecting public.
6. The telecommunications industry has corrupted the agencies that are supposed to be regulating them. The best example of this is that the FCC which regulates EMFs in the U.S. is a "captured agency", captured by the industry it is supposed to regulate, according to an 8 chapter document published by the Edmond J. Safra Center for Ethics at Harvard University [9]. Is it any wonder, therefore, that the industry keeps touting that their devices are within the safety guidelines set by the FCC?

I urge you to do the right thing on behalf of the health of Californians and future generations. Please let me know if I can provide further information. (503) 232-3883.

Sincerely,
Martin Pall, PhD (Caltech, 1968)
Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University

Citations:

1. Pall ML. 2013 Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965.
2. Pall ML. 2014 Electromagnetic field activation of voltage-gated calcium channels: role in therapeutic effects. Electromagn Biol Med. 2014 Apr 8.
3. Pall ML. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev Environ Health 30:99-116.
4. Pall ML. 2015 Elektromagnetische Felder wirken über die Aktivierung spannungsabhängiger Calciumkanäle, um günstige oder ungünstige Wirkungen zu erzeugen. Umwelt-Medizin-Gesellshaft 28: 22-31.
5. Pall ML. 2015 How to approach the challenge of minimizing non-thermal health effects of microwave radiation from electrical devices. International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 2350-0557, Volume-2, Issue -5, September 2015; 71-76.
6. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001. Epub 2015 Aug 21.
7. Pall ML. 2016 Electromagnetic fields act similarly in plants as in animals: Probable activation of calcium channels via their voltage sensor. Curr Chem Biol 10: 74-82.
8. Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations, Revised, ZR Glaser.
9. Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates, by Norm Alster. Published by Edmond J. Safra Center for Ethics, Harvard University. An e-book under the Creative Commons 4.0 License: https:/creativecommons.org/licences/by/4.0/

June 27, 2017

Assembly Member Cecilia M. Aguiar-Curry
Local Government Committee Chair
State Capitol
P.O. Box 942849
Sacramento, CA 94249-0004
Via email

Re: SB 649 - OPPOSE

Dear Chair Aguiar-Curry,

On behalf of The Greenlining Institute, I am writing to express our opposition to SB 649. SB 649 will not close the digital divide. Instead, it will allow phone and broadband providers to override community decisions about how those communities use public space. Additionally, SB 649 will allow providers to use community-owned property without paying just compensation.

Local Communities Fully Understand the Need for Advanced Phone and Broadband Services.

Every community in California is eager to see faster, more reliable, and more affordable phone and broadband service. Local governments are very aware that advanced telephone and broadband services are critical for access to educational, employment, and economic opportunities. Access to these opportunities is particularly critical for communities of color, who, as a result of the racial wealth and income divides, are more likely to live in areas that lack access to advanced phone and broadband services. State and local governments are particularly well-positioned to ensure that providers are serving communities equitably and non-discriminatorily and that community members have equitable access to economic opportunity.

SB 649 Would Not Help Close The Digital Divide.

Sadly, communications providers have repeatedly demonstrated that they will not make advanced services available to low-income or rural areas unless **they are required to do so**. SB 649 contains no such requirement, instead allowing providers to pick and choose where to build their networks without any community input. Under SB 649, it is likely that providers will focus any service improvements on high-income areas. SB 649 in no way guarantees that low-income communities and communities of color will gain increased access to advanced communications services. Accordingly, SB 649 will not help close the digital divide.

For Express Mail
7100 N Rachel Way
Unit 6 Eagles Rest
Teton Village WY 83025

ENVIRONMENTAL HEALTH TRUST

For U.S. Mail
P.O. Box 58
Teton Village WY 83025
www.ehtrust.org

The Honorable Jerry Brown
Governor, State of California
c/o State Capitol, Suite 1173
Sacramento, CA 95814
September 17, 2017

RE: SB 649 (Hueso) – Small Cell Wireless Facilities — OPPOSE

Honorable Governor Brown,

As a nonprofit research and policy organization dedicated to identifying and reducing environmental health hazards, Environmental Health Trust (EHT) writes to advise you of serious scientific grounds to veto SB 649 as advanced by Senator Hueso. I have personally served as an expert advisor to the California Department of Public Health as well as the city of San Francisco and Berkeley governments on matters relevant to this bill.

You are globally recognized as a champion of the environment and public health. I remain deeply grateful to you for your forward thinking on climate change and toxics policies which provide moral and political leadership at a time when it is sorely lacking. As someone who has been a presidential appointee confirmed by the US Senate, I fully understand the challenges that you face politically. You have provided leadership on the right side of history in too many ways to enumerate.

EHT has a longstanding history of research and policy advice to state, local and national governments regarding strategies to reduce disease and promote health by avoiding environmental health hazards. Our organization opposes the broad scale installation of untested wireless antennas and associated electrical equipment close to humans and through critical wildlife habitat and corridors.

The assumption that all wireless technology is safe has been shown through recent studies to be incorrect. EHT strongly opposes the widespread installation of 5G antennas and towers and believes that the state should move forward on its commitment to support the installation of fiber optic cables buried in the ground to every business, home, school, and hospital in California. We urge the state not to ignore this evidence of harm from wireless technologies.

Specific design standards must first be funded and created for 5G facilities for the more than thirty thousand expected new radiating 5G cell antennas to be constructed on city and county utility light poles and in the right of ways in close proximity to city and county workers, children, residents and visitors. Both federal and local zoning controls are absolutely needed to assure that cellular equipment are installed to avoid significant and serious safety threats of electrical shock, fire, and radio frequency (RF) microwave radiation exposures, as well as chronic impacts on public health and the environment.

Now the challenge before you is one of the most momentous you will have ever faced. The telecom industry is a global multi-trillion dollar phenomenon. They have provided massive amounts of political support throughout the political spectrum. Despite this, the weight of science has inexorably demonstrated that the experiment they

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have been conducting on ourselves and our progeny is without merit and has already exacted a serious toll for public health.

SB 649 will pave the way for widespread introduction of 5G microwave wireless radiation frequency (RF) that has never been tested for its impact of public health or the environment. Other RF microwave radiation such as that used by cellphones and other wireless devices has been classified as a 'possible carcinogen' by the International Agency for Research on Cancer in 2011 and more recently dubbed a 'probable carcinogen,' by expert researchers looking at newer information in 2015.[1,2,3] In addition, this bill could result in the loss of hundreds of millions of dollars in local revenue, as the San Francisco Chronicle noted today.

By ignoring growing scientific evidence of harm, the bill effectively will ensure the widespread exposures of millions of Californians to an agent that growing numbers of scientists and nations consider a serious health threat. Recently, studies have found that the frequencies which will be used in 5G and other future technologies can have harmful effects[4], as Dr. Cindy Russell, Vice President of Community Health for the Santa Clara Medical Association noted.[5] As articulated in their state Constitution, California cities and counties have a duty to protect the health and safety of their residents.

State and local authority and duty should not be overridden by any preemptive policies such as SB 649 which disregards scientific evidence on this matter as outlined below. Regarding potential health risks from RF a number of corporations advise their shareholders that they face serious risks from RF. For instance, Crown Castle's 2016 10-K ANNUAL REPORT, states that,

> *"If radio frequency emissions from wireless handsets or equipment on our wireless infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues. The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us...If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters."*

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Most wireless companies from AT&T to Nokia to T Mobile to Verizon Wireless have issued similar warnings to their shareholders.

Regarding public health impacts, recently released research findings from the premiere test program of the National Institute of Environmental Health Sciences (NIEHS) add to the body of scientific evidence indicating that RF microwave radiation can be harmful. The 10 year $25 million NIEHS National Toxicology Program's Studies of the Toxicology and Carcinogenicity Cell Phone Radiation reports that RF produced increases rates of highly malignant very rare tumors: gliomas of the brain and schwannomas of the heart.[6] These experimental findings are consistent with human studies showing increased rates of gliomas and acoustic neuromas (schwann cells) among humans exposed to cell phone radiation. In addition to increased cancers, the NTP study also reported that prenatally exposed animals produced offspring with lower birth weight and evidence of direct genetic damage.

Since the 2011 WHO/IARC classification, the peer reviewed research connecting microwave exposure to cancer has significantly strengthened. In 2015, a study replicated a 2010 experiment that found that weak cell phone signals significantly promote the growth of tumors in mice, and that toxic chemical exposures combine with RF to more than double the tumor response.[7,8] The Ramazzini Institute is engaged in similar research with RF that is 1000 less than the NTP exposures—set to mimic radiation exposure levels caused by network equipment (e.g., cell tower antenna emissions).

Consistent with the NTP findings, the Ramazzini Institute team report significantly lower litter weights, as presented at the January 2017 Conference on Wireless and Health at Israel Institute for Advanced Study, Hebrew University of Jerusalem.[9] Findings of effects at such low levels is indication of the capability of low level electromagnetic radiation exposure to result in biological effects.

Other studies finding serious increased risk of glioma in regular cell phone users are of special relevance. In 2014, a French national study linked higher cell phone exposure to increased glioma in cell phone users.[10] A newly published research report in the *American Journal of Epidemiology* finds that Canadians who have used cell phones for 558 hours or more have more than a doubled risk of brain cancer.[11] Previous published re-analysis of the multi country Interphone study data has found stronger positive associations to glioma risk

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among long term users and a statistically significant association between where tumors were located and how much radiation an individual received from their phone.[12,13] A 2017 review published by Hardell and Carlberg concludes that "RF radiation should be regarded as a human carcinogen causing glioma."[14] I invite you to view videos from Environmental Health Trust's expert forum in Jackson Hole, Wyoming on July 30, 2017 where longtime World Health Organization advisor Dr. Anthony Miller presented the scientific evidence for his updated opinion that RF is a human carcinogen.

More recently, research carried out by physicists in Israel and others have shown that the higher millimeter wave frequencies to be used in 5G applications uniquely interacts with sweat ducts of the human skin which can then function as antennas to amplify signals.[15] This work extends studies first produced in 1986.[16] The potential long-term impact of such stimulation on precancerous skin growths should be evaluated carefully, including potential super-growth of bacteria.[17] A lecture by Paul Ben-Ishai, PhD, and published research on this issue can be found on the 2017 Conference website.[18,19,20]

Cancer is not the only health concern presented by wireless devices and infrastructure. Impacts on reproduction and brain development have also been repeatedly reported in the peer reviewed literature in addition to a myriad of other adverse effects.[21, 22, 23, 24]

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In light of these developments showing growing evidence of the biological impact of RF, it is imperative that new infrastructure and 5G not be introduced widely into commerce at this time. The State of California needs to critically consider the potential impact of massive new and possibly carcinogenic wireless exposures to their population. Before introducing additional untested wireless technology into the environment, it is necessary to:

- model exposures to infants, children and pregnant women;
- conduct experimental tests on exposures' impacts on wildlife; and
- evaluate impacts on human systems through in vitro and in vivo toxicology

In 2015, the International EMF Scientist Appeal, now signed by over 225 scientists from 41 nations, was submitted to the Secretary-General of the United Nations, the Director-General of the World Health Organization and U.N. Member Nations urging the development of more protective guidelines for EMF (including RF-EMF), encouraging precautionary measures, and calling for education of the public about health risks, particularly risks to children and fetal development.[23] The EMF Scientists later submitted Comments to the FCC asking the FCC to critically consider the health impact of the 5G.

Most recently, in September 2017, over 180 scientists and doctors from 35 countries sent a declaration to the European Union calling for a moratorium on 5G expansion citing potential neurological impacts, infertility, and cancer.[25]

California firefighters have lobbied to protect themselves and successfully received exemption on health grounds from the installation of these cell towers.[26] Similarly cities and counties should be given the needed local controls to protect their citizens from the health and safety risks of these installations. As currently envisioned, transmitters can be placed in close proximity to bedrooms and schools without consideration of the health of their occupants. Research is critically needed to evaluate the public health and environmental impacts of proposed wireless facilities before deployment.

The organization that I founded a decade ago, Environmental Health Trust, is not opposing cell phones. We are in favor of public health and we note that the California Department of Public Health has drafted guidelines for safer use of phones so that the public reduce radiofrequency exposure for more than a decade.

As my colleagues who have been supported by the US Department of Defense on 5G have written to you, the evidence is compelling that this technology can interact with human body in ways that have never been evaluated for their long-term impact on health and safety. Recently, studies have found that the frequencies which will be used in 5G and other future technologies can have harmful effects[27], as Dr. Cindy Russell, Vice

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President of Community Health for the Santa Clara Medical Association noted.[28] As articulated in their state Constitution, California cities and counties have a duty to protect the health and safety of their residents.

Cardiologists are reporting increased numbers of patients with atrial fibrillation and heart disease who have no inherited risk factors. A recent study by Professor Gemma Figtree, published in the European Journal of Preventive Cardiology, found that the rate of heart attacks and heart disease in persons with no known risk factors has more than doubled in less than a decade.[29] Similar rates of serious eye problems and attention deficit disorder continue to increase without any knowns. Certainly, the phenomenal growth in the use of wireless technology should be explored as one of the explanations for these serious public health.

Please veto SB 649 and uphold the rights of local government to protect public health and the environment.

Sincerely,

Devra Davis, PhD, MPH
Founder & President, Environmental Health Trust
Fellow, American College of Epidemiology
Visiting Professor of Medicine, Hebrew University of Jerusalem and Ondokuz Mayis University

CC
Tom Dyer, Chief Deputy Legislative Affairs Secretary

Letter from Dr. Paul Ben Ishai to Governor Brown
Order Instituting Rulemaking to update the Commission's policies and procedures related to Rulemaking 04-08-020 electromagnetic fields emanating from regulated (Filed August 19, 2004) utility facilities.

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Beatrice Alexandra Golomb, MD, PhD
Professor of Medicine
UC San Diego School of Medicine
9500 Gilman Drive, #0995
La Jolla, CA 92093-0995
Phone: 858 558-4950 x201

August 18, 2017

To whom it may concern,

I urge in the strongest terms that you vigorously oppose California SB 649.

If this bill passes, many people will suffer greatly, and needlessly, as a direct result.

This sounds like hyperbole. It is not.
My research group at UC San Diego alone has received hundreds of communications from people who have developed serious health problems from electromagnetic radiation, following introduction of new technologies. Others with whom I am in communication, have independently received hundreds of similar reports. Most likely these are a tip of an iceberg of tens or perhaps hundreds of thousands of affected person. As each new technology leading to further exposure to electromagnetic radiation is introduced – and particularly introduced in a fashion that prevents vulnerable individuals from avoiding it – a new group become sensitized to health effects. This is particularly true for pulsed signals in the radiowave and microwave portion of the spectrum, the type for which the proposed bill SB 640 will bypass local control.

Mechanisms by which health effects are exerted have been shown to include oxidative stress (the type of injury against which antioxidants protect ,see optional section below), damage to mitochondria (the energy producing parts of cells), damage to cell membranes[1, 21], and via these mechanisms, an impaired "blood brain barrier"[3-5] (the blood brain barrier defends the brain against introduction of foreign substances and toxins; additionally, disruption can lead to brain edema[6]), constriction of blood vessels and impaired blood flow to the brain[7], and triggering of autoimmune reactions[8, 9]. Following a large exposure, that depresses antioxidant defenses, magnifying vulnerability to future exposures, some persons no longer tolerate many other forms and intensities of electromagnetic radiation that previously caused them no problem, and that currently cause others no problem. But this group deserves – nay needs -- the right to be able to avoid these exposures.

Affected individuals not only experience "symptoms" that "merely" cause them distress and suffering, when they are exposed – symptoms like headaches[10, 11], ringing ears[10, 11] and chest pain[10] from impaired blood flow, heart rhythm abnormalities[10, 11], and inability to sleep[10, 11]. These symptoms arise from physiological injury. Moreover, **many experience significant health problems that can include seizures[11], heart failure, hearing loss[12-14] and severe cognitive impairment[11, 15].** The mechanisms involved are those also involved in development and progression of neurodegenerative conditions including Alzheimer's disease[16].

Fully half who were employed when their problems developed lost their job because of the problem, among participants of a survey we conducted. They reported that their condition had cost them up to 2 million dollars to date. Many had lost their homes. A number became homeless, and have swelled the ranks of so-called "EMF refugees"[17-19]. Among those affected, many were previously high functioning individuals – engineers, doctors, lawyers. The best and the brightest are among those whose lives – and ability to contribute to society –will be destroyed. High profile individuals with acknowledged electrohypersensitivity include, for instance, Gro Harlem Brundtland – the former 3-time Prime Minister of Norway and former Director General of the World Health Organization[20]; Matti Niemela, former Nokia Technology chief[21]; as well as the wife of Frank Clegg[22], who formerly headed Microsoft Canada and is current head of Canadians for Safe Technology[23].

Each new roll-out of electromagnetic technology for which exposure is obligatory, swells the ranks of those who develop problems with electromagnetic fields (EMF).- particularly following a significant exposure to pulsed radiowave-microwave radiation, and particularly when people have no ability to avoid it.

Many state that they didn't give credence to the problem (if they had heard of it at all) **until they themselves fell prey to it.**

This is not a psychologically driven condition. Multiple objective physiological changes reflecting mechanisms of injury have been shown in persons with this condition[24, 25].

The role for oxidative stress, that has been shown in innumerable studies (below)**, is affirmed by evidence of a link of this condition to genetic variants in antioxidant defenses**, that are less avid in defending against oxidative stress[307]. People cannot manipulate their genes, to produce such an outcome by suggestibility.

An analysis by a University of Washington researcher showed that most studies funded by industry reported failure to show physiological effects. However, most studies without such industry bias affirmed effects. This is redolent of findings shown in medicine[26], regarding which the former editor in chief of the BMJ (the British Medical Journal), Richard Smith, noted, based on findings of a study, "This {result} suggests that, far from conflict of interest being unimportant in the objective and pure world of science where method and the quality of data is everything, it is the main factor determining the result of studies."[27]. So where articles deny injury from nonionizing radiowave-microwave radiation, there is commonly a stake aligned with financial benefit from such denial.

Those who are affected are in desperate need of *protection* by our elected officials. They need creation of safe spaces and housing, and roadways to allow travel, not removal of any prospect of one; protection of local rights to make decisions - **not removal of any recourse or ability to avoid what injures them**. They are far more strongly in need of protections than a great many protected classes – their problems arose due to actions of others, against which they were given no control – *and can be reversed,* in most cases, if the assault on them is rolled back. Through no fault of their own, and in some cases against their will (e.g. before opt out was permitted with smart meters), they were subjected to an

exposure that has altered their lives as they knew them, and forced them – needlessly - to the margins of society.

Let our focus be on safer, wired and well shielded technology – not more wireless.

This legislation, if passed, and the resulting unrestricted roll-out of this technology, will predictably and directly injure and disable a new group, and add depth of suffering to those already affected.

In other spheres we abridge freedoms to protect the vulnerable few. We require that every schoolchild be vaccinated, supposedly to protect the vulnerable few who may not respond effectively to a vaccine. The need to protect the vulnerable group is deemed to be so great that it justifies the decision to abridge individual rights.

In contrast, this bill seeks to abridge individual freedoms, and local rights, in the service of *harming* a vulnerable group, and creating a new one.
(The common factor appears to be that in both cases, the direction is aligned with a powerful industry that influences political decisions.)
Luckily, no abridgment of individual rights and freedoms is required to protect,t here.

If any group can opt out (such as, I understand, firefighters*)[28]; **then *every* group deserves that equal right**. Others should not be second class citizens, subject to fewer protections.

It would go far to helping this cause if anyone complicit in promoting or passing the legislation (and then after that, *their* families) were required to be the first subjected, for a substantial test period, to the *greatest* amount of exposure that anyone *else* (and their families) may be subjected to, when new policies of this type are rolled out. It will still not do them equal damage; because they may not represent the vulnerabilities that others will have; but such a policy might help them to think twice. *That* is a bill I would strongly endorse.

Most who are now affected – were not, until they were. This may become you – or your child or grandchild. Moreover, if you have a child, or a grandchild, his sperm, or her eggs (all of which she will already have by the time she is a fetus in utero), will be affected by the oxidative stress damage created by the electromagnetic radiation, in a fashion that may affect your future generations irreparably.

It was noted above that, among survey completers, fully half of those who were employed at the time they developed electrosensitivity, lost employment *due to* this problem. (This may understate the scope of the tragedy, since this most-affected group may be least likely to be able to respond to an online survey.) **Many who previously had no problem navigating in the world are now restricted from access to basic services** like hospital care, post offices and libraries because of these problems. With each new introduction of technology that exposes many to yet a new nondiscretionary source of electromagnetic radiation, particularly (but not exclusively) that which emits pulsed radiation in the radiowave-microwave part of the spectrum, a new group of people are affected; and the suffering of those who are already affected increases greatly.

Please, defend the public and our future. Protect the rights of the individual and the locality, against a form of incursion that will lead to serious harm to some – and set a terrible precedent. **Vote no on California SB 649**, and urge that everyone else do the same.

Sincerely,

Beatrice Alexandra Golomb, MD, PhD
Professor of Medicine
UC San Diego School of Medicine

*****Comment on the fire fighter exemption:"The legislature granted an exemption from SB 649 to the firefighters who requested it for health reasons. Throughout California firefighters have long complained of often disabling symptoms from cell towers on their stations. Cities frequently rent out space on fire stations to add to city revenue. …Symptoms experienced by the firefighters have included neurological impairment including severe headache, confusion, inability to focus, lethargy, inability to sleep, and inability to wake up for 911 emergency calls. Firefighters have reported getting lost on 911 calls in the same community they grew up in, and one veteran medic forgot where he was in the midst of basic CPR on a cardiac victim and couldn't recall how to start the procedure over again…Prior to the installation of the tower on his station, this medic had not made a single mistake in 20 years. A pilot study (2004) of California firefighters showed brain abnormalities, cognitive impairment, delayed reaction time, and lack of impulse control in all 6 firefighters tested (https://ecfsapi.fcc.gov/file/7022117660.pdf). This study led to the overwhelming passage of Resolution 15 by the International Association of Firefighters in Boston in August 2004. Res. 15 called for further study and was amended to impose a moratorium on the placement of cell towers on fire stations throughout the US and Canada."[15, 28]
Clearly, others who experience similar problems also deserve protections.

Optional – More on the Science

There is a robust literature showing that electromagnetic radiation, including in nonionizing frequencies, and at *levels*[29, 30] *below* those that are cause thermal effects (heating) – causes physiological effects, injury, and cell death –not only in humans but many animals and plants[3, 7, 31-49]. Unsurprisingly, industry has sought – against the tide of evidence to the contrary - to maintain that radiation must be ionizing or heating to cause injury.

Scores or hundreds of studies show that radiation, including specifically radiowave-microwave spectrum radiation, and including low-level exposure, can impair antioxidant defenses, increase "oxidative stress" (free radical injury) and damage mitochondria, the energy producing parts of cells[1, 2, 34, 50-6930, 70-104105-13646, 137-171]. These effects occur with ionizing and nonionizing radiation, at thermal and subthermal levels. (Indeed, much or most of the damage by ionizing radiation, and radiation above the thermal limit, occurs by mechanisms also documented to occur without ionization, and below the thermal limit.) These

mechanisms cohere with the mechanisms documented to play a role in symptoms and health conditions that are reported in those who are electrosensitive – extending to seizures[172-176], heart failure[177-184] and cognitive decline[5, 32, 57, 108, 185-195].

These mechanisms have known involvement in induction of **brain cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, and neurodegenerative conditions**, conditions that have exploded. In each case these have been linked, or presumptively linked, in some studies to electromagnetic radiation[8, 9, 16, 34, 196-219].

Such radiation also has effects on sperm[33, 100, 220-228]; and the DNA of sperm[229] (consistent with recent news reports of marked recent declines in sperm counts and function)..

Such radiation also has toxic effects in pregnancy[230], to the fetus and subsequent offspring[231-235] including at low levels[236], and is tied to developmental problems in later life, including attention deficit and hyperactivity[31, 235-241]. It is critical to defend pregnant women (and eggs of girls who may at a later time become pregnant) from exposures with such toxicity.

Electromagnetic radiation across much or most of the spectrum (not excluding visible light) has been shown to depress levels of melatonin[40, 72, 242-252]**,** which is best known for its role in sleep (and indeed, impaired sleep is the most consistent symptom in affected individuals[10, 11]).

Melatonin is in fact a critical antioxidant that defends the body against harm from *many* toxic exposures[253-266] **including electromagnetic radiation itself** [61, 66, 67, 82, 101, 107, 118, 121, 138, 144, 151, 204, 249, 267-284]**- reducing the oxidative stress** that is implicated in cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, bipolar disorder and neurodegenerative conditions, and that also plays a role in heart attack and stroke[9, 285-329330-343].

Radiation, and specifically radiation in the radiowave-microwave portion of the spectrum can also depress levels of other critical antioxidant systems that also defend the body against chemical, radiation, and other sources of injury. These other antioxidant systems include the glutathione system, superoxide dismutase and catalase[81, 102, 115, 116, 233, 344-358] - which are also involved in defending against health problems.

This suggests that depression of antioxidant defenses due to electromagnetic radiation may magnify risk of chemically induced health effects (and depression of antioxidant systems due to some chemicals may amplify risk of harm from electromagnetic radiation). Indeed just such effects have been reported[359, 360].

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List of 142 Reviews on Non-thermal Effects of Microwave/Intermediate Frequency EMFs
Martin L. Pall

Among the scientific reviews documenting these various non-thermal health effects are 142 that follow. Each of these reviews cites at least a dozen primary literature citations showing non-thermal effects, with many citing 100 or more going up to the 3rd reference which cites over 1000 such citations. It can be seen from this that the primary literature citations supporting the existence of various non-thermal health effects cited in these reviews go into several thousands. This list is not and is not intended to be a list of all important such reviews. However it gives some measure of the size of the literature that contradicts the industry contention that there are no non-thermal effects of microwave frequency EMFs.

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The Effect of Continuous Low-Intensity Exposure to Electromagnetic Fields from Radio Base Stations to Cancer Mortality in Brazil

Nádia Cristina Pinheiro Rodrigues [1,2,*], Adilza Condessa Dode [3], Mônica Kramer de Noronha Andrade [1], Gisele O'Dwyer [1], Denise Leite Maia Monteiro [4], Inês Nascimento Carvalho Reis [1], Roberto Pinheiro Rodrigues [5,6], Vera Cecília Frossard [1] and Valéria Teresa Saraiva Lino [1]

1 Sérgio Arouca National School of Public Health, Oswaldo Cruz Foundation, Rio de Janeiro 21041-210, Brazil; monicakra@gmail.com (M.K.d.N.A.); odwyer@ensp.fiocruz.br (G.O.); inesreis@ensp.fiocruz.br (I.N.C.R.); verafrossard@gmail.com (V.C.F.); valeriaslino@gmail.com (V.T.S.L.)
2 Institute of Social Medicine, Rio de Janeiro State University, Rio de Janeiro 20550-900, Brazil
3 Instituto Metodista Izabela Hendrix, Belo Horizonte, Minas Gerais 30160-012, Brazil; mreengenharia@mreengenharia.com.br
4 Medical Sciences College, Rio de Janeiro State University, Rio de Janeiro 20550-170, Brazil; denimonteiro2@yahoo.com.br
5 Federal Center for Technological Education Celso Suckow da Fonseca, Rio de Janeiro 20271-110, Brazil; roberto.88rpr@gmail.com
6 Petrobras, Rio de Janeiro 20031-912, Brazil
* Correspondence: nadiacristinapr@gmail.com

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Abstract: Background: this study aims to estimate the rate of death by cancer as a result of Radio Base Station (RBS) radiofrequency exposure, especially for breast, cervix, lung, and esophagus cancers. Methods: we collected information on the number of deaths by cancer, gender, age group, gross domestic product per capita, death year, and the amount of exposure over a lifetime. We investigated all cancer types and some specific types (breast, cervix, lung, and esophagus cancers). Results: in capitals where RBS radiofrequency exposure was higher than 2000/antennas-year, the average mortality rate was 112/100,000 for all cancers. The adjusted analysis showed that, the higher the exposure to RBS radiofrequency, the higher cancer mortality was. The highest adjusted risk was observed for cervix cancer (rate ratio = 2.18). The spatial analysis showed that the highest RBS radiofrequency exposure was observed in a city in southern Brazil that also showed the highest mortality rate for all types of cancer and specifically for lung and breast cancer. Conclusion: the balance of our results indicates that exposure to radiofrequency electromagnetic fields from RBS increases the rate of death for all types of cancer.

Keywords: cancer; mortality; electromagnetic fields; breast neoplasms; lung neoplasms; esophageal neoplasms; uterine cervical neoplasms

1. Background

Mobile phones have become extremely common in modern times. Wireless technology has a large number of Radio Base Stations (RBSs), which transmit information through radiofrequency signals. In 2006, there were already more than 1.4 million RBSs in the world [1]. In the Brazilian capitals, RBSs were implemented in 1992 in Brasília (the capital of Brazil), and in 2017, there were 27,145 RBSs indexed in the capitals [2].

The effect of electromagnetic fields emanating from RBS on health is not very well known. The World Health Organization (WHO) reported, in 2006, that scientific knowledge indicates that RBS radiofrequency exposure is within the international standards and, therefore, does not pose a risk to human health [1]. However, in 2014, the WHO recognized the need to promote research to investigate the effect of the radiofrequency field on human

health as a priority in order to fill the knowledge gaps [3]. Several issues relating to new wireless technologies are currently highlighted: the environmental impact of RBS radio frequency exposure, its effects on human health, its thermal effects, and its noise emission [4].

In Brazil, the National Telecommunications Agency (ANATEL) is the entity that regulates the electromagnetic emission of RBSs in accordance with the limits established by Resolution No. 700 of 28 September 2018 (Union Official Diary) [5]. In addition to ANATEL, telecommunication antenna installations are also regulated by municipal laws in order to minimize environmental and human health impacts [4].

Mobile phone-derived electromagnetic fields are classified by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans [3,6,7]. The intensity of the RBS radiofrequency fields is higher near the antenna and decreases as the distance from it is greater [1,8]. In big cities, however, RBSs are located very close to populated areas, above or between homes and businesses. The antennas are so close to homes that the multi-story windows of residential buildings, for example, are side by side to these antennas [9].

Despite the scarce knowledge on this subject, there are few resources allocated to investigating the role of exposure to electromagnetic fields from RBSs on human health. In the United States, for example, until 2010, no funding had been reserved by government agencies to study the possible health effects on people living near RBSs [9]. This study aims to estimate the rate of death for cancer according to RBS radiofrequency exposure, especially by breast, cervix, lung, and esophagus cancers, which are among the most common cancers in Brazil for men, women, or both sexes.

2. Methods

This is an ecological study using capitals as the unit of analysis. We collected information on the number of deaths by cancer per gender, age group, Gross Domestic Product (GDP) per capita, death year, and the amount of exposure over a lifetime.

Information on deaths by cancer per gender and age was collected from the Mortality National System (SIM) from the Computer Science Department of the Unified Health System (DATASUS) website [10]. We investigated all cancer types and some specific types: (1) deaths by breast cancer (International Classification of Diseases 10th Revision (ICD10) group—malignant breast neoplasms), (2) deaths by cervix cancer (C54 category of ICD10—malignant neoplasm of the cervix), (3) deaths by lung cancer (C34 category of ICD10—malignant neoplasms of the bronchi and lungs), and (4) deaths by esophageal cancer (C15 category of ICD10—malignant neoplasm of the esophagus). The choice of these specific types of cancer for this study took into account the high frequency of new cases in women or in men. Current statistics from 2020 from the National Cancer Institute show that breast cancer had the highest number of new cases in 2020 for women (about 66,000 cases, corresponding to about 30% of cases). Cervical cancer was the third, with more new cases in 2020 in women. Lung cancer was the fourth with more new cases in 2020 in men and women, and esophageal cancer was the sixth with more new cases in men. With regard to mortality, data from 2018 indicate that the cancers selected for this study are among the top five in number of deaths. These values refer to both genders for lung cancer, to female strata for breast and cervical cancers, and to the male stratum for esophageal cancer [11]. Although brain cancer does not have a high frequency in Brazil and metastatic brain tumors are more frequent than primary brain tumors, as several studies have evaluated their relationship with exposure to electromagnetic fields, we have included the results of the analysis of this type of cancer in Supplementary Tables S1 and S2.

Census population data [12] and GDP were also collected from the DATASUS website [10]. The number of RBSs and the year they were implemented in each capital were collected from Telecommunication Service System [2].

People's exposure times were calculated according to birth and death years. The annual RBS radiofrequency exposure was calculated by summing the number of RBS implementations in each year multiplied by the people's exposure time. The total exposure was calculated from the sum of annual exposures.

A map with charts was built using the mortality rate per square kilometer (km^2) and the median of RBS radiofrequency exposure in the 2010–2017 period.

3. Statistical Analysis

We calculated the median and interquartile range of mortality rate per 100,000 according to the levels of explanatory variables. The Kruskal–Wallis test was used to access the statistical differences between groups.

Multilevel Poisson regression models were used to estimate the risk-adjusted mortality. The response variable was death by cancer, and the fixed effects were the logarithm transformation of RBS radiofrequency exposure, gender, age group, and death year. We also included an offset with the logarithm of population size. The random effects included capital city (intercept), square root transformation of GDP (slope), and capital's area per km^2 (slope). When the response variables were death by breast and cervix cancer, the gender was not included as a fixed effect, as only females were investigated.

The abovementioned logarithmic transformations and the square root transformation were used to normalize the distribution of variables. We used R-Project version 3.6.1 (R Foundation, Vienna, Austria) and ArcGis version 10.5 (Environmental Systems Research Institute, Redlands, CA, USA) to perform the analysis.

4. Results

For all cancers and for the specific types investigated (breast, cervix, lung, and esophagus cancers), the higher the exposure to RBS radiofrequency, the higher the median of mortality rate. In capitals where RBS radiofrequency exposure was higher than 2000/antennas-year, the median of the breast cancer mortality rate was 27.33/100,000, while for all cancers, it was 111.68/100,000 (Table 1).

Table 1. Descriptive analysis of cancer mortality in Brazilian capitals.

	Breast	Cervix	Lung	Esophagus	All Cancers
	Median/10^5 (IQR)	**Median/10^5 (IQR)**	**Median/10^5 (IQR)**	**Median/10^5 (IQR)**	**Median/10^5 (IQR)**
RBS-sign	*	*	*	*	*
≤500	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	7.30 (44.94)
501–1000	1.16 (27.11)	2.74 (26.30)	0.00 (38.97)	0.00 (0.00)	26.32 (382.14)
1001–2000	20.12 (54.53)	7.38 (25.79)	4.47 (63.42)	0.00 (8.74)	71.95 (500.43)
>2000	27.33 (63.06)	9.56 (16.43)	9.58 (76.46)	1.62 (14.21)	111.68 (552.78)
Sex-sign			*	*	*
Female			3.77 (46.88)	0.00 (3.17)	75.31 (360.87)
Male			4.31 (98.82)	0.45 (22.06)	56.49 (540.97)
Age group-sign	*	*	*	*	*
<30	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	5.75 (4.53)
30–49	9.89 (13.56)	6.75 (7.31)	1.81 (4.39)	0.00 (1.13)	38.59 (44.90)
50–69	43.43 (20.19)	15.02 (14.71)	34.08 (42.50)	6.75 (16.28)	258.79 (240.76)
≥60	91.18 (64.51)	27.35 (37.02)	159.40 (159.63)	20.31 (39.68)	1178.11 (1012.72)
Year-sign	NS	NS	NS	NS	NS
2010–2011	16.95 (52.66)	6.29 (19.36)	4.44 (64.91)	0.00 (8.87)	68.76 (508.70)
2012–2013	15.98 (56.94)	6.42 (19.09)	4.13 (66.30)	0.00 (10.29)	65.09 (501.19)
2014–2015	17.36 (56.05)	8.29 (19.52)	4.13 (65.15)	0.00 (9.54)	65.56 (491.10)
2016–2017	18.01 (52.08)	7.62 (16.66)	3.54 (65.52)	0.00 (8.22)	61.87 (444.41)

RBS = exposure to radio base stations (antennas-year); IQR = interquartile range; sign = statistical significance − significance. * p-value < 0.001 and NS, p-value > 0.05.

Females showed the highest median of mortality rate for all cancers but specifically for lung and esophagus cancers; the highest median of mortality rate was observed in males (4.31/100,000 and 0.45/100,000, respectively) (Table 1).

For all cancers and for the specific types investigated, the higher the age group, the higher the median of mortality rate. Lung and breast cancers showed high medians of mortality rate (159.40/100,000 and 91.18/100,000, respectively) (Table 1).

The median of mortality rate for all types of cancer decreased from 68.76/100,000 to 61.87/100,000 over the period. For breast, cervix, lung, and esophagus cancers, it showed slight variations over the period, around 17/100,000, 7/100,000, 4/100,000, and lower than one per 100,000, respectively (Table 1).

In the adjusted analysis, the results showed that the higher the logarithm of RBS radiofrequency exposure, the higher the cancer mortality rate. The highest adjusted risk was observed for cervix cancer (Rate Ratio (RR) = 2.18) (Table 2).

Table 2. Adjusted risk of cancer mortality in Brazilian capitals.

	Breast		Cervix		Lung		Esophagus		All Cancers	
	RR	**Sign**	**RR**	**Sign**	**RR**	**Sign**	**RR**	**Sign**	**RR**	**Sign**
Fixed effects										
Log RBS	1.25	***	2.18	***	1.14	***	1.18	**	1.15	***
Sex										
Female					1.00		1.00		1.00	
Male					1.97	***	4.88	***	1.42	***
Age group										
<30	1.00		1.00		1.00		1.00		1.00	
30–49	37.59	***	13.82	***	20.11	***	73.84	***	6.06	***
50–69	132.29	***	30.74	***	323.80	***	876.50	***	40.73	***
≥60	297.55	***	53.88	***	1250.63	***	2154.44	***	164.61	***
Year										
2010–2011	1.00		1.00		1.00		0.00		1.00	
2012–2013	0.97	NS	0.78	***	0.97	NS	0.96	NS	0.98	*
2014–2015	0.96	NS	0.62	***	0.93	**	0.88	***	0.95	***
2016–2017	0.81	**	0.46	***	0.84	***	0.76	***	0.84	***
Random effects										
	Std Dev				Std Dev		Std Dev		Std Dev	
Capital (intercept)	0.61	***	1.55	***	0.19	***	0.86	***	0.28	***
Sqrt GDP (slope)	0.00	***	0.01	***	0.00	***	0.00	***	0.00	***
Area/Km^2 (slope)	0.00	NS	0.00	NS	0.00	NS	0.00	*	0.00	NS
Deviance	12274		8345		24732		10364		100918	

Sqrt GDP = square root transformation of gross domestic product per capita; RR = rate ratio; Std Dev = standard deviation; Log RBS = logarithm transformation of radio base station radiofrequency exposure (RBS radiofrequency exposure = sum of the number of RBS in each year multiplied by the exposure time); sign = statistical significance − significance. *** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05; and NS, p-value > 0.05.

A multilevel Poisson model was used to estimate the risk of cancer mortality. Except for breast and cervix cancers, which were estimated only for women, every adjusted models included as fixed effects the variables sex, logarithm of RBS, age group, and death year. The variables included as random effects were capital (intercept), GDP (slope), and area/Km^2 (slope). The offset of the population was also included in the models.

Males showed the highest adjusted risk of lung, esophagus, and all types of cancer (Table 2), although the median of mortality rate for all cancers was higher for females in the bivariate analysis (the results are shown in Table 1).

As expected, there was an increasing trend in the adjusted risk of cancer mortality in the older the age group. Compared to people younger than 30 years old, the adjusted risks were 297.55, 53.88, 1250.63, 2154.44, and 164.61 for breast, cervix, lung, esophagus cancer, and all cancers, respectively (Table 2).

For cervix cancer and all types of cancers, there was a decreasing trend in the adjusted risk of cancer mortality for more recent periods. For lung and esophagus cancers, this trend is observed from 2014–2015 period (Table 2).

The inclusion of random effects was significant in every models for the following effects: "capital" (intercept) and "square root of GDP" (slope). However, for the "area of the capital" (slope), it was significant only for esophagus cancer. For all models, the greatest standard deviation of random effects was observed for the "capital" (intercept) (Table 2).

The spatial descriptive analysis showed that the highest median of RBS radiofrequency exposure was observed in Florianópolis (South of Brazil) (44.23 antennas-year/km^2). Florianópolis also has the highest mortality rate per km^2 for all types of cancer and specifically for lung and breast cancer (0.09/100,000, 0.31/100,000, and 0.93/100,000, respectively). Recife (Northeast) and Belo Horizonte (Southeast) showed medians of RBS radiofrequency exposure higher than 20 antennas-year/km^2, and their mortality rates per km^2 for all cancers were 0.29/100,000 and 0.19/100,000, respectively. Vitoria (Southeast), Teresina, Fortaleza, Natal, and Aracaju (both in Northeast) showed medians of RBS radiofrequency exposure higher than 10 antennas-year/km^2, and mortality rate per km^2 for all types of cancer were 0.60/100,000, 0.49/100,000, 0.21/100,000, 0.35/100,000, and 0.38/100,000, respectively (Figure 1).

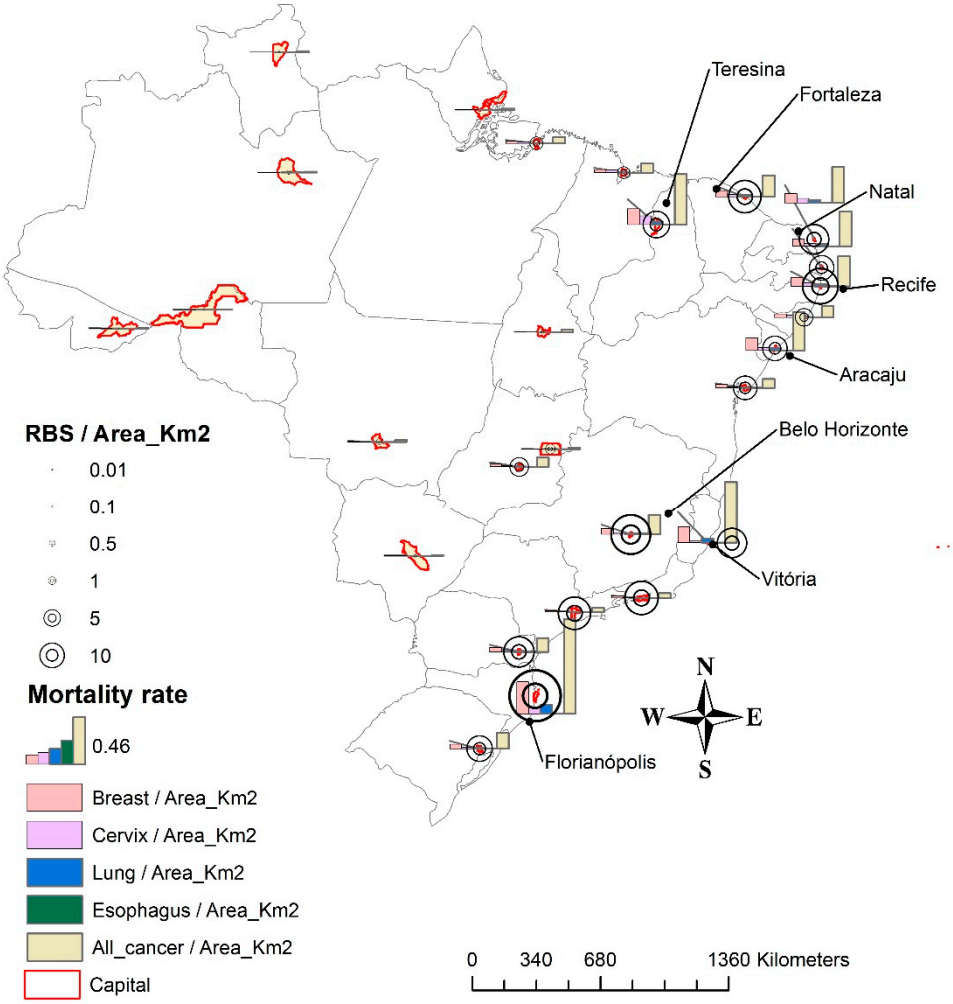

Figure 1. Distribution of the cancer mortality rate in each capital and their experience of exposure to radio base stations radiofrequency, 2010–2017. RBS = median of the number of radio base station radiofrequency exposure (RBS radiofrequency exposure = sum of the number of RBS in each year multiplied by the exposure time). RBS/Area_Km2 = median of the number of RBS per Km^2. We used the median of mortality rate. Breast/Area_K2, Cervix/Area_K2, Lung/Area_K2, or Esophagus/Area_K2 = median mortality rate for a specific cancer type per Km^2.

5. Discussion

The biological effects of exposure to electromagnetic fields were investigated in some studies, mainly experimental studies with mice. The authors point out the following effects: an increase in the calcium efflux in human neuroblastoma cells, impairing cellular functions [13]; changes in the immune system [14]; a decrease in reproductive function [15]; an increase in serum testosterone levels [16]; an increase in permeability of the blood–brain barrier, which protects the brain from toxic substances, bacteria, and viruses [17]; and damage to cell DNA [18–20].

The evidence of radiofrequency radiation carcinogenesis has increased since 2011. Some animal studies suggest that exposure to electromagnetic fields accelerate the development of sarcoma colonies in the lung, mammary tumors, skin tumors, hepatomas, and sarcomas [21,22]. This study detected an increase in the rate of death by cancer in capitals where there is a greater exposure to electromagnetic fields emanating from radio base stations. Studies made in Stockholm (Sweden) indicate that high levels of environmental radiofrequency radiation are quite present in residential and commercial areas [23–25]. In the United Kingdom, at the beginning of 2009, there were 51,300 RBSs and two thirds were installed in existing buildings or other structures [9].

Dode et al., 2011, pointed that electromagnetic fields from telecommunication systems is an important environmental problem nowadays [8]. The authors detected 6724 deaths by neoplasia occurring within an area of 500 m from the RBS and 320 deaths within an area between 500 and 1000 m. The mortality rate within an area of 500 m was 34.76 per 10,000 inhabitants, while within an area of 1.000 m, the rate was 32.78 [8].

Although in the present study, we investigate all cancers, we also investigated breast, cervix, lung, and esophagus cancers separately. In a mortality study performed in Brazil, breast and lung cancers were among the main cancers related to radiofrequency electromagnetic fields from RBS radiofrequency exposure [8].

Breast and cervix cancer have cure rates of around 95% when diagnosed early [26]. Mortality from breast cancer continues to increase in Brazilian capitals, while mortality from cervical cancer remains stable, unlike what occurs in developed countries, in which mortality for these cancers is decreasing. Lung cancer has less chances to be cured when detected in the early stages (56%) [26]. Esophageal cancer is difficult to detect early. In most cases, the signs and symptoms only appear in more advanced stages of the disease [26].

Despite the advance in knowledge about cancer, not all countries seem to benefit from this advance. This is the case of low- and middle-income countries, where a significant portion of the population does not have access to diagnosis and treatment, decreasing their chances of survival.

In the present study, we detected that the higher the exposure to radiofrequency electromagnetic fields from RBSs, the higher cancer mortality is. A study conducted in Israel also found that low-frequency electromagnetic fields contribute to breast cancer development [27–29]. Others studies also referred to the relationship between cancer and radiofrequency electromagnetic fields [30,31], including in animal studies [32].

In addition to exposures to radiofrequency electromagnetic fields, we have to consider other factors that contribute to the increase in cancer incidence and mortality. In Brazil, about 70% of the population depends on public health [33], and there are difficulties accessing cancer diagnosis and treatment in public health services. Opportunistic screening is still adopted, performed only when the patient in the risk group comes to the health service and there is difficulty starting cancer treatment within 60 days, as required by Brazilian law [34]. The consequences of these problems are the worsening of the disease and the high number of preventable deaths.

The main risk factor for lung cancer is tobacco consumption, which is higher for males [35]. Tobacco consumption has been decreasing gradually in Brazil from 1980 to 2013 [36], and this decline may have contributed in some way to reducing lung cancer mortality in men over time [37]. The main risk factors for esophageal cancer are the high intake of hot drinks [38], alcoholic beverages, and tobacco; low ingestion of fruit and

vegetable; and exposure to occupational agents like benzene, silica, and asbestos [39]. Family history is one of the most important breast cancer risk factors [40]. However, there are many other risk factors, such as aging, genetic mutations, reproductive history, dense breasts, past history of breast disease, previous treatment with radiotherapy, sedentary lifestyle, overweight or obesity after menopause, alcohol intake, and use of hormones and some oral contraceptives [41]. Cervix cancer risk factors are associated with the risk of Human Papillomavirus (HPV) infection. A high number of pregnancies and no regular preventive colpocytology are pointed out as risk factors to cervix cancer [42].

In the present study, a capital located in the south showed the highest RBS radiofrequency exposure and the highest mortality by cancer (Florianópolis). In fact, other studies have also reported high rates of cancer in this capital [43–47].

Our results showed that, in general, men had a higher mortality rate of esophageal and lung cancer and that this rate increases with age. In fact, the scientific literature corroborates these results [48–52].

In order to keep the cellular sets running, the radiofrequency transmitters installed on the tops, roofs, and façades of buildings and residences emit electrical and magnetic fields 24 h a day. However, it is known by scientific knowledge that the nonthermal magnetic component can penetrate deeper into the body than the electrical one [53].

A person can stand at a fixed distance to an RBS and be exposed to 100% of the maximum permissible exposure or 5% of it depending on the antenna height and the bystander altitude. Therefore, people living in the upper floors of a building located in front of the antennas receive radiofrequency corresponding to 100% of the maximum permissible exposure [54]. Those data were confirmed in the Post-Graduation Project conducted at the Federal University of Minas Gerais (UFMG), Brazil, based on measures made in the capital of the state inside 400 residences located near the RBS from 2015 to 2019, measurements made by "MRE Engenharia—Medição de Radiações Eletromagnéticas" [55].

The measured values of the electrical and magnetic fields have shown more human exposure to electromagnetic radiation in an area within a 500 m radius from the transmitter antennas of cellular telephony [8]. To avoid hazards to human health, the safest solution would be to switch off the RBS in an area within a 500 m radius from residences, workplaces, hospital areas, kindergartens, and buildings.

As a limitation, it is important to note that this study used cancer data from national Brazilian sources, which can provide underestimated rates at different levels according to the region. For example, a study conducted in northern Brazil found a large proportion of deaths classified as unspecified uterine cancer. After the proportional redistribution of these deaths, there was an increase of 46% in the average cervical cancer mortality rates [56]. Another study conducted in a northeastern region of Brazil highlights that, within the older age group, the number of deaths before and after correction showed a significant variation, especially for breast cancer, where variation reached 54% [57].

Still as limitations of the study, we highlight two more points. As this is an ecological study and due to the unavailability of individual dwelling time data, the time that each individual lived close to an RBS could not be accessed. The possible migratory movements could also not be considered for calculation of the amount of exposure to RBS radio frequency throughout life in the resident population. This was calculated only according to birth, death year, and the year in which the RBS was implemented. However, people could have been born in another city and then migrated to the capital where the death was recorded. The other point is the proximity of stations to places of residence that interfere with the level of exposure of individuals. As it is an ecological study in which the unit of analysis is the capital, this study did not take into account the distances between stations and homes.

6. Conclusions

The balance of our results indicates that the exposure to radiofrequency electromagnetic fields from an RBS increases the rate of mortality by all cancers and specifically by

breast, cervix, lung, and esophageal cancers. These conclusions are based on the fact that the findings of this study indicate that, the higher the RBS radiofrequency exposure, the higher the cancer mortality rate, especially for cervix cancer (adjust RR = 2.18). The spatial analysis showed that the highest RBS radiofrequency exposure was observed in a city located in the southern region of Brazil, which also showed the highest mortality rate for all types of cancer and specifically for lung and breast cancers.

Environmental pollution caused by nonionizing electromagnetic fields increases continuously. The location of RBSs is still a controversial field with regard to their regulation. There are numerous RBSs installed in residential areas, including on their roofs. Some epidemiological studies indicate an increased risk of cancer close to RBSs. It is important that further epidemiological investigations are conducted to elucidate the role of the environment in radiofrequency signals on carcinogenesis processes.

Supplementary Materials: The following are available online at https://www.mdpi.com/1660-4601/18/3/1229/s1, Table S1: Descriptive analysis of brain cancer mortality in Brazilian capitals, Table S2: Adjusted risk of brain cancer mortality in Brazilian capitals.

Author Contributions: Conceptualization, N.C.P.R.; methodology, N.C.P.R.; software, N.C.P.R.; formal analysis, N.C.P.R. and R.P.R.; investigation, N.C.P.R.; data curation, R.P.R.; writing—original draft preparation, N.C.P.R.; writing—review and editing, N.C.P.R., A.C.D., M.K.d.N.A., G.O., D.L.M.M., I.N.C.R., V.C.F., R.P.R. and V.T.S.L.; visualization, A.C.D., M.K.d.N.A., G.O., D.L.M.M., I.N.C.R., V.C.F. and V.T.S.L.; supervision, N.C.P.R. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest: The authors declare no conflict of interest.

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Planning Department

From: Daniel Kaseman <kasemandan@gmail.com>
Sent: Monday, June 5, 2023 9:58 AM
To: Planning Department
Subject: Shannondale Lake Telecommunications Tower (File: 23-3-SP)

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or on clicking links from unknown senders.

Dear Jefferson County,

Here are our comments per the subject application:

1) Would building this tower on a dam site compromise the structural integrity of the dam?
2) Have optional sites been investigated that are more conducive to this type of application (i.e. Industrial and/or commercial zoning districts)?
3) Can the height of the pole be 80' as opposed to 100' reduce the visual affect?
4) The State of West Virginia owns hundreds of acres of uninhabited land close by. Locating in this unpopulated area would reduce the effect on far fewer neighbors. Has this been considered?
5) Can the pole be disguised and made less visible.
6) Could an eagle nesting platform be added?

You can put us down s against this application, but do realize it will be determined by the laws and regulations that are applicable. I wish we had a more detailed plan as to where this type of thing can be located. We as a community can do much better.

Thank you for your work to make Jefferson County a better place!

Sincerely,
Daniel M. Kaseman/Theresa Fahy, DPM
49 Lakeside Court
Harpers Ferry, WV 25425
kasemandan@gmail.com
703-217-0664

Planning Department

From: Diane Obenchain <dianeobenchain@outlook.com>
Sent: Monday, June 5, 2023 10:07 PM
To: Planning Department
Subject: File:23-3-SP Shannondale Lake Telecommunication Tower Plan

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or on clicking links from unknown senders.

To whom it may concern,

I write concerning a Shannondale Lake Telecommunication Tower Concept Plan to place a 100' Monopole Telecommunication Tower on the shores of Shannondale Lake.

We live at 161 Juniperwood Court, about one-half mile from the lake. My husband is 83 years and I am 75. We have owned our home for 25 years. We do not own property on the lake, but frequently walk around the lake for exercise.

The Shannondale community is a residential community, where hundreds of homes are located. It is not a rural area nor an urban area, but a residential community on the side of a mountain.

We understand that the telecommunication tower will be placed on the large vacant point of land next to the dam on Shannondale Lake.

We have been present on more than one occasion when a medical helicopter has landed on that very same point of land to medivac a patient needing emergency care. As seniors in the community, we have been grateful that a medical helicopter can land conveniently in the midst of our community. So we wonder: how will a medical helicopter will be able to land with the 100 foot telecommunication tower located at the very same place?

We have heard that one reason for the telecommunication tower is that some folks on the mountain lack efficient cell phone service to access 911. This seems a good reason to put a telecommunication tower somewhere near the Shannondale community, but why right on the same point of land that is used for medical helicopters?

If the telecommunication tower is needed, why not place the telecommunication tower somewhere near the new Route 9 or in Charles Town itself instead of taking away the one place where a medical helicopter can access the deeply residential area of Shannondale?

Thank you for considering my question at your meeting on June 13, 2023. We look forward to hearing from you.

Sincerely,

Dr. Diane B. Obenchain (retired university/seminary professor)
Dennis D. Donahue (retired US Foreign Service Officer)

TO the Planning Commission, Jefferson County (June 5, 2023)

These comments are submitted by Adam Shub and Rachel Shub, 51 Lakeside Court, pursuant to the Notice of a Public Workshop dated May 30, concerning the application of Smartlink to build a 100-ft monopole cell tower next to lake Shannondale (File: 23-3-SP). As set out below and in the attachment, please:

(1) do not approve this ill-advised plan that is utterly inconsistent with the County's zoning policies or

(2) if any doubt remains as to the ill effects of this plan, postpone its consideration until next month's meeting to allow for further community discussions.

--

The site proposed is ill-advised, to say the least, as it would impose an ugly industrial structure right next to a bucolic lake in a neighborhood which, while zoned rural, is a recreation site for water sports in a fairly dense residential area of small plots. The proposed site, with a chain link fence of 50' by 50, with no camouflage promised or even possible, will be visible by all who frequent or are located in the main part of the lake and inlets/fingers, and would be the only structure to protrude almost twice the height of the tree line. A site visit by the Commissioners would be helpful to better understanding the shocking effect of what is proposed: currently the site presents a scenic focal point for the entire lake, almost a horizon view, with only the dam and trees in the distance. The proposed location of the tower in the middle of this lovely view would ruin this view--and is utterly oblivious to the concerns of those who have bought property precisely for the use and enjoyment of a beautiful recreational site and to the underlying policies of land use in the County, as set out below.

<u>Legal requirements and policies</u>

A review of the application and the relevant Jefferson County policies underscores that the proposal flies in the face of the objectives, intentions, and requirements of the **Jefferson County Zoning and Land Development Ordinance Article 4B.7**, and is not in the best interests of the community.

Specifically under the rules (see **Article 4B7 D**), the applicant bears the burden of demonstrating by substantial evidence not only a *bona fide* need (for the community, not its expected profits), but must overcome the strong presumption-- in the County's "preferred structures and location policy"((**Article 4B7 H**)--that such towers be located in (a) "the Industrial-Commercial District" or (b) NON-RESIDENTIAL areas screened by "existing" vegetation (**para 3**). The applicant's file does not meet the criteria or show any serious effort to find an alternative location and to avoid locating a facility in this very residential Lake Shannondale neighborhood.

Moreover, the policy in **section H** also provides that the *preferred* support structures are first, (a) Silos, and next, (b) "other alternative structures" (**paragraph 2**). There has been no evidence presented that the need for a structure (which has not been specifically set out or descried either) could not be met by an *alternative* structure or approach.

In fact the policy in section H states a very clear preference for communications companies to first explore *co-location and the use of "existing…or alternative structures* (**paragraph 1**).

The applicant has not met its "burden of demonstrating by substantial evidence in a written record that a *bona fide* need exists" for the particular structure, including its location**. Sections D and H 4(c).** The narrative and papers are missing any kind of explanation of the need or of the extent of any problem with connectivity, and no serious study or a detailed RF report was ever shared on this with the public. (**Sections D and F**). There is no narrative addressing, let alone defending, the design criteria as linked with any defined need. **(Section B, para 2.i)**

Indeed a glance at the maps provided by the applicant, showing "before and after" coverage (required by **Section F)** indicates that there is very little additionality in terms of increased number of households or areas to be covered. Why is a state-of-the-art powerful 100 ft monopole with 4 antennae needed? Given that the law requires avoidance of placement in residential neighborhoods, any application should address the current delta in coverage with specificity. In this case, the demonstration of need, and the Commission's decision, should also include and address the fact that the ATT concept plan for a monopole tower in an industrial-commercial zone off Berryville pike, which was approved over the last year (21-8-SP), would already extend stronger coverage in most of the broader area. This would seem to suggest that the proposed Shannondale radio waves would be stronger and more extensive than the actual need. (The law does not require all companies to have the chance to serve virtually the same areas). Overall, hence, Jefferson county would be subject to stronger cumulative radio frequency radiation than necessary. However this application has no such relevant information and makes no effort to design or tailor its plans to diminish the effect of the tower on residents.

As a practical matter, in the context of reviewing this application, we urge the Commission to take seriously these policies and requirements—particularly the avoidance of towers in a scenic residential neighborhood. Approval of a telecommunications tower in a residential recreational neighborhood should not be automatic or based simply on whatever a company decides to request and assert with an uninformative application. There are good reasons underlying the Ordinance's prioritization of location of communications facilities in non-residential, preferably industrial-commercial zones, and minimization of additional facilities such as a separate 100ft monopole tower. As noted by many experts, beside obvious aesthetic issues, cell towers bring increased radiation (and associated environmental and health concerns), devastating fire risk issues (from equipment failures in the last ten years), and additional noise, and hence also property devaluation issues. All of these issues are important and need due diligence by decision makers.

<u>Further detailed reasons why caution is warranted in the application of the Ordinance's criteria</u>

1. For a variety of reasons (health, environmental, sound, aesthetic), the presence of such towers within view of residences or in the near vicinity reduces the market value of the neighboring residence. It is uncontested that cell towers reduce aesthetic value, and buyers are more reluctant to purchase property within sight of cell towers. See https://ehtrust.org/cell-phone-towers-lower-property-values-documentation-research/

2. This Shannondale lake community location and broader rural area are replete with birds, vegetation and wildlife. The area is also sandwiched between two Shannondale wilderness areas and not far from the Shenandoah River. Has an environmental impact been assessed? There are studies showing that radio frequency radiation affects wildlife, and towers can cause death of birds. A previous application by ATT for a monopole on Berryville pike (now at the site plan stage) included a separate environmental impact study—even

though that application was for a tower in a “industrial-commercial” district. No application should go forward with respect to this site without the due diligence and consideration of these potential short and long-term effects. Such a study is all the more warranted given the delicate balance and structures of the dam and manmade lake.

3. Many recent studies have shown that proximity to radio frequencies of this kind has lasting detrimental health effects, particularly on children whose brains, flesh and bones are more fragile and less developed than those of adults. The American Cancer Society has warned that cell towers increase the risk of health hazards, such as headaches, memory loss, congenital disabilities and cardiovascular stress. Many peer-reviewed studies also report that proximity to wireless technology may also lead to cancer, low sperm count, and birth defects as they emit non-ionizing high RF waves – which many serious scientists do say affects human health and wildlife.

   The science on 5G radiation in particular is new and evolving—and should not be assumed to be relatively safe, the way cigarettes and opiods once were. There are dozens of US and international studies of health risks of exposure to towers. See at least some of these health studies, as well as letters of concern from doctors around the world, here: https://ehtrust.org/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/

   The major questions concerning both long and short-term health effects warrant strict adherence to the Ordinance’s preferences and policies, rather than willy-nilly expansion of 5G networks without regard to nearby residents.

4. The electrical activity of the tower will create noise pollution in an area that is very quiet at night (in keeping with the rural zoning.) Residents of the lake have experienced that the particular geographical configuration of the lake seems to magnify sounds considerably—a private conversation between two people in the center of the lake can be heard loud and clear at the end of an inlet and across the lake. Has a sound test been conducted to simulate the effect of the addition of a working tower?

5. An unrelated but relevant issue is that the property owners also have stated a goal of installing a helipad in the area to help in an emergency. Will FCC require lighting to be installed accordingly, as a condition? Such lighting would significantly disturb the restful quality of the community at night.

Request for postponement due to inadequate notice and inadequate study

As the owners of a small property on Lake Shannondale, with a direct view of the proposed site from our property as well as our dock, we are also dismayed by the lack of time provided to those directly affected, and insufficient information provided to the public concerning details of the proposal—details without which no proposal should go forward. We request that the Chair use discretion to postpone consideration of the application at least for the Commission to review more closely the various comments and concerns of nearby residents (including the referenced scientific studies provided) as well as to pay a site visit.

Specifically, beyond the lack of detail described above, the mailing list used to advise residents of the balloon test appeared to lack many names of people who have owned property on Lake Shannondale for years, my family included. The property owners also seem not to have taken steps to advise at least the Mountain Lake Club membership in writing (ie. email) of their intentions or negotiations with Verizon. The green signs prepared by the Commission notifying the public of the hearing were not ON the site or specifically next to it either. (A few of us discovered one by happenstance this past weekend, by Fern Drive, rather than at the site, where, in contrast there is currently still a perfectly visible large sign for the Mountain Lake Club, as seen in the balloon pictures.). Given the exceptional treatment being sought by the application—which came as a shock to many on the lake-- more time should be provided to allow further discussion by the Commission and consideration of alternatives with the community.

From: roberta cohen
To: Planning Department
Subject: Shannondale Lake Telecommunication Tower (file: 23-3-SP)
Date: Tuesday, June 6, 2023 12:03:45 PM

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Dear Madam/Sir:

After reading informed, well argued and concerned points of view from neighbors in the residential area, I am opposed to the placement of the Telecommunication Tower at Shannondale Lake.

To begin with, it is creating a conflict with the neighborhood and a great deal of resentment in an otherwise peaceful and serene community, which will harm the current good feeling and cohesiveness of that community so important for everyone's well being and for the wellbeing of Jefferson County. Recall that this lake area had to overcome the trauma of the burning down of the lodge years ago and a community has slowly but surely been rebuilding. It's taken a long time. The Tower proposal will clearly interfere with that rebuilding.

Much of the opposition -- and there is alot -- is because the tower will mar the beautiful view of those in the area, who chose to live in this recreational space in great part because of the view, to which we are all accustomed and enjoy. Undermining the residents in this way cannot be an acceptable consequence of a plan, whatever its intent.

There are also concerns about whether this structure will cause health problems over the long term that are not now evident; and contribute to lowering real estate values, which is a clear possibility.

In sum, there must be far greater discussion with those seeking to impose this tower upon the community and the neighborhood being imposed upon. If it is decided that a tower must be built, then another site, most notably an industrial site, should be chosen as the location, or better yet an alternative structure targeted to those who are missing reception on the mountain.

No tower can be worth the rancor that has developed in the lake community, and which must be taken into account and addressed as soon as possible.

Thank you.

Roberta Cohen
102 Twin Cove Court

Harper's Ferry, West Va 25425
Tel. 202 302 2881 (cell)

From: Harriet Gordon Getzels
To: Planning Department
Subject: Concern about Verizon Tower
Date: Tuesday, June 6, 2023 4:26:41 PM

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To Jefferson County WV Planning Dept:

Hello,

Peter Getzels and I have owned a property on Lake Shannondale since 2018. The area is one of extraordinary beauty. Recently the new owners of the lake and their Mountain Lake Club have enhanced the area by providing social spaces and events that attract large numbers of local people and those who live further afield. The future looks promising for this area.

We recently learned that the owners of MLC plan to lease a piece of their property to Verizon so that a new cell phone tower can provide a wider reach than what is currently available. We are asking for the decision process to be extended, since we are among a number of people who found out about the tower only in the past two weeks. What concerns us is the following:

1. How many people are currently not reached by cell phone service, around the lake and on the mountain? Has this information been collected by the county or a third party, and if so, can the data be made publicly available? We'd like to have a better idea of why this is so urgent and how many people it is going to serve, in order to better understand impact, potential benefits and potential harm.

2. The size of the tower at the end of the lake will be unsightly in a recreation area, and taller than the trees. Have other sites been reviewed, higher up on the mountain and nearer the population who are out of cell phone reach? Can the towers that already exist be made more powerful to reach those who need service? Can the county provide internet-driven voice phones to those who aren't reached by cell service, as an alternative to the tower?

3. The location of the tower is in quite a densely populated residential area. It is my understanding that such a tower can only be located in an industrial or commercial area, for health and safety reasons. We would like to better understand how approval can be granted under this circumstance.

4. Studies on the health impact on humans and wildlife of electromagnetic radiation emitted from such a cell phone tower indicate that the structure should not be located in a residential area. We would like more time to review how the decision has been made to allow the tower to be located so near the lake and the residents.

5. The lake is considered ecologically fragile. Motorboats are not allowed. It does not seem environmentally appropriate that a powerful cell phone tower be located on a lakefront that is fragile.

Thank you for your consideration,

Harriet and Peter Getzels

711 Lakeside Drive

Harpers Ferry WV 25425

From:	Alexander Korovin
To:	Planning Department; Zoning
Subject:	Opposition to Shannondale Lake telecom tower (file 23-3-SP)
Date:	Tuesday, June 6, 2023 2:44:39 PM
Attachments:	Shannondale telecom tower objection letter.docx

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Dear Sir or Madame,

I am writing to express my opposition to the proposed telecommunications tower near Lake Shannondale (file 23-3-SP). Attached to this e-mail, please find a statement of objection from myself and several of my neighbors.

As lakeside property owners, we are concerned about the potential harmful impacts this project could have on human and environmental health, local property values, and the scenic beauty and recreational value of the lake.

We urge the Jefferson County Planning Commission to reject the tower proposal and consider alternative locations in non-residential areas, as required by the Jefferson County Zoning and Land Development Ordinance.

Thanks for your consideration,

Alex Korovin
548 Lakeside Drive
Harpers Ferry, WV 25425
(304)-728-2143

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Dear Jefferson County Planning Commission members,

I am writing to urge you to deny the application (file 23-3-SP) to build a 100 ft. Verizon telecommunication tower near Lake Shannondale, on property owned by the Mountain Lake Club. As lakeside property owners, we are concerned about the potential harmful impacts this project could have on human and environmental health, local property values, and the natural beauty and recreational value of the lake.

In the first place, the location of this project clearly violates the Jefferson County Zoning and Land Development Ordinance, which states that the preferred location of new towers is in "industrial-commercial districts" and "non-residential areas." Such a tower does not belong in the middle of a residential neighborhood, much less a natural recreation area like Lake Shannondale. According to the National Association of Realtors, cell phone towers can lower surrounding property values by up to 7.5%.

Secondly, many peer-reviewed studies have demonstrated the harmful effects of electromagnetic radiation on human health. For example, a literature review by A. Balmori concluded that approx. 74% of 38 studies reviewed found an association between radio frequency (RF) radiation and radiofrequency sickness, cancer, or changes in biochemical parameters (*Environmental Research,* 2022). The World Health Organization (WHO) has classified RF radiation as a class 2B possible carcinogen. Many additional examples of research linking cell phone towers with harmful effects on human health can be found at Cell Tower Radiation Science - Environmental Health Trust (ehtrust.org). These studies reinforce Jefferson County's rationale for limiting towers to commercial-industrial and non-residential areas.

Furthermore, a growing body of scientific evidence suggests that RF radiation harms wildlife as well as humans, especially insects and birds (see for example articles by Blake Levitt in *Reviews on Environmental Health,* 2021). The proposed location of the cell phone tower is within 1.5 miles of the Shannondale Springs Wildlife Management Area and the Appalachian Trail. It is also in close proximity to Furnace Creek and the Shenandoah River. Stakeholder organizations like the WV Division of Natural Resources (WVDNR), the Appalachian Trail Conservancy (ATC), and the National Park Service (NPS) – which manage nearby protected wilderness areas – should be consulted and given time to weigh in on the proposed tower project.

Finally, I would point out that many Shannondale residents (including myself) never received any notice, in the mail or otherwise, about this construction project in our neighborhood. A couple of signs were placed along Lakeside Drive, as if residents could read them while driving by. In the very least, consideration of the rezoning proposal should be postponed until appropriate public comment and environmental review can be conducted.

In summary, the proposed telecom tower near Lake Shannondale represents a threat to quality of life for thousands of nearby residents and property owners. We ask that you reject the tower proposal and consider alternative locations in non-residential areas, as required by the Jefferson County zoning ordinance.

Sincerely,

Alex Korovin
548 Lakeside Drive
Harpers Ferry, WV 25425
(304)-728-2143
alexander.korovin@clarivate.com

Adam McDowell
2175 Lakeside Drive
Harpers Ferry, WV 25425
adamwmcdowell@yahoo.com

Peter and Harriet Getzels
711 Lakeside Drive
Harpers Ferry, WV 25425
pgetzels@gmail.com
hgetzels@gmail.com

From: linda reeves
To: Planning Department
Subject: Comments on the Lake Shannondale Telecommunications Tower Concept Plan
Date: Tuesday, June 6, 2023 11:31:52 PM

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My name is Linda Reeves and I am one of the homeowners on Lake Shannondale whose home is in close proximity to where the proposed 100 foot telecommunications tower is projected to be placed. I am providing you with my written comments for your careful consideration of this important matter before you. **I am NOT in favor of the tower being installed at Lake Shannondale,** since currently there has been insufficient time for the scientific community to complete long term studies to determine whether there will be neutral or harmful effects on individuals, plants, animals, birds, insects, etc. on those within close proximity to the 100 foot cell tower and which may result in dangerous outcomes.. Some scientific studies conducted in Germany and other areas outside the United States have already concluded there are negative results with an increase in cancer to humans and negative impacts on other living things as well. By the time all the more complete long term scientific research studies are completed here in the U.S, it may be too late to undo the damage that may result, should the Jefferson Planning Committee you ignore the importance of these uncompleted studies.

Having previously served as a research assistant with the Environmental Protection Agency, (EPA), under the leadership of its first Administrator, Bill Ruckelshouse as well as spending more than 35 years with the Department of Health and Human Service within the Public Health Service and it's multi agencies, NIH, FDA, CDC, etc. I am aware of the government's responsibility in protecting the health and safety of its citizens and its environment vis a vis our scientific studies. One cannot ignore the importance of these reliable and widely acceptable scientific studies. However, one must also recognize these studies often require a significant amount of time and large populations to reach reliable conclusions and scientific consensus. These studies are needed to ensure responsible leaders are also made aware of potential negative impacts that must be taken into consideration when making decisions that might affect their constituents. I am therefore calling this to the committee's attention. The Jefferson Planning Committee has a fiduciary responsibility to its Jefferson County constituents.. Hopefully you are looking out for our best interest.

A case in point: I have four sisters (and no brothers). We are all very healthy and no one in our families {all the way back to our immigrant grandparents who came from Italy) were very healthy, all cancer-free, However, my sister who is a few years younger than me was diagnosed with a brain tumor after having lived 15 years in close proximity to a tall electrical tower. She had encountered many years of headaches and had difficulty over the years with sleeping. Fortunately they were able to catch the cancer in her brain at an early stage, and soon thereafter they sold their home and moved to a different area. She and the rest of the family are convinced the high powered electrical tower had something to do with that tumor.. But at the time they purchased the home, no research had been conducted to determine

whether those living in close proximity to the tower would potentially encounter some of these issues. Today, it is well established that some of these conditions are likely.

As evidenced in the topical research discussed below, foreign studies done in Germany and elsewhere have completed their cell tower studies determining whether individuals living within close proximity to residential homes have had an increase in various cancers affecting the residential individuals. The results were a resounding **YES, there was an increase.** I find this alarming and I believe it should give the Planning Committee the need to rethink where a cell tower should be alternatively placed. I would propose the Jefferson County Planning Committee seek a more protected piece of property outside of placing the tower in a residential community such as ours. Why not select a site such as within the protected battlefields down near Harpers Ferry where no residential homes are located? The county might even be able to use the revenue it will receive from the placement of such a tower there to offset some of the county's projects that are still waiting on funds to be accomplished. This makes much better sense than locating a cell tower in our community where it could potentially have a negative impact on someone living in close proximity to the tower.

I would encourage the Planning Committee to preview some of the research currently made available to the public and the resultant mixed results specified within each article. I have therefore included some of the topics which individuals can go online and search to review the stated findings. I also would ask that each Planning Committee Member try to put themselves in our shoes.. Would you be willing to live next to a cell tower when current scientific research shows that there has been an increase in cancer to those living in close proximity to a cell tower? Are you willing to take this risk YOURSELVES and to also subject your family members to the potential unknown harms that might result? I suspect you would not nor should you subject your trusting constituents to the unknown consequences of such a decision. to approve the proposed plan.

In conclusion, even if I were not concerned about living in close proximity to the tower (which I definitely am concerned about) I don't think there is any added value to me or to my family or to my home that would encourage me to support the erection of a cell tower in close proximity to my property. It will definitely take away the beauty of our community, which was the main reason I decided to move here to live.. I hope you will not vote to approve the location of the proposed telecommunication tower to Lake Shannondale. . Thank you for reading my comments.

<u>On Line Research Topics:</u>

Cell tower effects on health and property values

Compilation of research studies on cell tower radiation

Seven major harmful effects of cell phone tower pollution / radiation

Side effects of a mobile tower on (or near) your house

The impact of proximity to cell phone towers

Do cell phone towers cause cancer

Linda Reeves

33 Lakeside Drive

Harpers Ferry, WV 25425

reeves.lindajo@gmail.com

561-577-9378

From: Coral Howe
To: Planning Department
Subject: Opposition to cell tower in Shannondale
Date: Wednesday, June 7, 2023 9:57:18 AM

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Dear Zoning Board Members,

I am reaching out to voice strong objections to the proposed cell tower construction in the Shannondale community. This development stands to drastically disrupt our serene environment, negatively affecting both our cherished rural aesthetics and potentially our health.

Our community values Shannondale's tranquility and natural beauty, and a towering industrial structure would undeniably diminish this appeal. We fear the domino effect of this infrastructure, potentially paving the way for more intrusive developments, undermining our community's distinct rural charm.

Moreover, the health risks associated with cell towers, including the emission of low-level radiation, continue to be a topic of scientific debate (Russell, 2018; **Wall et al., 2019**). Out of concern for our most vulnerable — children, the elderly, and those with weakened immunity — we advocate for a precautionary approach until conclusive safety assurance is available. Additionally, there is evidence (**Kumar, 2018**) suggesting the detrimental effects of cell tower radiation on local wildlife, threatening the delicate balance of our unique ecosystems.

Finally, modern technology offers less invasive alternatives to large cell towers, such as small cell technologies or distributed antenna systems. These options can improve connectivity without compromising the community's character. We urge the Board to explore these potential solutions.

We understand the need for progress, but this should not come at the expense of our community's well-being and charm. We hope for a solution that will accommodate advancements without undermining our cherished rural lifestyle. Thank you for considering our concerns.

Sincerely,

References Cited:

Russell, C.L. (2018). 5 G wireless telecommunications expansion: Public health and environmental implications. Environmental Research, 165, 484-495.

Cindy L. Russell,
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Santhosh Kumar S. Colony Collapse Disorder (CCD) in Honey BeesCaused by EMF Radiation. Bioinformation. 2018 Dec 21;14(9):421-424. doi: 10.6026/97320630014521. PMID: 31223202; PMCID: PMC6563664.

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Coral Howe

From: Cheryl Wilfong
To: Planning Department
Subject: Cell tower on mountain
Date: Wednesday, June 7, 2023 11:10:37 AM

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I am in favor of the cell tower on the mountain in Shannondale.

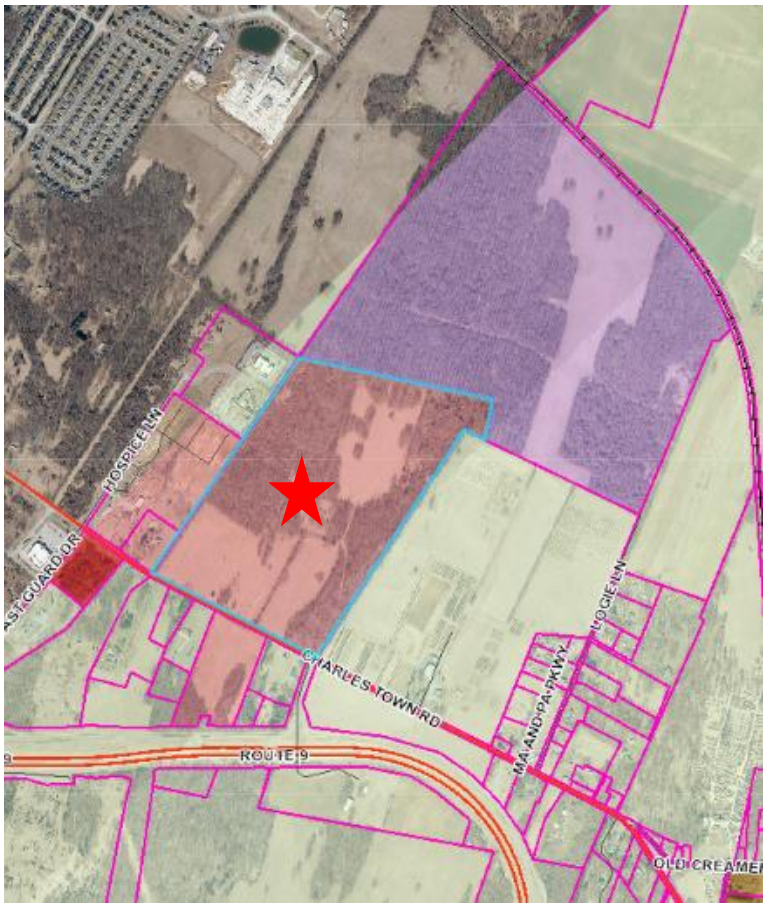
Thank You,

Cheryl Wilfong

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2022

Hunter Hills (Block Length) Waiver Request (File: 23-10-PCW)

Item #4: **Public Hearing:** Waiver from Section 21.101.A, which requires blocks to not exceed six lots in length on one side of the street, to allow a mixture of lot numbers along both sides of the streets for the proposed Hunter Hills Subdivision.

Owner/ Applicant	ILA Properties, Inc.
Consultant	P.J. Raco Consulting, LLC / Paul Raco
Parcel Location and Information	4469 Charles Town Road, Kearneysville, WV Parcel ID: 0700010002; Size: 107 acres; Zoning District: Residential-Light Industrial-Commercial 
Adjacent Zoning	North: Industrial-Commercial; East: Rural; South and West: Rural and Residential-Light Industrial-Commercial
Proposed Activity	Major Subdivision consisting of 642 Unit Subdivision that includes 171 Townhouse Lots and 471 Single Family Detached Lots
Previous Approvals:	• Hunter Family Zoning Map Amendment (Z13-01) to RLIC (CC Approved: 02/20/14) • Hunter Hills Major Subdivision Concept Plan (21-21-SD) (PC Approved 7-13-21; noting that interconnectivity is not required). • 21-17-PCW Waiver from Sect. 24.113.B.10 re: Archaeological Survey (PC Appr. 9/14/21) • The Hunter Hills Preliminary Plat (21-21-SD) was initially submitted 9/22/22 and the 4th review was completed on 4/21/23; pending approval of this waiver.

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2022

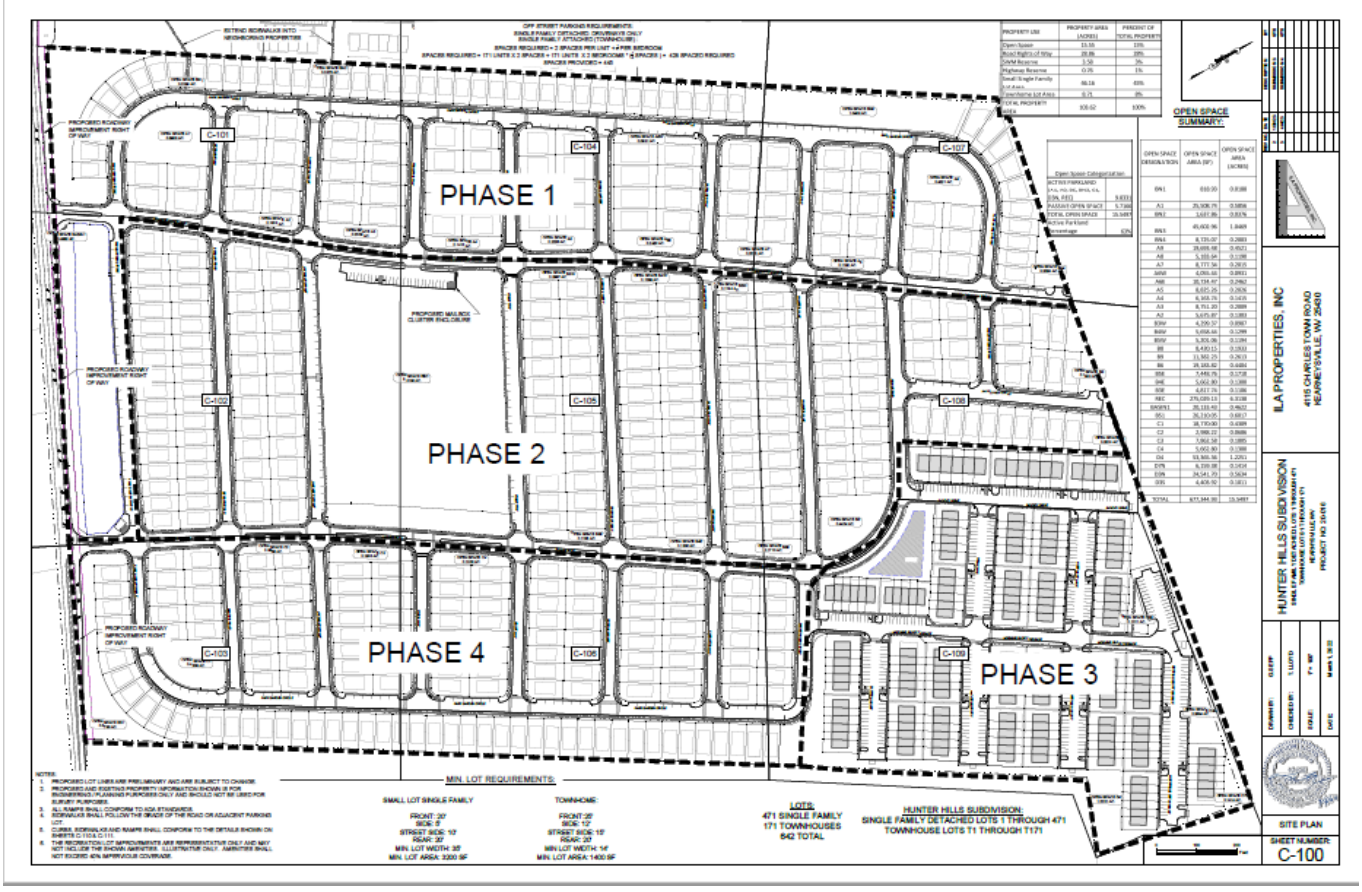
Hunter Hills (Block Length) Waiver Request (File: 23-10-PCW)

Summary of the Request:

The applicant is proposing a Major Residential Subdivision consisting of 642 Units (471 single family detached home lots and 171 Townhouse Lots) on 107+/- acres to be served by public water and sewer by the Berkeley County Public Service Water and Sewer Districts. The project is processing under the Small Lot provision of the Jefferson County Zoning and Land Development Ordinance and is planned with a grid street system (see graphic below).

The proposed subdivision is located east of the proposed Rocky Ridge Development (19-7-SD) which includes 132 townhomes and a section of mini warehouse storage units, and the Hospice of the Panhandle. The Hunter Hills Concept Plan Public Workshop was held at the July 13, 2021 Planning Commission meeting. After the Concept Plan, a Major Residential Subdivision requires processing a Preliminary Plat and Final Plat. The Preliminary Plat is currently under review. As a part of the Preliminary Plat, the applicant is requesting the following waiver, which influences the design of the overall development.

The requested waiver (23-10-PCW) is asking to waive the requirement of Section 21.101.A of the Subdivision Regulations, which requires blocks to not exceed 6 lots in length on one side of the street, to allow a mixture of lot numbers along both sides of the streets for the proposed Hunter Hills Subdivision (see graphic below). The applicant states that a maximum of 18 lots will be permitted on one side of the road.



Staff Report
Jefferson County Planning Commission Meeting
June 13, 2022

Hunter Hills (Block Length) Waiver Request (File: 23-10-PCW)

Summary of the Request:

The applicant is requesting a waiver of this section to allow block lengths with a variable number of lots on one side of the street. Section 21.101A of the Jefferson County Subdivision and Land Development Regulations states that blocks *"*shall not, in most instances, exceed *six lots in length on one side of the street"* (emphasis added). It further states that the length, width, and shape of blocks shall be determined with due regard to the provision of adequate sites for buildings of the type proposed, zoning requirements, fire access, emergency service, and police protection. There is some provision for longer blocks in rural subdivisions if there are topographic constraints, but only if there are no more than nine total lots in the subdivision and the lots are over ¾ acre in land area each. This proposed development is zoned Residential-Light Industrial-Commercial and these criteria do not apply.

There is an additional division in the Subdivision Regulations (21.300 Modification of Development Standards) which states that the maximum length of blocks is set to provide connectivity between adjoining parcels as they develop separately over time and that there are conditions that can exist that warrant longer lengths. In this case, the entire property is being developed and approval of the Concept Plan included the condition that no connectivity with the adjoining properties will be permitted. The criteria set forth in Sec. 21.305, which allows the modification of Block Length do not apply in this particular situation and therefore, this waiver is requested from Section 21.101.A.

The applicant has noted that the grid street system that is proposed allows ease of access to all of the lots and that the requirement of the Ordinance does not have a clear purpose or benefit to the subdivision design.

Waiver Requirements:

The applicant provides a response to the requirements found in "Division 24.300 Waivers" of the Subdivision Regulations, which is attached to the application. Waivers from the minimum standards in these Regulations may be granted by the Planning Commission only when the Planning Commission finds that granting a waiver will be consistent with all of the following criteria:

(1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature;

(2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents;

(3) that the waiver, if granted, will be in keeping with the intent and purpose of these Regulations; and

(4) that the waiver if granted will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

Staff Comments:

Generally blocks are defined as areas of land bounded by streets, other transportation features and/or public open spaces. The length of blocks influence the interconnectivity of neighborhoods and the walkability of communities. The standard width of the lots found within the blocks can also impact the length of the blocks. This project is utilizing the small lot provisions of the Zoning Ordinance which

means each lot will be narrower that otherwise required and therefore creates blocks that allow interconnectivity and a grid system that may not meet the literal requirement of Section 21.101A, but appear to meet the intent of the Ordinance. Blocks found in more urban environments with a rectilinear grid street pattern lend themselves to a smaller number of lots in a given block to allow for greater interconnectivity. In this case, the interior blocks consisting of the narrower small lot widths allows the development of this interconnectivity in the grid street system. Along the exterior curvilinear streets, it is reasonable to allow blocks to contain additional lots, particularly along open space areas or on one side of a proposed road. In areas where block lengths include more numerous lots, it is recommended that additional pedestrian connectivity be utilized to break up the length of the blocks and allow access to open space and common areas.

Staff Recommendation:

Planning and Zoning staff recommends that the waiver be granted to allow block lengths with a variable number of lots, with the recommendation that mid-block pedestrian connectivity be provided to common open space areas, as possible. The request acknowledges that the narrower lots utilizing the small lot provisions of the Zoning Ordinance would logically result in blocks with a greater number of lots on each block. The grid design proposed allows ease of access throughout the development and can accommodate a greater number of lots on each block.

Jefferson County, West Virginia
Department of Engineering, Planning and Zoning
Office of Planning and Zoning
116 E. Washington Street, 2nd Floor
P.O. Box 716
Charles Town, West Virginia 25414

File #: 23-10-PCW
Mtg Date: 6/13/2023
Date Rec'd: 5/19/2023
Fees Paid: $100
Staff Int: ME
List of Adjoiners: ☒

Email: planningdepartment@jeffersoncountywv.org
zoning@jeffersoncountywv.org
Phone: (304) 728-3228
Fax: (304) 728-8126

Planning Commission Waiver Request

Waivers must comply with Division 24.300 of the 2008 Subdivision Regulations, as amended.

Property Owner Information

Owner Name:
Business Name: ILA Properties, Inc
Mailing Address: 4115 Charles Town Road, Kearneysville, WV 25430
Phone Number: c/o Paul 304/676-8256 Email: Paul pjraco.consulting@gmail.com

Applicant Contact Information

Applicant Name: Same Same as owner: ■
Business Name: ILA Properties, Inc.
Mailing Address:
Phone Number: Email:

Consultant Information

Name: Paul J Raco
Business Name: P.J. Raco Consulting, LLC
Mailing Address: P.O. Box 548, Charles Town, WV 25414
Phone Number: 304/676-8256 Email: pjraco.consulting@gmail.com

Physical Property Details

Physical Address: Route 115 North Side just south of 4115 Charles Town Road, Kearneysville, WV Vacant Lot: ☐
Tax District: Middleway Map No: 1 Parcel No: 2
Parcel Size: 107+- Acres Deed Book: 1277 Page No: 293
Zoning District: Residential/Light Industrial/Commercial District

On a separate sheet of paper sketch the shape and location of the lot. Show the location of the intended construction or land use and indicate building setbacks, size, and height. Identify existing easements, roads, buildings, structures, or land uses on the property. Sign and date the sketch.

■ Included ☐ Not applicable (include a vicinity map if a sketch is not applicable)

What Section of the Subdivision Regulations and year of the Regulations are you requesting to Waive?

Section 21.101

Briefly Describe the Nature of Your Waiver Request:

The provision inexplicably states that 'blocks shall not, in most instances, exceed six lots in length on one side of the street'. This provision does not explain the purpose and doesn't describe what 'in most instances' means. Actual length of the block seems to be irrelvant, as Six 300' wide lots are allowed at 1800' in length, but a block of Twelve 80' wide lots is not permitted at 960' in length. So the request is to allow the blocks to contain the number of lots as depicted on the attached Plan, which shows a maximum of 18 lots on one side of the road.

Explain how the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County Parks Plan or benefits of a similar nature.

See Attached

Explain how the waiver, if granted, will not adversely affect the public health, safety, or welfare or the rights of adjacent property owners or residents.

See Attached

Explain how the waiver, if granted, will be in keeping with the intent and purpose of this Ordinance.

See Attached

Explain how the waiver, if granted, will result in a project of better quality and/or character.

See Attached

By signing this application, I give permission to the Planning and Zoning Staff to conduct a site visit for the purpose of taking photos for the Planning Commission staff report. The information given is correct to the best of my knowledge.

Property Owner Signature Date

Property Owner Signature Date

Notification Requirements

The subject parcel shall be posted with a minimum of one 28" x 22" placard at least 14 days prior to the public hearing. The placard(s) will be prepared by the Staff and posted by the applicant. Adjacent property owner name and address information shall be provided by the applicant so that notification letters can be mailed by Staff least 14 days prior to the public hearing.

6/13/2023	5/30/2023	5/30/2023
Public Hearing Date	Date Placard Posted	Date Adjoiners Mailed

Planning Commission Determination

Approved ☐ Denied ☐ Date: ____ / ____ / ____

Hunter Hills Preliminary Plat
ILA Properties Inc
Waiver Request Block Length
Sections: 21.101
Jefferson County Subdivision and Site Development Ordinance
May 19, 2023

Brief Description:

This provision only allows blocks to contain 6 lots maximum on one side of the road in a subdivision. The ordinance does not explain the purpose of the provision and even allows it is sometimes by saying 'in most instances'. The provision doesn't make sense in that most subdivisions that have blocks, also have nice sidewalks for pedestrians. Hunter Hills has these rectilinear blocks with a complete network of sidewalks, parks, and recreation areas. There seems to be no reason to limit block length by number of lots. If there is a reason to limit them, then it should be by distance instead of number of lots, since Six 300 feet wide lots seems to be permitted at 1800 feet in length, but a block of Twelve lots with 80' widths is not permitted at 960 feet in length. It doesn't make sense.

As designed with the longer block, the Fire Companies have been sent a copy of the plat and had no comment. Also, the water provider has been provided a copy of the plat, along with the water system including the location of fire hydrants and that plan has been approved. So, it seems that fire safety is not an issue. Since the blocks are square or rectangular for the most part, and will all be marked with a house number, it doesn't appear to be an emergency service provision. Oddly, if this subdivision was not rectilinear, it probably wouldn't have been an issue since the ordinance allows 30 lots without a second entrance, so there could be a long 'block' that ends in a cul-de-sac with 15 lots on each side and block length wouldn't be an issue. This is permitted in 'rural' subdivisions because of topography. So, in these cases where an emergency service provider looking for a house or someone in the neighborhood walking on the road since there are no sidewalks may have to go quite some distance to get to a cross street or turnaround, a nice square of more than 6 lots with sidewalks is not permitted. This is arbitrary at best.

Finally, this waiver has been granted when requested previously. The requirement should be removed or addressed in the future.

Hunter Hills Preliminary Plat
ILA Properties Inc
Waiver Request Block Length
Section 21.101 Subdivision and Site Development Ordinance
May 19, 2023

Four Criteria:

1. *Explain how the design of the Project will provide public benefit in the form in the reduction of Public maintenance costs, greater open space, parkland consistent with the County Park Plans or benefits of a similar nature;*

   This request has no effect on County Cost or Public Parks. As a matter of fact, it has a huge community open recreational space with many planned amenities for the residents that will take the pressure off of other public parks for the residents in this subdivision.

   The project is in an area that is identified as the Route 9 Preferred Growth Area. This area was established in the Envision Jefferson 2035 Comprehensive Plan. The PGAs are for the development of Urban Level Growth and full development. This property is zoned for high density residential, and this project is a development of affordable housing in the form of small lots. Since they are small lots, the number of lots in a block should not be limited to a low number since they are very narrow in length. Plus, all sidewalks lead to a recreation area or a park.

   The project meets the standards for open space and park land. They will be privately maintained and will have no public maintenance cost.

   Granting the waiver will allow the project to move forward and will generate a great deal of taxes and Impact Fees that benefit Parks, Emergency Services and Police.

2. *Explain how the waiver, if granted, will not adversely affect the public health, safety and welfare or the rights of adjacent property owners or residents;*

   The granting of the waiver will have no effect on the public health safety or welfare of the neighbors or adjacent property owners. The waiver is to allow a well-designed rectilinear project to go forward without even more impervious surfaces. Each lot is walkable to a major recreation area that will most likely include soccer, basketball, playground, community center and possibly a swimming pool. Each lot will have access to pocket parks, trails, and the large community area via the intensive network of sidewalks in the development. Additional roads are not necessary.

   Furthermore, the design has been approved by the water provider with regard to the location of fire hydrants in case the provision has to do with that possibility. This is true even though the blocks can be the same size if they were double and triple in the width

of the lot, so the provision doesn't appear to relate to safety, since the project is rectilinear with many cross intersections. The project as designed is adequately served by the existing roads.

Accordingly, there appears to be no adverse impact on public health, safety or welfare of the intended residents or neighbors. Again, as stated in the description, the ordinance allows 30 lots on a single road without respect to length. So, it is really odd to limit this development to 6 lots. This is especially true since the width of the lots isn't even a parameter in the provision.

3. *Explain how the waiver, if granted, will be keeping with the intent and purpose of this ordinance;*

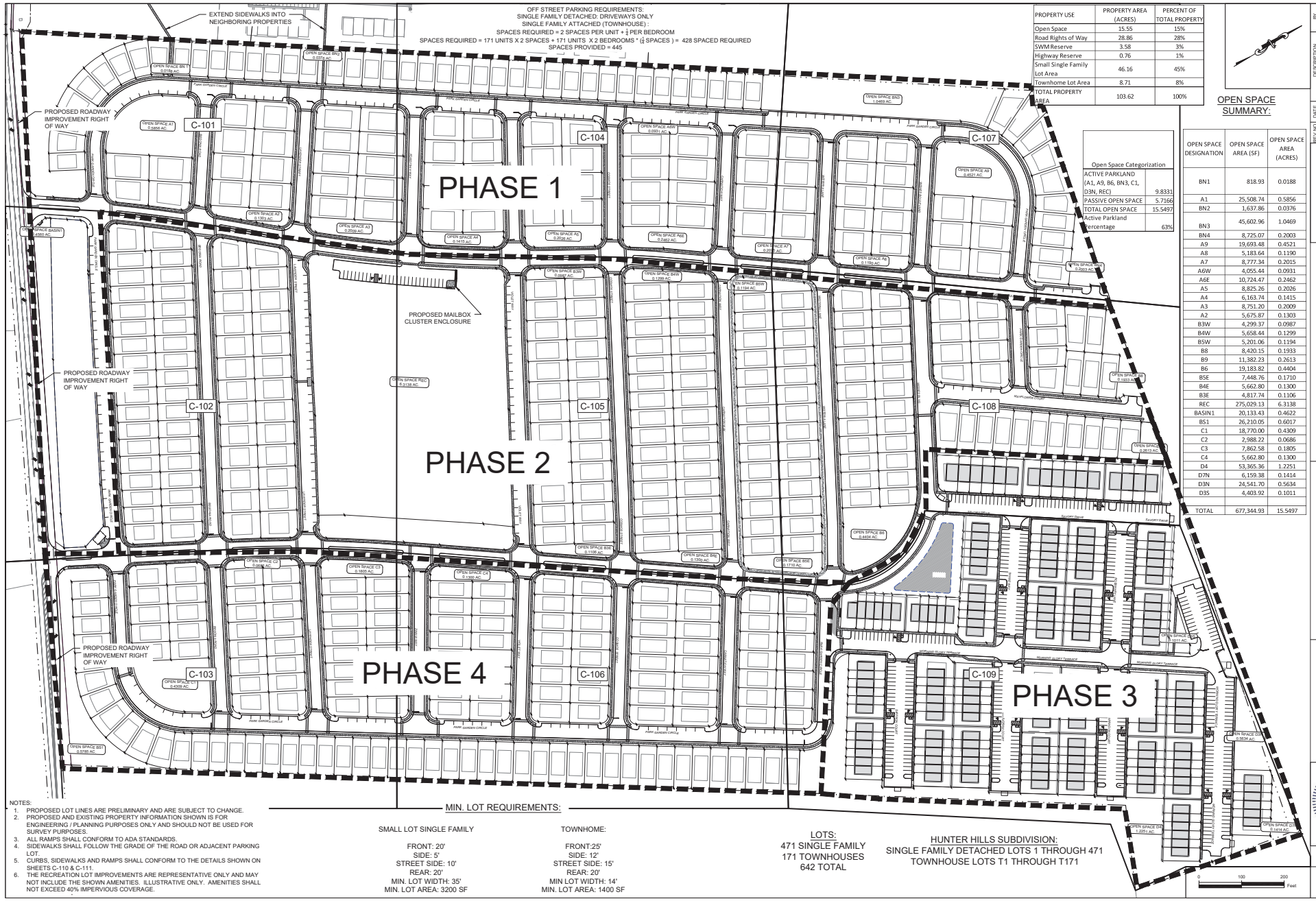
   After discussion with the Staff, the intent of the provision is unknown. A review of the actual standards found in the Subdivision Ordinance show that there isn't any requirement found in the Standards that would address what the intent is. In fact, the provision says blocks are limited to 6 lots in' most' instances, without going into depth. There are no length standards, so 6 wide lots having a length of 1800 feet are allowed, but 7 lots have a length of 560 feet are not allowed. Again, no rhyme nor reason for the provision. Even more lots without respect to length are permitted on a winding road in the rural area. Therefore, it would appear to be a better situation in a rectilinear block design to have multiple lots for more efficient emergency services, as compared to a long winding road that dead ends.

   The Planning Commission and County Staff have agreed to this waiver in the past based on similar arguments. Likewise, Staff agrees that the provision should be reviewed.

4. *Explain how the waiver, if granted, will result in a project of better quality or character;*

   There is no purpose identified in the Subdivision Ordinance for this provision. The project has been reviewed for over a year by multiple agencies and accept for the realization that a waiver is needed, there has been no comments on the blocks as currently designed. If the waiver is not granted, then there would be need for even more roads crisscrossing through the development that already needed over 25 named roads. There are no design advantages for more roads other than to confuse and slow emergency response. Regarding ease of walking for the residents, the open space and recreational areas are all served by the extensive network of sidewalks and trails. Additional impervious surfaces in the form of roads would mean less green area or smaller lots.

   Accordingly, the Applicant respectfully asks that the Planning Commission approve the waiver so that the process can continue in a timely and more cost-effective fashion. The Planning Commission approved the Concept Plan with very little comment. Thank you for your consideration.



PROPERTY USE	PROPERTY AREA (ACRES)	PERCENT OF TOTAL PROPERTY
Open Space	15.55	15%
Road Rights of Way	28.86	28%
SWM Reserve	3.58	3%
Highway Reserve	0.76	1%
Small Single Family Lot Area	46.16	45%
Townhome Lot Area	8.71	8%
TOTAL PROPERTY AREA	103.62	100%

Open Space Categorization	
ACTIVE PARKLAND (A1, A9, B6, BN3, C1, D3N, REC)	9.8331
PASSIVE OPEN SPACE	5.7166
TOTAL OPEN SPACE	15.5497
Active Parkland Percentage	63%

OPEN SPACE SUMMARY:

OPEN SPACE DESIGNATION	OPEN SPACE AREA (SF)	OPEN SPACE AREA (ACRES)
BN1	818.93	0.0188
A1	25,508.74	0.5856
BN2	1,637.86	0.0376
BN3	45,602.96	1.0469
BN4	8,725.07	0.2003
A9	19,693.48	0.4521
A8	5,183.64	0.1190
A7	8,777.34	0.2015
A6W	4,055.44	0.0931
A6E	10,724.47	0.2462
A5	8,825.26	0.2026
A4	6,163.74	0.1415
A3	8,751.20	0.2009
A2	5,675.87	0.1303
B3W	4,299.37	0.0987
B4W	5,658.44	0.1299
B5W	5,201.06	0.1194
B8	8,420.15	0.1933
B9	11,382.23	0.2613
B6	19,183.82	0.4404
B5E	7,448.76	0.1710
B4E	5,662.80	0.1300
B3E	4,817.74	0.1106
REC	275,029.13	6.3138
BASIN1	20,133.43	0.4622
BS1	26,210.05	0.6017
C1	18,770.00	0.4309
C2	2,988.22	0.0686
C3	7,862.58	0.1805
C4	5,662.80	0.1300
D4	53,365.36	1.2251
D7N	6,159.38	0.1414
D3N	24,541.70	0.5634
D3S	4,403.92	0.1011
TOTAL	677,344.93	15.5497

NOTES:
1. PROPOSED LOT LINES ARE PRELIMINARY AND ARE SUBJECT TO CHANGE.
2. PROPOSED AND EXISTING PROPERTY INFORMATION SHOWN IS FOR ENGINEERING / PLANNING PURPOSES ONLY AND SHOULD NOT BE USED FOR SURVEY PURPOSES.
3. ALL RAMPS SHALL CONFORM TO ADA STANDARDS.
4. SIDEWALKS SHALL FOLLOW THE GRADE OF THE ROAD OR ADJACENT PARKING LOT.
5. CURBS, SIDEWALKS AND RAMPS SHALL CONFORM TO THE DETAILS SHOWN ON SHEETS C-110 & C-111.
6. THE RECREATION LOT IMPROVEMENTS ARE REPRESENTATIVE ONLY AND MAY NOT INCLUDE THE SHOWN AMENITIES. ILLUSTRATIVE ONLY. AMENITIES SHALL NOT EXCEED 40% IMPERVIOUS COVERAGE.

MIN. LOT REQUIREMENTS:

SMALL LOT SINGLE FAMILY

FRONT: 20'
SIDE: 5'
STREET SIDE: 10'
REAR: 20'
MIN. LOT WIDTH: 35'
MIN. LOT AREA: 3200 SF

TOWNHOME:

FRONT:25'
SIDE: 12'
STREET SIDE: 15'
REAR: 20'
MIN LOT WIDTH: 14'
MIN. LOT AREA: 1400 SF

LOTS:
471 SINGLE FAMILY
171 TOWNHOUSES
642 TOTAL

HUNTER HILLS SUBDIVISION:
SINGLE FAMILY DETACHED LOTS 1 THROUGH 471
TOWNHOUSE LOTS T1 THROUGH T171

0 100 200 Feet

REV NO.	DATE	DESCRIPTION	BY
2	1/30/23	SUBMISSION 3	GTS
3	4/4/23	SUBMISSION 4	GTS

ILA PROPERTIES, INC

ILA PROPERTIES, INC
4115 CHARLES TOWN ROAD
KEARNEYSVILLE, WV 25430

HUNTER HILLS SUBDIVISION
SINGLE FAMILY DETACHED: LOTS 1 THROUGH 471
TOWNHOUSE LOTS 1 THROUGH 171
KEARNEYSVILLE, WV
PROJECT NO: 20-016

DRAWN BY: G.SEPP
CHECKED BY: T. LLOYD
SCALE: 1" = 100'
DATE: March 1, 2022

REVOR LLOYD
REGISTERED
19190
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
3/6/23

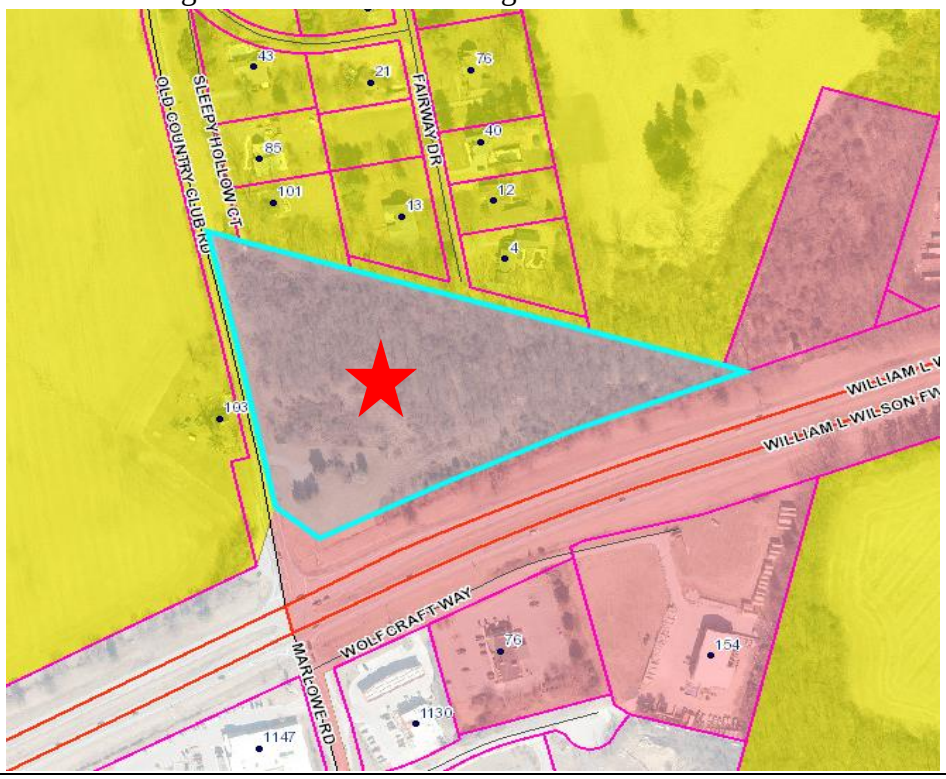
SITE PLAN

SHEET NUMBER:
C-100

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Country Club Commons (Early Grading) Waiver Request (File: 23-11-PCW)

Item #5: **Public Hearing:** Waiver from Section 20.102B of the Subdivision Regulations to allow site grading and utility work to commence prior to Final Plat approval for the proposed four-lot Country Club Commons Nonresidential Subdivision (19-17-SD).

Owner/Applicant	B.C. Partners / Dan Snyder, P.E
Consultant	P.J. Raco Consulting, LLC / Paul Raco
Parcel Information	Vacant lot NE corner of US 340 & WV 24 (Country Club Road), Charles Town Parcel ID: 04001100110000; Size: 9.54 acres; Zoning District: Residential-Light Industrial-Commercial 
Adjacent Zoning	North and West: Residential Growth; East and South: Residential/Light Industrial/Commercial & Charles Town
Proposed Activity	4 Non-Residential Lots and a public street for future commercial pad users
Approvals:	Country Club Commons Major Non-Residential Sub. Concept Plan (PC: 02/11/20) Country Club Commons Major Non-Residential Sub. Preliminary Plat (PC: 11/15/22; approved conditioned upon DOH approval & stormwater management approval)
Waivers/Variances	• 22-2-PCW Waiver from Sect. 24.113.B.10 re: Archaeological Survey (PC Appr. 3/8/22) • 22-3-PCW: Waiver from Appendix B Table 2.2-1 "Roadway Design Standards" related to Non-Residential/ Industrial & Commercial Streets (PC Approved 3/8/22) • 22-25-PCW: Waiver from Appendix B, Table 2.2-1, "Roadway Design Standards" for entrance drive (PC Approved 11-15-22) • 22-10-ZV: Variance from Section 8.9A.10 to modify the 50' landscape buffer requirement along a limited access highway (BZA Approved 3/24/22)

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Country Club Commons (Early Grading) Waiver Request (File: 23-11-PCW)

Summary of the Request:

The subject 9.54-acre property, located at the NE corner of US 340 and Old Country Club Road (WV 24), is being developed as a Major Non-Residential Subdivision consisting of four (4) non-residential lots, a public street and stormwater area. The property is zoned Residential–Light Industrial-Commercial (RLIC) and within the US 340 East Preferred Growth Area (PGA).

As a Major Non-Residential Subdivision, this project is required to process a Concept Plan (approved 2-11-20), Preliminary Plat (approved 11-15-22, conditioned upon DOH approval & stormwater management approval), and a Final Plat (not yet submitted). In accordance with Section 20.203 of the Subdivision Regulations, once a Major Non-Residential with master planned roads and stormwater is approved, each Site Plan will be permitted to process as a Minor Site Plan, which is administratively approved.

This request is to allow the applicant to be permitted to commence site grading and utility work prior to Final Plat approval. The applicant has indicated that they will provide either the "full bond for the project or the partial bond for erosion and sediment control and reclamation of the land if the plan doesn't move forward and will install and have inspected the Erosion and Sediment Controls before any work is commenced".

Subdivision Regulation Requirements:

Section 20.102B of the Subdivision Regulations requires that before development of the land is commenced, subdivision plats and site plans must be approved by the Planning Commission, recorded, and surety posted for required improvements in accordance with these Regulations and the Comprehensive Plan. This request is to waive this requirement and to allow the site grading and utility work to be initiated after a full or partial bond is posted, but prior to the approval of the Final Plat.

Staff Comments/Recommendation:

As staff has noted previously, many jurisdictions allow separate grading permits provided that all Erosion and Sediment Control and SWM plans have been approved by the County and are bonded. These plans will receive such approval for all Erosion and Sediment Control measures and will be inspected by the County prior to earth movement. The Jefferson County Planning Commission has allowed early grading plans in the past and staff recommends that this concept should be included as a provision in the Subdivision Regulations/Ordinance when it is amended.

Staff recommends approval of the waiver request with the following conditions:

a. A grading permit will be issued to allow the owner to perform site grading and utility work in preparation for the non-residential subdivision improvements. No additional work will be allowed on the individual lots until the Final Plat has been recorded, and a site plan and building permit is approved for each lot. This permit is subject to the requirements of the sediment and erosion control plan submitted and approved as part of the grading plan and building permit application, and a NPDES permit is obtained; and
b. The Owner/Developer assumes all risk for "jump-starting" the project and understands that the final subdivision approved by the Planning Commission and/or staff might necessitate some changes and additional construction cost; and
c. Provide bonding of all proposed site improvements related to sediment and erosion control/SWM pertaining to the permit.

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Country Club Commons (Early Grading) Waiver Request (File: 23-11-PCW)

As a reminder, the Preliminary and Final Plats cannot be approved until the WV DOH entrance permit is obtained.

Waiver Requirements:

The applicant provides a response to the requirements found in "Division 24.300 Waivers" of the Subdivision Regulations, which is attached to the application. Waivers from the minimum standards in these Regulations may be granted by the Planning Commission only when the Planning Commission finds that granting a waiver will be consistent with all of the following criteria:

(1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature;

(2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents;

(3) that the waiver, if granted, will be in keeping with the intent and purpose of these Regulations; and

(4) that the waiver if granted will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

Jefferson County, West Virginia
Department of Engineering, Planning and Zoning
Office of Planning and Zoning
116 E. Washington Street, 2nd Floor
P.O. Box 716
Charles Town, West Virginia 25414

File #: 23-11-PCW
Mtg Date: 6/13/23
Date Rec'd: 5/19/23
Fees Paid: $100
Staff Int: me
List of Adjoiners: ☒

Email: planningdepartment@jeffersoncountywv.org
zoning@jeffersoncountywv.org
Phone: (304) 728-3228
Fax: (304) 728-8126

Planning Commission Waiver Request

Waivers must comply with Division 24.300 of the 2008 Subdivision Regulations, as amended.

Property Owner Information

Owner Name:
Business Name: B.C. Partners, Inc
Mailing Address: 24024 Frederick Road, Clarksburg, MD 20871
Phone Number: c/o Paul 340/676-8256 Email: c/o pjraco.consulting@gmail.com

Applicant Contact Information

Applicant Name: Dan Snyder, P.E. and Paul J Raco Same as owner: ☐
Business Name: B.C. Partners P.J. Raco Consulting, LLC
Mailing Address: above and below
Phone Number: Email:

Consultant Information

Name: Paul J Raco
Business Name: P.J. Raco Consulting, LLC
Mailing Address: P.O. Box 548, Charles Town, WV 25414
Phone Number: 304/676-8256 Email: pjraco.consulting@gmail.com

Physical Property Details

Physical Address: NE Corner of Route 340 and Route 24 (Country Club Road) Vacant Lot: ■
Tax District: Harpers Ferry Map No: 11 Parcel No: 11
Parcel Size: 9.54 Deed Book: 941 Page No: 546
Zoning District: Residential/Light Industrial/Commercial

On a separate sheet of paper sketch the shape and location of the lot. Show the location of the intended construction or land use and indicate building setbacks, size, and height. Identify existing easements, roads, buildings, structures, or land uses on the property. Sign and date the sketch.

☐ Included ■ Not applicable (include a vicinity map if a sketch is not applicable)

What Section of the Subdivision Regulations and year of the Regulations are you requesting to Waive?

Section 20.102B Early Grading Permit Request

Briefly Describe the Nature of Your Waiver Request:

See Attached

See Attached Justification

Explain how the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County Parks Plan or benefits of a similar nature.

See Attached

Explain how the waiver, if granted, will not adversely affect the public health, safety, or welfare or the rights of adjacent property owners or residents.

See Attached

Explain how the waiver, if granted, will be in keeping with the intent and purpose of this Ordinance.

See Attached

Explain how the waiver, if granted, will result in a project of better quality and/or character.

See Attached

By signing this application, I give permission to the Planning and Zoning Staff to conduct a site visit for the purpose of taking photos for the Planning Commission staff report. The information given is correct to the best of my knowledge.

			5-12-2023
Property Owner Signature	Date	Property Owner Signature	Date

Notification Requirements

The subject parcel shall be posted with a minimum of one 28" x 22" placard at least 14 days prior to the public hearing. The placard(s) will be prepared by the Staff and posted by the applicant. Adjacent property owner name and address information shall be provided by the applicant so that notification letters can be mailed by Staff least 14 days prior to the public hearing.

Public Hearing Date	Date Placard Posted	Date Adjoiners Mailed

Planning Commission Determination

Approved ☐ Denied ☐ Date: ____ / ____ / ____

Country Club Commons Commercial Subdivision
B.C. Partners Inc
Waiver Request Early Grading Permit
Section 20.102B
Jefferson County Subdivision and Site Development Ordinance
May 19, 2023

Brief Description

The request is to allow early grading and utility work for the proposed Country Club Commons Commercial Subdivision Lots 1-4.

The Application for the Country Club Commons in the Final Stage of Preliminary Plat which has been conditionally approved by the Planning Commission after a Public Hearing. It is mostly just waiting for the Division of Highways approval and signoff from the Federal Highway Administration.

These plans have been completely vetted by the County Process, State Agencies, and the City and Private Utility Companies and have submitted plans and revised plans to the State and Feds for the Entrance Permit.

An early grading permit and utility work will allow the project to begin without any risk to the County. Many jurisdictions allow grading permits provided that all Erosion and Sediment Control Plans have been approved by both the State DEP and County. These plans have received such approval for all Erosion and Sediment Control measures. Also, the Utility Plans have been approved by Charles Town, JUI and the State Health Department. Much of the utility work is offsite and will be constructed, built, approved, or bonded through the respective utility. Also, this work will be completed to the site regardless of the PC approval. The onsite utilities will also be bonded, approved, and transferred to the respective utility at the completion of the construction.

Jefferson County has allowed early grading plans and other work including foundation and footing plans to be approved on other projects in the County. And these waivers were granted for the same type of request.

Allowing this project to begin will be extremely helpful in getting the commercial/business subdivision started as soon as possible in light of the length of time it has taken for the right turn in to the project from the State/Federal controlled Route 340. While it is just waiting for the final sign off by the Federal Agency, even if it was surprisingly denied after these several years of processing, the subdivision would still move forward without the Right Turn In Entrance from Route 340 without harm to the early grading or utilities. The entrance plans at the State are essentially approved and awaiting the final signoff. This requested approval for early grading and utilities will have no impact on the entrances if ultimately denied. None of those improvements in that specific area will be started until after the State gives the final approval for the Entrance Permit. This request is for grading interior to the site and utilities offsite at the control of the Utilities and onsite reviewed by the County and Utilities.

The Applicant is prepared to provide either the full bond for the project or the partial Bond for erosion and sediment control and reclamation of the land if the plan doesn't move forward and

will install and have inspected the Erosion and Sediment Controls before any work is commenced. Furthermore, the offsite utilities will be built by or inspected, approved, and accepted by the Utilities since these will be transferred to the Utilities.

Hopefully, by the time this waiver is heard, the request will be moot, but until that time, any relief while the applicant is waiting for the Final Entrance Permit will be appreciated.

Based on the above, the Applicant respectfully requests the Planning Commission to grant the waiver to allow the early grading and utility site work, prior to the final approval of the Final Plat which will be processed administratively once the final conditions of the conditional Preliminary Plat approval are completed. Thank you for your consideration of the request.

Country Club Commons Commercial Subdivision
B.C. Partners Inc
Waiver Request Early Grading Permit
Section 20.102B
Jefferson County Subdivision and Site Development Ordinance
May 19, 2023

Four Criteria:

1. *Explain how the design of the Project will provide public benefit in the form in the reduction of Public maintenance costs, greater open space, parkland consistent with the County Park Plans or benefits of a similar nature;*

   This project will have no Public costs since this is the private construction of a commercial project that will be maintained by the owner. There will be no public maintenance costs involved as the infrastructure will be built and maintained with private funds. In actuality, the project will be a net gain for the County since the Commercial Subdivision and the resultant four lots of commercial businesses will have considerable tax benefits and no County cost to construct the infrastructure. In this case the project will benefit the community by providing Commercial services in this neighborhood which should help keep traffic off of the primary roads for shopping in the immediate area of this development. The extension of the public water and sewer will also be at the applicant's expense and will be dedicated to Charles Town Sewer Utility and Jefferson Utilities. Furthermore, the Public Utility will have a recurring benefit of the applicant paying a monthly bill for sewer service. The water service will be provided by a private utility that will take over and maintain the water lines, again without cost to the County taxpayers.

   Finally, this project will ultimately be four commercial businesses. Accordingly, the commercial taxes will benefit the entire community with little or no maintenance by the government.

2. *Explain how the waiver, if granted, will not adversely affect the public health, safety and welfare or the rights of adjacent property owners or residents;*

   If the waiver is granted, it will have absolutely no adverse effect on public health, safety or welfare since the project will still be required to meet every standard and requirement of the ordinance. It has obtained the necessary Health Department Approval, as well as just waiting for signed paperwork for the necessary Division of Highways' approval that includes the signoff from the Feds on the one entrance. The granting of the waiver will effectively allow the grading and utility work for the four commercial lots. Again, all the requirements of the ordinances have been met with

regard to design and outside agency approval with the exception of the final entrance permit. The offsite water utility work has already started since that doesn't need County approval (it has State approval) and the offsite sewer work will be at the direction of Charles Town Utilities. The onsite grading and utility work will be at the supervision and inspection of the County and the Utilities. Therefore, the public is assured that it will be constructed and installed to County and State standards, as well as to the individual Utility requirements before they accept the utilities.

Additionally, the subdivision will be bonded to ensure that all the improvements will be completed to County Standards.

The waiver will not have any effect on the neighbors since the development still needs to provide plans that are reviewed by the professional Staff to ensure compete ordinance compliance. And the neighboring properties will be protected by State and County approved Erosion and Sediment Control measures. Enforcement of these measures are by both the State and County.

3. *Explain how the waiver, if granted, will be keeping with the intent and purpose of this ordinance;*

   The PC and other Agencies have already reviewed the project for compliance. The remaining items are all Staff related approvals or signatures. Nothing in the ordinance has been sidestepped. All of the Erosion and Sediment Control designs have been approved and these protections will be bonded to ensure compliance. The purpose of the ordinance is to make sure that a proposed project is designed and constructed to ordinance standards and requirements. That process has been completed. The granting of the waiver will not change that fact since the project construction will be reviewed completely for compliance with the approved design and then the project will be bonded to ensure proper construction. Regarding the Utilities, they go through the additional step of being inspected, approved, and accepted for transfer to the Utilities.

4. *Explain how the waiver, if granted, will result in a project of better quality and/or character;*

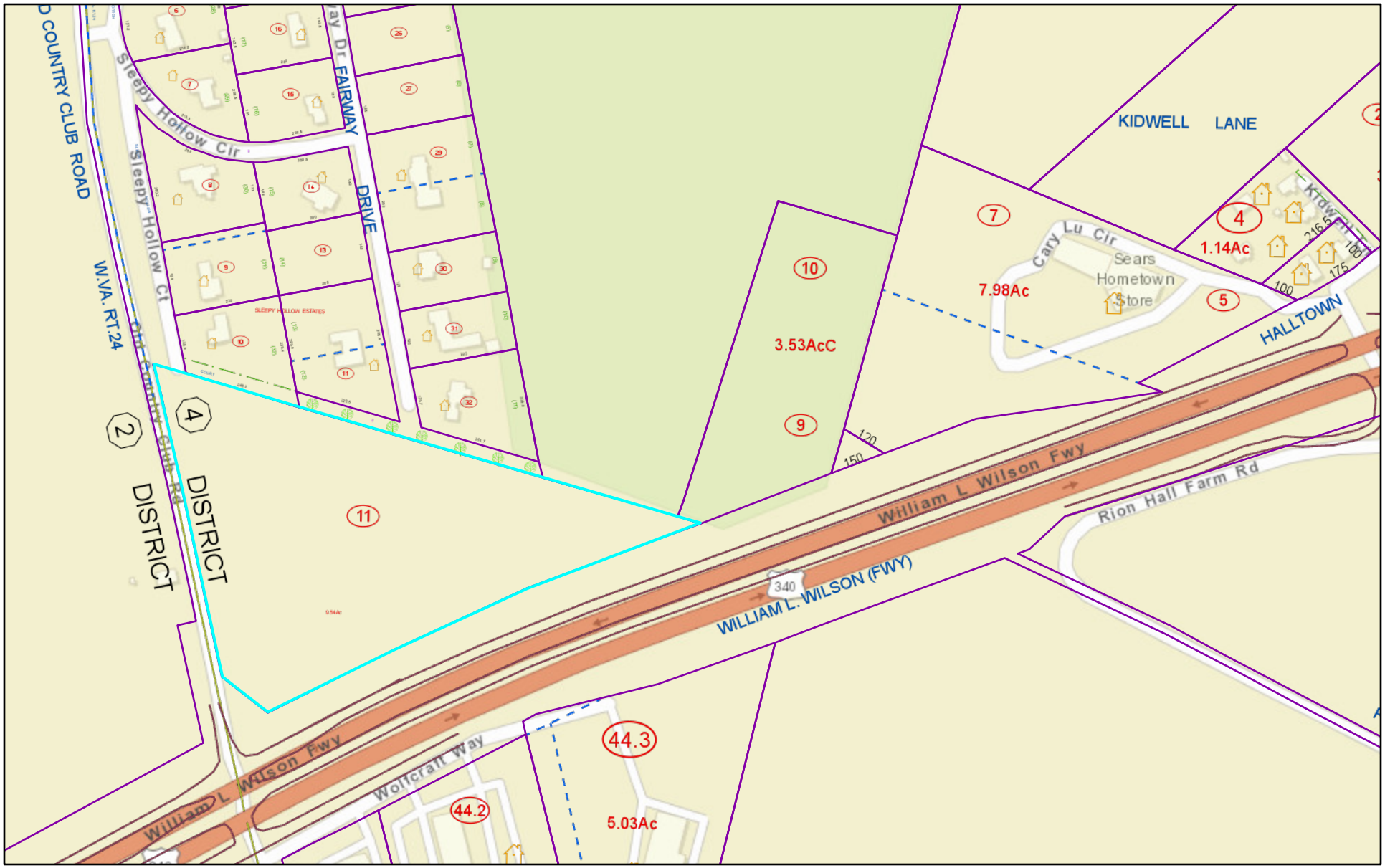
   Many jurisdictions allow Early Grading in accordance with the proper bonding. This is all the Applicant is asking for the ability to begin while a minor portion of the approval process is being completed. The State has already accepted the entrances and is just waiting for the Federal Agency to sign off on the one entrance since it involves a Federal Funded Highway (Route 340). Also, the Utility work has all been approved by the necessary agencies and can begin (some of the offsite work has already begun by the individual Utilities). The Early Grading and Utility work will allow the project to start so that the intended lots can be prepared for the businesses. Individual site plans for the

lots will also need to be done once these businesses buy each lot. Nothing is being subverted in terms of approvals for the individual lots.

The granting of the waiver will not change the fact that the Preliminary Plat for the Subdivision has already been approved and individual Site Plan for each lot will need to meet all the standards of the ordinance and be approved again. It really just allows the Developer to start the grading work that will be bonded to protect the public. Utility work to the site and on the site could already be started if the subdivision wasn't in the PC process. In this case, the process for construction has already been approved with the Conditional Approval of the Preliminary Plat. The project is just in a holding pattern while waiting for final DOH/Fed signatures on the one entrance. If this entrance is not approved, the project will still move forward and there will be no wasted work that would begin with this waiver approval.

Accordingly, the Applicant respectfully asks that the Planning Commission approve the waiver so that the work can continue in a timely and more cost-effective fashion. Thank you for your consideration.

Viewer Map



May 12, 2023

1:4,514

0 162.5 325 650 ft

0 45 90 180 m

County of Loudoun, VITA, Esri, HERE, Garmin, INCREMENT P, Intermap, NGA, USGS

Me

Copyright 2014

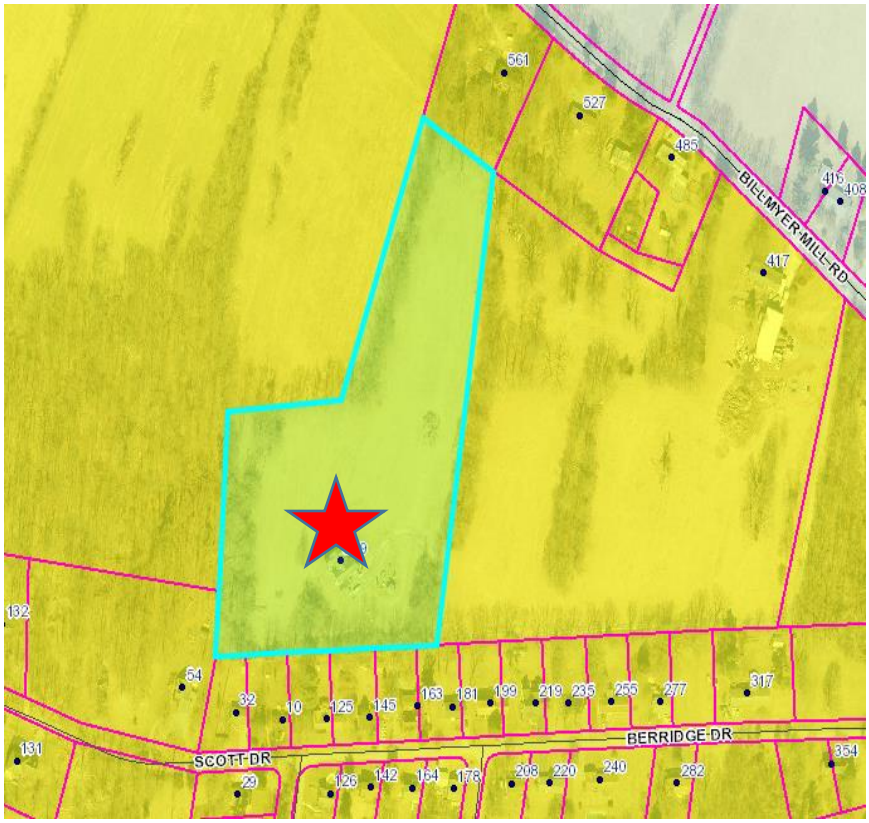
Staff Report

Jefferson County Planning Commission Meeting

June 13, 2023

Lutman-Wines MSD (Access) Waiver Request (File: 23-12-PCW)

Item #6: **Public Hearing:** Waiver from Section 20.201A.2 of the Subdivision Regulations to reduce the width of the required access easement from 50' to 40’ for a proposed four lot minor subdivision.

Owner	Howard Wines and Regina Northcraft
Applicant	David Lutman
Property Location & Information	389 Billmyer Mill Rd, Shepherdstown; Parcel ID: 09000700150005; Size: 10.11+- acres; Zoning District: Residential Growth 
Adjacent Zoning Districts	*North, South, East and West:* Residential Growth
Proposed Activity	Creation of a four lot minor subdivision utilizing the existing 40’ access easement created on the Luther Lamp Minor Subdivision
Previous Approvals	5/28/03 Luther M. Lamp Minor Subdivision (PB20/PG7)

Summary of the Request:

The applicant is proposing to divide Lot 1 of the Luther Lamp Minor Subdivision into four lots utilizing the existing 40’ access easement across the 17+ acre Residue parcel as a Minor Subdivision.

In order to proceed with the subdivision, the applicant is requesting a waiver from Section 20.201A.2, to waive the required 50’ access easement to either a WV DOH road or a road in a major subdivision that meets county roadway design standards, and to allow the use of an existing 40’ driveway serving the existing house and lot.

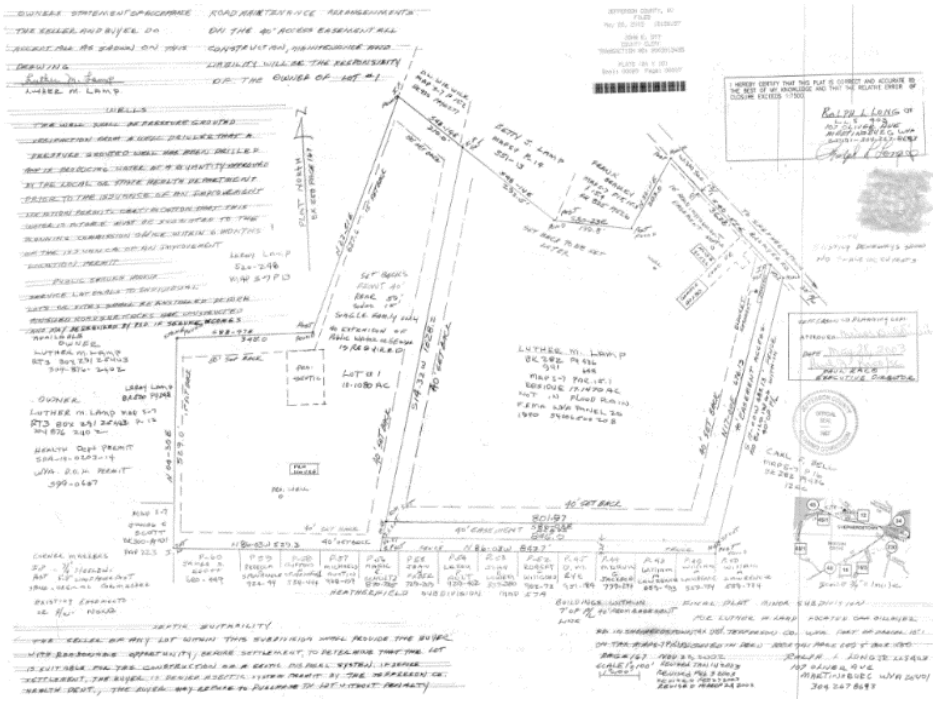
Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Lutman-Wines MSD (Access) Waiver Request (File: 23-12-PCW)

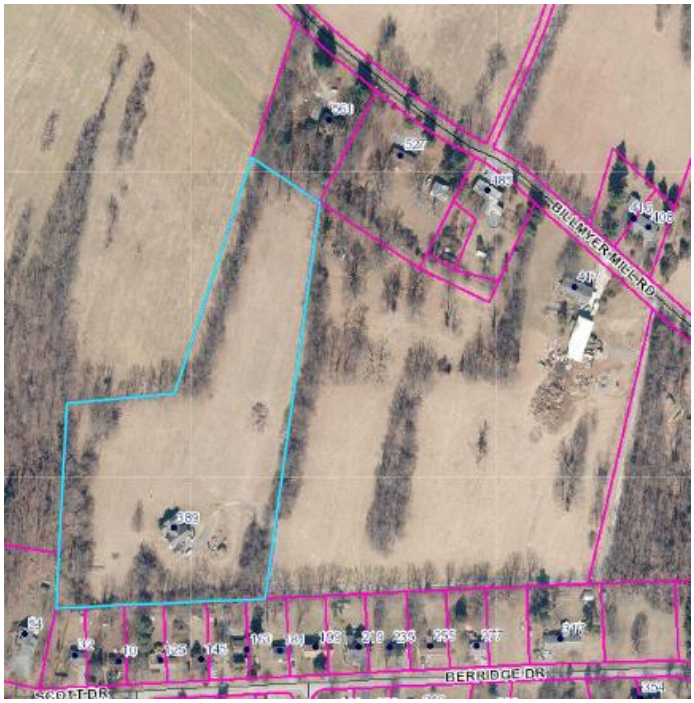
Relevant Site Information:

In 2003, the subject parcel was created as a part of a two-lot subdivision and is known as Lot 1. When the subdivision was created, access to the newly created Lot 1 was provided with a 40' access across the Residue Lot. At the time, the Residue Lot was occupied by a house and garage and had a separate approved access from Billmyer Road. There is no clear language indicating whether the Residue Lot has the right to access the 40' access easement as well.

The extension of the access easement through Lot 1 to serve the new lots will be the required 50' wide.



Staff Discussion/Recommendation:



As noted above, this subdivision has the right to create four lots (3 lots and a residue) as a Minor Subdivision in accordance with Section 20.201A.2 of the Subdivision Regulations, provided that a 50' access is provided. This application is requesting a waiver of this requirement to be allowed to use the existing 40' access easement.

Note that the creation of these four lots will be the maximum that can be created from the original Luther Lamp development as a Minor Subdivision. Any additional subdivision of either Lot will be required to process as a Major Subdivision.

If the Planning Commission is inclined to approve this waiver, the subdivision should be limited to the 4 lots proposed at this time to minimize the impact on the proposed access.

Staff Report

Jefferson County Planning Commission Meeting

June 13, 2023

Lutman-Wines MSD (Access) Waiver Request (File: 23-12-PCW)

Sections of Subdivision Regulations under Consideration:

Sec. 20.201 Minor Subdivisions

A. **Residential**

All minor residential subdivisions shall conform with the following:

1. A minor residential subdivision divides the property into lots and a residue parcel. The subdivision of the lots creates the residue parcel out of the original parcel.
2. All lots, regardless of the zoning district, shall have motor vehicle access via a 50' access easement, provided that the access easement serves no more than 5 lots to either:
   a. A WV DOH road right-of-way or easement; or
   b. A road in a major subdivision that meets county roadway design standards (Table 2.2-1)
3. Potable water and sanitary sewer service shall be provided according to the requirements of Appendix B, *Engineering Standards.* All submissions shall provide a plat approved by the Department of Health or letters of water and sewer availability, as applicable.

Waiver Requirements:

The applicant provided a response to the requirements found in "Division 24.300 Waivers" of the Subdivision Regulations in the waiver application. Waivers from the minimum standards in these Regulations may be granted by the Planning Commission only when the Planning Commission finds that granting a waiver will be consistent with all of the following criteria:

1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature;
2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents;
3) that the waiver, if granted, will be in keeping with the intent and purpose of these Regulations; and
4) that the waiver, if granted, will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

Jefferson County, West Virginia
Department of Engineering, Planning and Zoning
Office of Planning and Zoning
116 E. Washington Street, 2nd Floor
P.O. Box 716
Charles Town, West Virginia 25414

File #: 23-12-PCW
Mtg Date: 6/13/2023
Date Rec'd: 5/23/2023
Fees Paid: $100
Staff Int: ME
List of Adjoiners: ☒

Email: planningdepartment@jeffersoncountywv.org
zoning@jeffersoncountywv.org
Phone: (304) 728-3228
Fax: (304) 728-8126

Planning Commission Waiver Request

Waivers must comply with Division 24.300 of the 2008 Subdivision Regulations, as amended.

Property Owner Information

Owner Name: Howard Wines Regina Northcraft
Business Name:
Mailing Address: 389 Billmyer Mill Road, Shepherdstown, WV 25443
Phone Number: c/o Paul 304/676-8256 Email: c/o pjraco.consulting@gmail.com

Applicant Contact Information

Applicant Name: David Lutman Same as owner: ☐
Business Name:
Mailing Address: 412 W Burr Blvd, Kearneysville, WV 25430
Phone Number: c/o Paul 304/676-8256 Email: c/o pjraco.consulting@gmail.com

Consultant Information

Name: Paul J Raco
Business Name: P.J. Raco Consulting LLC
Mailing Address: P.O. Box 548, Charles Town, WV 25414
Phone Number: 304/676-8256 Email: pjraco.consulting@gmail.com

Physical Property Details

Physical Address: 389 Billmyer Mill Road, Shepherdstown, WV Vacant Lot: ☐
Tax District: Shepherdstown Map No: 7 Parcel No: 15.5
Parcel Size: 10.11+- Acres Deed Book: 975 Page No: 152
Zoning District: Residential Growth

On a separate sheet of paper sketch the shape and location of the lot. Show the location of the intended construction or land use and indicate building setbacks, size, and height. Identify existing easements, roads, buildings, structures, or land uses on the property. Sign and date the sketch.

■ Included ☐ Not applicable (include a vicinity map if a sketch is not applicable)

What Section of the Subdivision Regulations and year of the Regulations are you requesting to Waive?

Section 20.201A.2.

Briefly Describe the Nature of Your Waiver Request:

See Attached

Explain how the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County Parks Plan or benefits of a similar nature.

See Attached

Explain how the waiver, if granted, will not adversely affect the public health, safety, or welfare or the rights of adjacent property owners or residents.

See Attached

Explain how the waiver, if granted, will be in keeping with the intent and purpose of this Ordinance.

See Attached

Explain how the waiver, if granted, will result in a project of better quality and/or character.

See Attached

By signing this application, I give permission to the Planning and Zoning Staff to conduct a site visit for the purpose of taking photos for the Planning Commission staff report. The information given is correct to the best of my knowledge.

Howard Sims 5/23/23

Property Owner Signature Date

Property Owner Signature Date

Notification Requirements

The subject parcel shall be posted with a minimum of one 28" x 22" placard at least 14 days prior to the public hearing. The placard(s) will be prepared by the Staff and posted by the applicant. Adjacent property owner name and address information shall be provided by the applicant so that notification letters can be mailed by Staff least 14 days prior to the public hearing.

6/13/2023	5/30/2023	5/30/2023
Public Hearing Date	Date Placard Posted	Date Adjoiners Mailed

Planning Commission Determination

Approved ☐ Denied ☐ Date: ____ / ____ / ____

Lutman
Waiver Request 40’ Easement/ROW
Owner: H Wines and R Northcraft
Sections 20.201A(2)
Jefferson County Subdivision and Site Development Ordinance
May 23, 2023

Brief Description

The Applicant is requesting a waiver from a 50’ ROW/Easement to use the existing 40’ ROW/Easement for a proposed permitted 3 lot subdivision and residue. There is only one other lot on the access easement and the sole maintenance of the easement rests with the Applicant’s lot. So, the additional lots will continue to maintain the access easement as required by the original subdivision of the two parcels.

The total of 5 lots on an access easement does not require upgrading the road, so this is not a request from upgrading the road. It is merely requesting the ability to utilize the existing 40’ Easement that does not require a County Grade access. As such, it doesn’t need to be wider than 40’. As a matter of fact, the previous standard for a Minor Subdivision and up to 10 lots was a 40’ access easement. This is why the existing easement is only 40’. Since the easement does not need to construct a country grade access road, the construction of a simple driveway to serve the lots doesn’t need to be 50’.

The application otherwise conforms to a Minor Subdivision, and it is permitted to be subdivided as requested without upgrading the road. There is no purpose to provide a 50’ ROW. Since the subject parcel is in the rear of the other existing parcel, the ROW/Easement cannot be increased to 50’ since that property is under different ownership.

The Planning Commission has granted many requests to allow a 40’ ROW/Easement when there is no requirement to provide for or upgrade an existing road. This request is not similar to recent requests where an applicant was adding additional lots on a road that was already substandard and should have been upgraded. This application is only for a total of 5 lots on and existing ROW/Easement which does not require a country grade road. Therefore, 40’ is more than adequate to serve the new lots. Furthermore, the subject parcel is required to continue to maintain the access easement.

Based on the above, the Applicant respectfully requests the Planning Commission to grant the waiver to allow the proposed new lots to utilize the existing 40’ which was the standard at the time when the original lot was created. Thank you for your consideration of the request.

Lutman
Waiver Request 40' ROW/Easement
Owner: H Wines and R Northcraft
Sections 20.201A(2)
Jefferson County Subdivision and Site Development Ordinance
May 23, 2023

Four Criteria:

1. *Explain how the design of the Project will provide public benefit in the form in the reduction of Public maintenance costs, greater open space, parkland consistent with the County Park Plans or benefits of a similar nature;*

   This project will have no Public costs since the existing 40' Access Easement is a private access and is required to be maintained by the Applicant by virtue of the prior Subdivision approval. There will be no public maintenance costs involved as the Easement and any driveway improvements within the easement will be maintained privately by the lots created in this subdivision.

   The existing 40' access easement was the correct easement width when this lot was created and approved by the Planning Commission. With this proposed 4 lot subdivision, it only creates an additional 3 lots on the easement and there is no requirement for road construction. The maintenance of the access easement is entirely on this lot and the newly subdivided lots, so the other property owner on the easement is not required to participate in the maintenance of the easement. The subdivision will need current DOH approval and Health Department approval, as well.

2. *Explain how the waiver, if granted, will not adversely affect the public health, safety and welfare or the rights of adjacent property owners or residents;*

   If the waiver is granted, it will have absolutely no adverse effect on public health, safety or welfare since the project will still be required to meet every other standard and requirement of the Minor Subdivision standards of the Subdivision Ordinance. This approval will include the Health Department and Highway Department Approval for the development.

   Furthermore, as stated previously, the waiver will not have any effect on the neighbors or public health since the development needs all other approvals and the applicant will need to maintain the driveway to the new lots. There are no other improvements that are necessary since the subdivision otherwise qualifies as a Minor Subdivision.

3. *Explain how the waiver, if granted, will be keeping with the intent and purpose of this ordinance;*

   The purpose of the ROW standard is to ensure that a proper road can be constructed within the space provided. In this case, only a driveway is needed within the 40' ROW. The 40' ROW/Easement will not hamper further access to the subdivision. No subdivision road is required since it is a Minor Subdivision, so the 40' access easement is more than adequate to serve the additional 3 lots. The driveway will be maintained by the new lots, as required by the previous plat.

   Furthermore, the property is located in the Residential Growth Zoning District, so many more lots could be developed on this property, but the Applicant is only developing an additional 3 lots. The addition of 3 lots in this area is supported by the Comprehensive Plan, the Zoning Ordinance and the Subdivision Ordinance.

4. *Explain how the waiver, if granted, will result in a project of better quality and/or character;*

   The granting of the Waiver will allow an additional 3 lots for a total of 5 lots on the easement. This qualifies as a Minor Subdivision without any requirement to upgrade the driveway access. Therefore, there is no need to upgrade the ROW/Easement to 50'. The 50' wide standard is required for ROWs or Easements primarily for the purpose of providing space for construction of a County Grade Road. None is required in this subdivision. Furthermore, the driveway will be maintained by the new lots without need for public maintenance. Additionally, the new houses will contribute to increased property values in the neighboring community, as well as additional Impact Fees and taxes for the general County Budget and County School Budget and Bonds. The Applicant is a well known local builder that has constructed many well designed houses and subdivisions in Jefferson County.

   Accordingly, the Applicant respectfully asks that the Planning Commission approve the waiver so that the process can continue the creation of the one proposed three new lots. Thank you for your consideration.

OWNERS STATEMENT OF ACCEPTANCE

THE SELLER AND BUYER DO ACCEPT ALL AS SHOWN ON THIS DRAWING

Luther M. Lamp

LUTHER M. LAMP

ROAD MAINTENANCE ARRANGENMENTS.

ON THE 40' ACCESS EASEMENT ALL CONSTRUCTION, MAINTENANCE AND LIABILITY WILL BE THE RESPONSIBILITY OF THE OWNER OF LOT #1

WELLS

THE WELL SHALL BE PRESSURE GROUTED VERIFICATION FROM A WELL DRILLER THAT A PRESSURE GROUTED WELL HAS BEEN DRILLED AND IS PRODUCING WATER AT A QUANTITY APPROVED BY THE LOCAL OR STATE HEALTH DEPARTMENT PRIOR TO THE ISSUANCE OF AN IMPROVEMENT LOCATION PERMIT. CERTIFICATION THAT THIS WATER IS POTABLE MUST BE SUBMITTED TO THE PLANNING COMMISSION OFFICE WITHIN 6 MONTHS OF THE ISSUANCE OF AN IMPROVEMENT LOCATION PERMIT

PUBLIC SERVICE HOOKUP

SERVICE LATERALS TO INDIVIDUAL LOTS OR SITES SHALL BE INSTALLED BEFORE FINISHED ROAD SURFACES ARE CONSTRUCTED AND MAY BE REQUIRED BY PSD IF SERVICE BECOMES AVAILABLE

OWNER
LUTHER M. LAMP
RT 3 BOX 291 25443
304-876-2402

OWNER
LUTHER M. LAMP MAP S-7
RT 3 BOX 291 25443 P-13
304 876 2402

HEALTH DEPT PERMIT
SPA-19-0203-14

WVA. D.O.H. PERMIT
599-0607

CORNER MARKERS
IP - 3/4" STEEL Rods
PBST 6"-8" WOOD FENCE POST
STONE - ORGINAL COR MARKER

EXISTING EASEMENTS OR R/W - NONE

SEPTIC SUITABILITY

THE SELLER OR ANY LOT WITHIN THIS SUBDIVISION SHALL PROVIDE THE BUYER WITH REASONABLE OPPORTUNITY, BEFORE SETTLEMENT, TO DETERMINE THAT THE LOT IS SUITABLE FOR THE CONSTRUCTION OF A SEPTIC DISPOSAL SYSTEM. IF BEFORE SETTLEMENT, THE BUYER IS DENIED A SEPTIC SYSTEM PERMIT BY THE JEFFERSON CO. HEALTH DEPT., THE BUYER MAY REFUSE TO PURCHASE THE LOT WITHOUT PENALTY

JEFFERSON COUNTY, WV
FILED
May 28, 2003 15:58:57

JOHN E. OTT
COUNTY CLERK
TRANSACTION NO: 2003013435

PLATS (24 X 18)
Book: 00020 Page: 00007

I HEREBY CERTIFY THAT THIS PLAT IS CORRECT AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND THAT THE RELATIVE ERROR OF CLOSURE EXCEEDS 1:7500.

RALPH L. LONG JR
L.L.S 403
107 OLIVER AVE
MARTINSBURG WVA
25401-304-267-8693

NOTE
EXISTING DRIVEWAYS SHOW
NO SWALE OR CULVERTS

JEFFERSON CO. PLANNING COM.
APPROVED Minor Subdivision
DATE May 28, 2003
Paul D. Raco SC
PAUL RACO
EXECUTIVE DIRECTOR

JEFFERSON COUNTY
OFFICIAL SEAL
1967
PLANNING COMMISSION

LEROY LAMP
520-248
MAP S-7 P 13

LEROY LAMP
BK 520 P 248

BETTY J. LAMP
MAP S-7 P-14
551-13

FRANK BEADLEY
MAP S-7 P 15, 15.3
& 15.4
BK 825 PG 26

W.J. WILLIAMS
MAP S-7 P 15
BK 930 PAGE 277

PLAT NORTH
BK 550 PAGE 167

LOT 1A 1.5004

LOT 1B 1.5030 AC

SET BACKS
FRONT 40'
REAR 50'
SIDES 15'

SINGLE FAMILY ONLY

NO EXTENSION OF PUBLIC WATER OR SEWER IS REQUIRED

LOT # 1C
~~1.5108~~ AC
1.5801 ac

PRO. SEPTIC

PRO HOUSE

PRO. WELL

Residue 1D - Residue
5.5729 ac

S88-47E 345.0

N22-51E 627.6

S98-14E 210.0'

S98-14E 293.5'

S80-23E 199.8'

N22-51E 203.0'

S14-32W 1028.2

N04-30E 529.0'

N86-03W 529.3

S80-23E 801.97

S89-03E 845.0

N86-03W 843.7'

S40-53E 363.8'

N11-00E 676.13'

S17-00W 683.13'

50' SET BACK

40' SET BACK

40' EASEMENT

10' ROAD IMPROVEMENT EASEMENT

SEPTIC

HOUSE 40X26

CONC. DR

GARAGE 40X80

WELL

BLANKET EASEMENT

40' EASEMENT ACCESS

6' FENCE WITHIN

TO SHEPHERDSTOWN BILLMYER RD.

W.VA SEC. 12

POST FOUND

IP SET

IP FOUND

SET BACK TO BE SET LATER

30' R/W

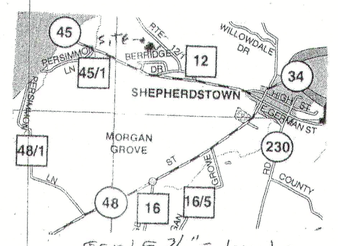
MAP S-7
JAMES E SCOTT
BK 300-P 431
PAR 22.3

P-60	P 59	P-58	P-57	P 56	P 55	P 54	P 53	P-52	P 45	P-44	P-43	P-49	P 50
JAMES S. SCOTT 680-449	REBECCA B SPONANGLE 924-44	CLIFTON M STUBBLEFIELD 554-444	MICHAELS AUSTIN 928-109	MARK E. SCHULTZ 870-735	JEAN M. FABER 729-209	LEROY P. AULT 929-452	JOHN B LOWERY 337-580	ROBERT C WILCOXS 902-72	D. M. EYE 951-184	MARVIN G. JACKSON 779-294	WILLIAM M LAWRENCE 659-433	WILLIAM M LAWRENCE 559-734	WILLIAM M LAWRENCE 559-734

HEATHERFIELD SUBDIVISION MAP 57A

CARL F. BELL
MAP S-7 P 16
BK 282 PG 436
12 AC

Secrist
LUTHER M. LAMP
BK 282 PG 436
941 649
MAP S-7 PAR. 15.1
RESIDUE 17.1470 AC
NOT IN FLOOD PLAIN
F.E.M.A. WVA PANEL 20
1950 540050D 20B



SCALE 3/4" = 1 mile

BUILDINGS WITHIN 7' OF P/L 40' FROM EASEMENT LINE

SCALE 1" = 100'
1" = 100'

FINAL PLAT MINOR SUBDIVISION
FOR LUTHER M. LAMP LOCATED ON BILLMYER RD. IN SHEPHERDSTOWN TAX DIST. JEFFERSON CO. WVA. PART OF PARCEL 15.1 ON TAX MAPS-7 P/S RECORDED IN DEED BOOK 941 PAGE 649 & BOOK 550 PAGE 167

NOV 22, 2002
REVISED JAN 14 2003
REVISED FEB 3 2003
REVISED FEB 27 2003
REVISED MARCH 23, 2003

RALPH L LONG JR LS 403
107 OLIVER AVE
MARTINSBURG WVA 25401
304 267 8693

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Sam Michaels (Early Grading) Waiver Request (File: 23-13-PCW)

Item #7: **Public Hearing:** Waiver from Section 20.102B of the Subdivision Regulations to allow overlot site grading and footings to commence prior to Site Plan approval for the proposed Phase II of the AMP at Sam Michaels Park due to grant deadlines (File: 22-2-SP).

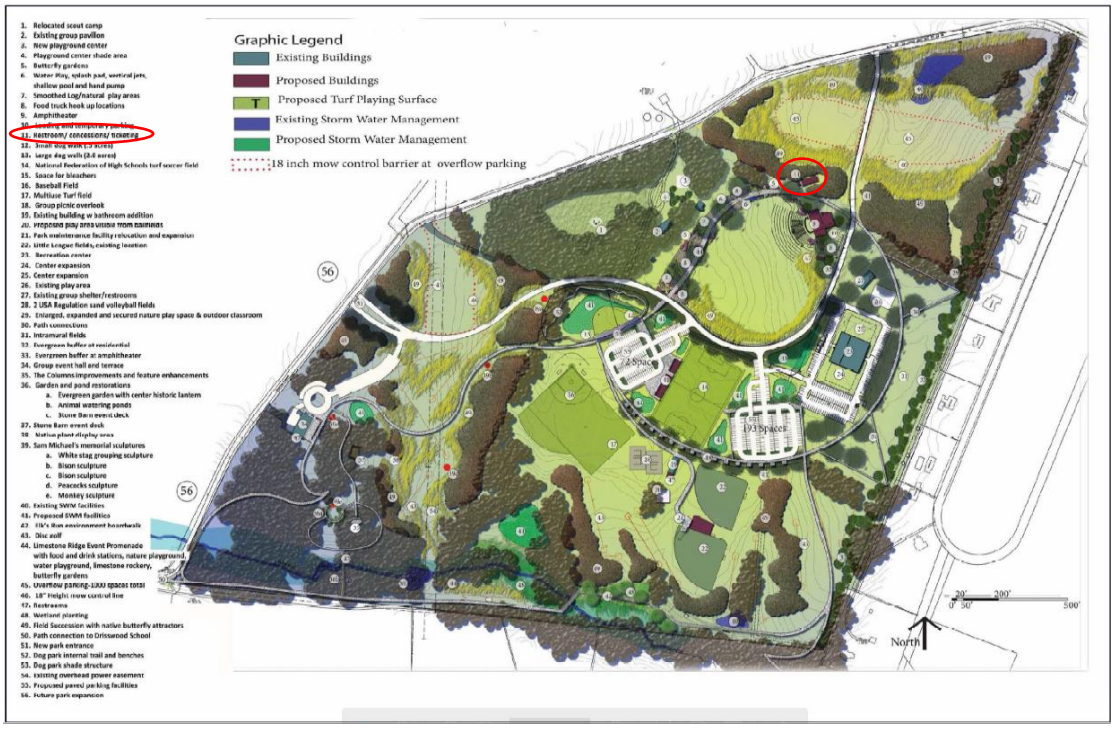
Owner	Jefferson County Commission
Consultant	Jefferson County Parks & Recreation Commission
Parcel Information	235 Sam Michaels Lane, Shenandoah Junction, WV Parcel ID: 02000300120000; Size: 136.6 acres; Zoning District: Rural
Adjacent Zoning	North, East, South and West: Rural
Proposed Activity	Proposed Addition to the Amphitheater including a ticketing area, concession area, restrooms, offices, and meeting spaces.
Previous Approvals	• 22-2-SP Concept Plan for Sam Michaels Park Master Plan (PC 5/17/22) • 19-5-PCW Waiver of the required paved parking and to continue to utilize grass and gravel parking in the park for large events at the amphitheater (PC 4/9/19) • 19-6-ZC for use of Sam Michaels Park facilities as a Publicly Owned Facility per the Concept Plan (5/10/19) • 18-79 Building Permit - Amphitheater (3/11/18) • S04-21 Redline Revisions for various additions and new construction • S04-21 Sam Michaels Park Recreation Center Site Plan • S00-11 Approved Preliminary Plat/Site Plan for development of Sam Michaels Park.

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

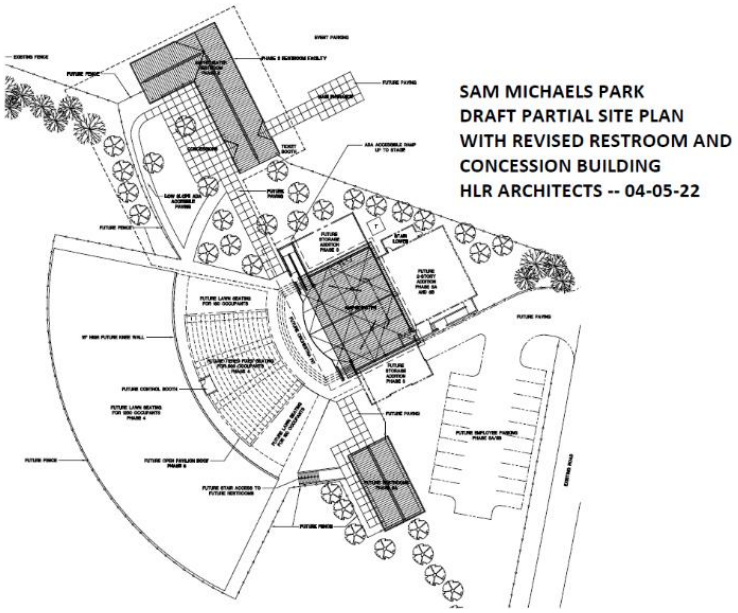
Sam Michaels (Early Grading) Waiver Request (File: 23-13-PCW)

Summary of the Request:

In 2022, the Planning Commission approved a Concept Plan for Sam Michaels Park, which was developed by the Parks and Recreation Commission (JCPRC), based on the 2026 Master Plan for all of Jefferson County Parks and Recreation Facilities. The Sam Michaels Park Master Plan includes a proposed restroom/concessions/ticketing area for the Amphitheater (see #11 below).



The JCPRC is currently developing a Site Plan for the expansion of the amphitheater, including a ticketing area, concession area, bathrooms, office and meeting spaces, with the intent of finalizing the Site Plan prior to the construction of the facility (which has not yet been submitted to the County Offices). JCPRC is also working with the Charles Town Utility Board (CTUB) to have public sewer serve this site and to remove the existing septic system.



Currently, the JCPRC is developing this restroom and concession project around grant deadlines, some of which expire on June 30, 2023. For this reason, and due to the summer being the optimal season to conduct grading, the JCPRC are requesting that they be able to initiate overlot grading and footing prior to the approval of the Site Plan.

Staff Report
Jefferson County Planning Commission Meeting
June 13, 2023

Sam Michaels (Early Grading) Waiver Request (File: 23-13-PCW)

All Major Site Plans require processing a Concept Plan and a Site Plan. A Concept Plan was processed for the Sam Michaels Park in May 2022, which depicted the build out of the entire property. Prior to construction beginning on the site, the Subdivision Regulations require that the Site Plan be approved and bonded, therefore this waiver is required to initiate grading.

Subdivision Regulation Requirements:

Section 20.102B of the Subdivision Regulations requires that "before development of the land is commenced, subdivision plats and site plans must be approved by the Planning Commission, recorded, and surety posted for required improvements in accordance with these Regulations and the Comprehensive Plan." This request is to waive this requirement and to allow the overlot grading and footings to be initiated prior to the final approval of the Site Plan. The JCPRC is not required to post a bond for this project.

Staff Comments/Recommendation:

As staff has noted previously, many jurisdictions allow separate grading permits provided that all Erosion and Sediment Control and SWM plans have been approved by the County and are bonded. Generally, the full Site Plan has already been under review and, if approved, the grading plans receive early approval for all Erosion and Sediment Control measures and are be inspected by the County prior to earth movement. The Jefferson County Planning Commission has allowed early grading plans in the past and staff recommends that this concept should be included as a provision in the Subdivision Regulations/Ordinance when it is amended. In this case, however, no site plan has been submitted at this time, so there is no initial staff approval of any portion of the site plan required for this project.

The applicant has indicated that allowing this project to begin will be helpful in getting the Amphitheater project initiated under the timing of the grant requirements and during the summer season. This request is for overlot grading and footings.

Staff recommends approval of the waiver request with the following conditions:

a. A grading permit is issued to allow the owner to perform site grading and footings in preparation for the building pad and related improvements, provided that an Early Grading Plan (EGP) is submitted and approved prior to the issuance of the permit. A building permit can be issued for only the foundations of the proposed concessions and restroom building. No additional work will be allowed on the building until the Site Plan is approved. This permit will be subject to the requirements of the sediment and erosion control plan submitted and approved as part of the Early Grading Plan (EGP) and building permit application and a NPDES permit is obtained; and

~~b.~~ The owner/Developer assumes all risk for "jump-starting" the project and understands that the final site plan design approved by the Planning Commission might necessitate some changes and additional construction cost. The applicant shall not hold the Jefferson County Commission liable for any losses, damages, and/or mishap caused by the approval of this waiver.

As a reminder, this Site Plan cannot be approved until the WV DOH entrance permit and Health Department or CTUB permits are obtained.

Waiver Requirements:

The applicant provides a response to the requirements found in "Division 24.300 Waivers" of the Subdivision Regulations, which is attached to the application. Waivers from the minimum standards in

these Regulations may be granted by the Planning Commission only when the Planning Commission finds that granting a waiver will be consistent with all of the following criteria:

(1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature;

(2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents;

(3) that the waiver, if granted, will be in keeping with the intent and purpose of these Regulations; and

(4) that the waiver if granted will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

Jefferson County, West Virginia
Department of Engineering, Planning and Zoning
Office of Planning and Zoning
116 E. Washington Street, 2nd Floor
P.O. Box 716
Charles Town, West Virginia 25414

File #: 23-13-PCW
Mtg Date: 6/13/2023
Date Rec'd: 5/24/2023
Fees Paid: $100
Staff Int: ME
List of Adjoiners: ☐

Email: planningdepartment@jeffersoncountywv.org
zoning@jeffersoncountywv.org
Phone: (304) 728-3228
Fax: (304) 728-8126

Planning Commission Waiver Request

Waivers must comply with Division 24.300 of the 2008 Subdivision Regulations, as amended.

Property Owner Information

Owner Name: Jefferson County Commission
Business Name:
Mailing Address: PO Box 250, Charles Town, WV 25425
Phone Number: 3047283284 Email:

Applicant Contact Information

Applicant Name: Jefferson County Parks & Recreation Commission Same as owner: ☐
Business Name:
Mailing Address: 235 Sam Michaels Park, Shenandoah Junction, WV 25442
Phone Number: 3047283207 Email: jmyers@jcprc.org

Consultant Information

Name: Marcus Spina
Business Name: Civil & Environmental Consultants, Inc.
Mailing Address: 786 Foxcroft Ave, Martinsburg, WV 25401
Phone Number: 3048487186 Email: mspina@cecinc.com

Physical Property Details

Physical Address: 235 Sam Michaels Park, Shenandoah Junction, WV 25442 Vacant Lot: ☐
Tax District: 02 Map No: 3 Parcel No: 12
Parcel Size: 137.86 Deed Book: 494 Page No: 157
Zoning District: Rural

On a separate sheet of paper sketch the shape and location of the lot. Show the location of the intended construction or land use and indicate building setbacks, size, and height. Identify existing easements, roads, buildings, structures, or land uses on the property. Sign and date the sketch.

■ Included ☐ Not applicable (include a vicinity map if a sketch is not applicable)

What Section of the Subdivision Regulations and year of the Regulations are you requesting to Waive?

Section 20.102B of the Subdivision Regulations

Briefly Describe the Nature of Your Waiver Request:

Jefferson County Parks & Recreation Commission is asking for a waiver to initiate overlot grading and footings prior to the approval of the required Site Plan to begin construction of Phase II of the AMP at Sam Michaels Park. This waiver is being requested due to grant deadlines, as there are several grants funding the project, some of which expire on June 30, 2023. Additionally, summer weather is optimal to begin the grading process.

Explain how the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County Parks Plan or benefits of a similar nature.

Phase II of the AMP includes restrooms, concession stand, ticketing as well as office and meeting room space within Sam Michaels Park.

Explain how the waiver, if granted, will not adversely affect the public health, safety, or welfare or the rights of adjacent property owners or residents.

As an updated site plan is currently being developed and the intent is to submit a finalized site plan for approval before full construction, we do not believe there is any adverse affect to the public.

Explain how the waiver, if granted, will be in keeping with the intent and purpose of this Ordinance.

The JCPRC intends to submit a site plan to the Planning Commission for approval within the next few months.

Explain how the waiver, if granted, will result in a project of better quality and/or character.

If granted, the waiver to begin groundwork will allow JCPRC to use grant funding that will be expiring June 30, 2023.

By signing this application, I give permission to the Planning and Zoning Staff to conduct a site visit for the purpose of taking photos for the Planning Commission staff report. The information given is correct to the best of my knowledge.

Property Owner Signature Date 5/23/23 Property Owner Signature Date

Notification Requirements

The subject parcel shall be posted with a minimum of one 28" x 22" placard at least 14 days prior to the public hearing. The placard(s) will be prepared by the Staff and posted by the applicant. Adjacent property owner name and address information shall be provided by the applicant so that notification letters can be mailed by Staff least 14 days prior to the public hearing.

Public Hearing Date	Date Placard Posted	Date Adjoiners Mailed
6/13/23	5/30/23	5/30/23

Planning Commission Determination

Approved ☐ Denied ☐ Date: ____ / ____ / ____

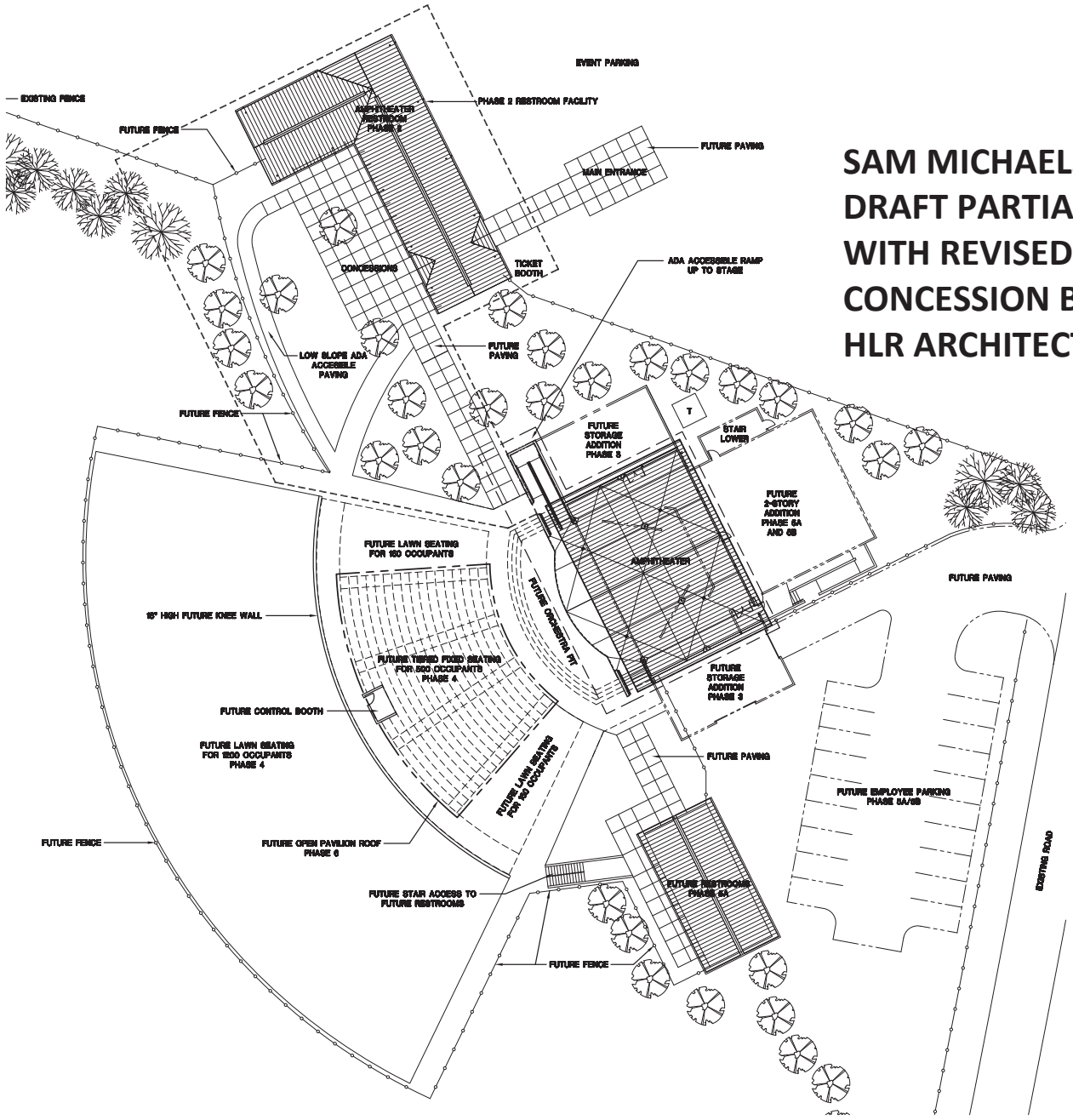
1. Relocated scout camp
2. Existing group pavilion
3. New playground center
4. Playground center shade area
5. Butterfly gardens
6. Water Play, splash pad, vertical jets, shallow pool and hand pump
7. Smoothed Log/natural play areas
8. Food truck hook up locations
9. Amphitheater
10. Loading and temporary parking
11. Restroom/ concessions/ ticketing
12. Small dog walk (.5 acres)
13. Large dog walk (2.0 acres)
14. National Federation of High Schools turf soccer field
15. Space for bleachers
16. Baseball Field
17. Multiuse Turf field
18. Group picnic overlook
19. Existing building w bathroom addition
20. Proposed play area visible from ballfields
21. Park maintenance facility relocation and expansion
22. Little League fields, existing location
23. Recreation center
24. Center expansion
25. Center expansion
26. Existing play area
27. Existing group shelter/restrooms
28. 2 USA Regulation sand volleyball fields
29. Enlarged, expanded and secured nature play space & outdoor classroom
30. Path connections
31. Intramural fields
32. Evergreen buffer at residential
33. Evergreen buffer at amphitheater
34. Group event hall and terrace
35. The Columns improvements and feature enhancements
36. Garden and pond restorations
    a. Evergreen garden with center historic lantern
    b. Animal watering ponds
    c. Stone Barn event deck
37. Stone Barn event deck
38. Native plant display area
39. Sam Michael's memorial sculptures
    a. White stag grouping sculpture
    b. Bison sculpture
    c. Bison sculpture
    d. Peacocks sculpture
    e. Monkey sculpture
40. Existing SWM facilities
41. Proposed SWM facilities
42. Elk's Run environment boardwalk
43. Disc golf
44. Limestone Ridge Event Promenade with food and drink stations, nature playground, water playground, limestone rockery, butterfly gardens
45. Overflow parking-1000 spaces total
46. 18" Height mow control line
47. Restrooms
48. Wetland planting
49. Field Succession with native butterfly attractors
50. Path connection to Drisswood School
51. New park entrance
52. Dog park internal trail and benches
53. Dog park shade structure
54. Existing overhead power easement
55. Proposed paved parking facilities
56. Future park expansion

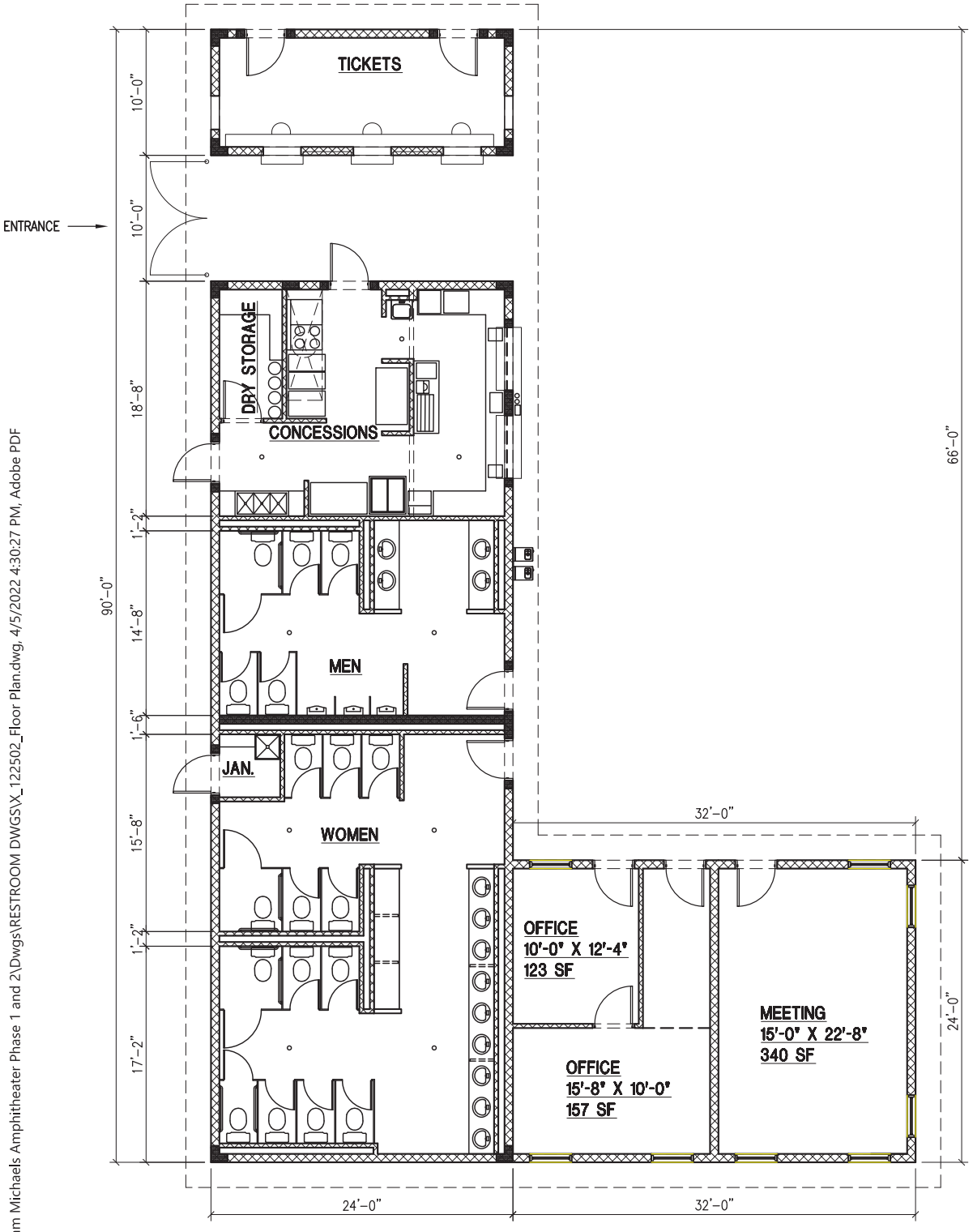
Graphic Legend

- Existing Buildings
- Proposed Buildings
- T Proposed Turf Playing Surface
- Existing Storm Water Management
- Proposed Storm Water Management
- 18 inch mow control barrier at overflow parking

F:\Archived Jobs\2016 - 2020\117006 - Sam Michaels Amphitheater Phase 1 and 2\Dwgs\RESTROOM DWGS\122502_ASP1_Architectural Site Plan.dwg, 4/5/2022 5:40:41 F

SAM MICHAELS PARK
DRAFT PARTIAL SITE PLAN
WITH REVISED RESTROOM AND CONCESSION BUILDING
HLR ARCHITECTS -- 04-05-22





REVISED REST ROOM BUILDING PLAN - FOR REVIEW 04-05-22

HLR ARCHITECTS ---- 1/8"=1'-0"

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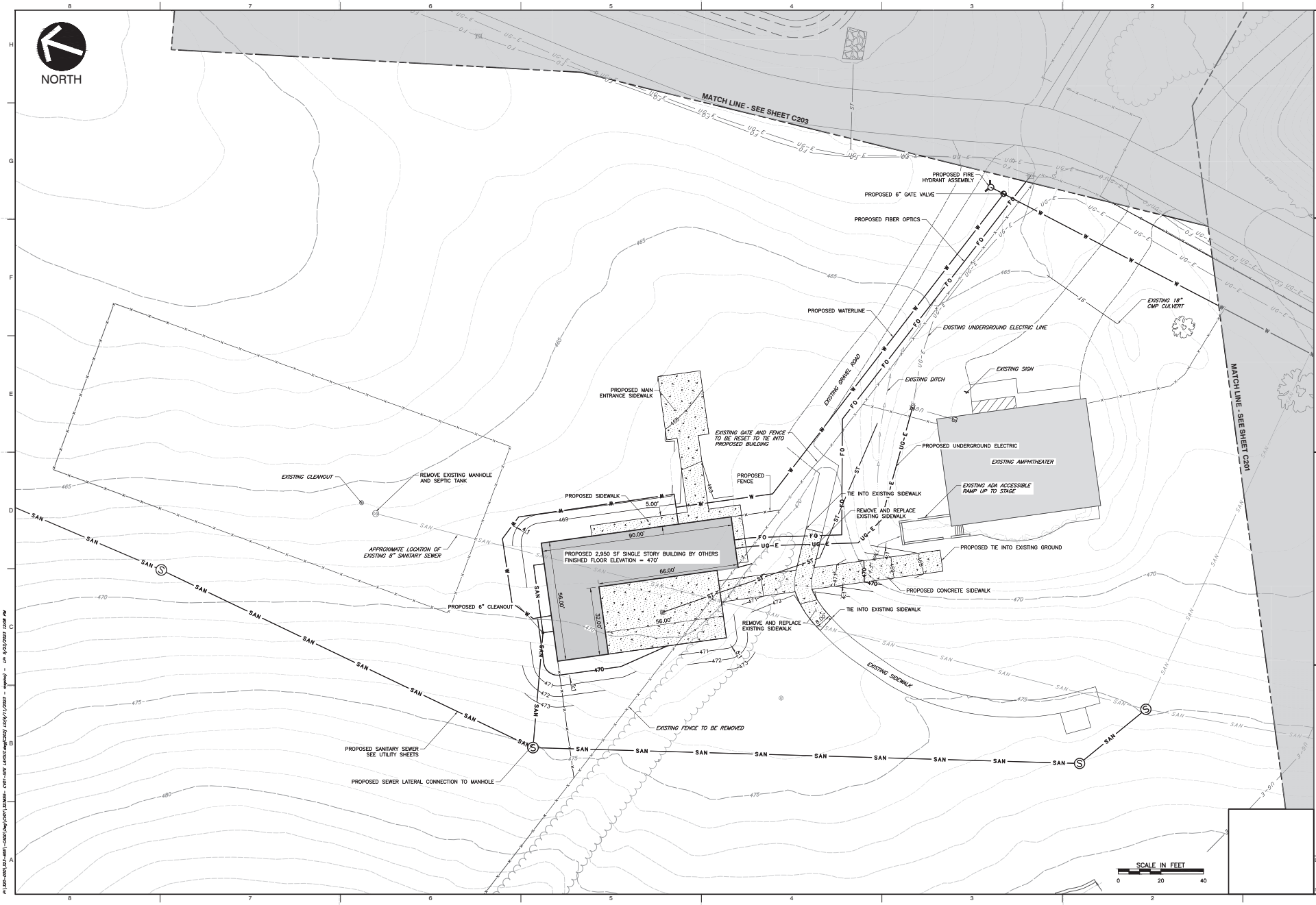


REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
142 North Queen Street · Martinsburg, WV 25402
304-841-6278 · 855-488-9539
www.cecinc.com

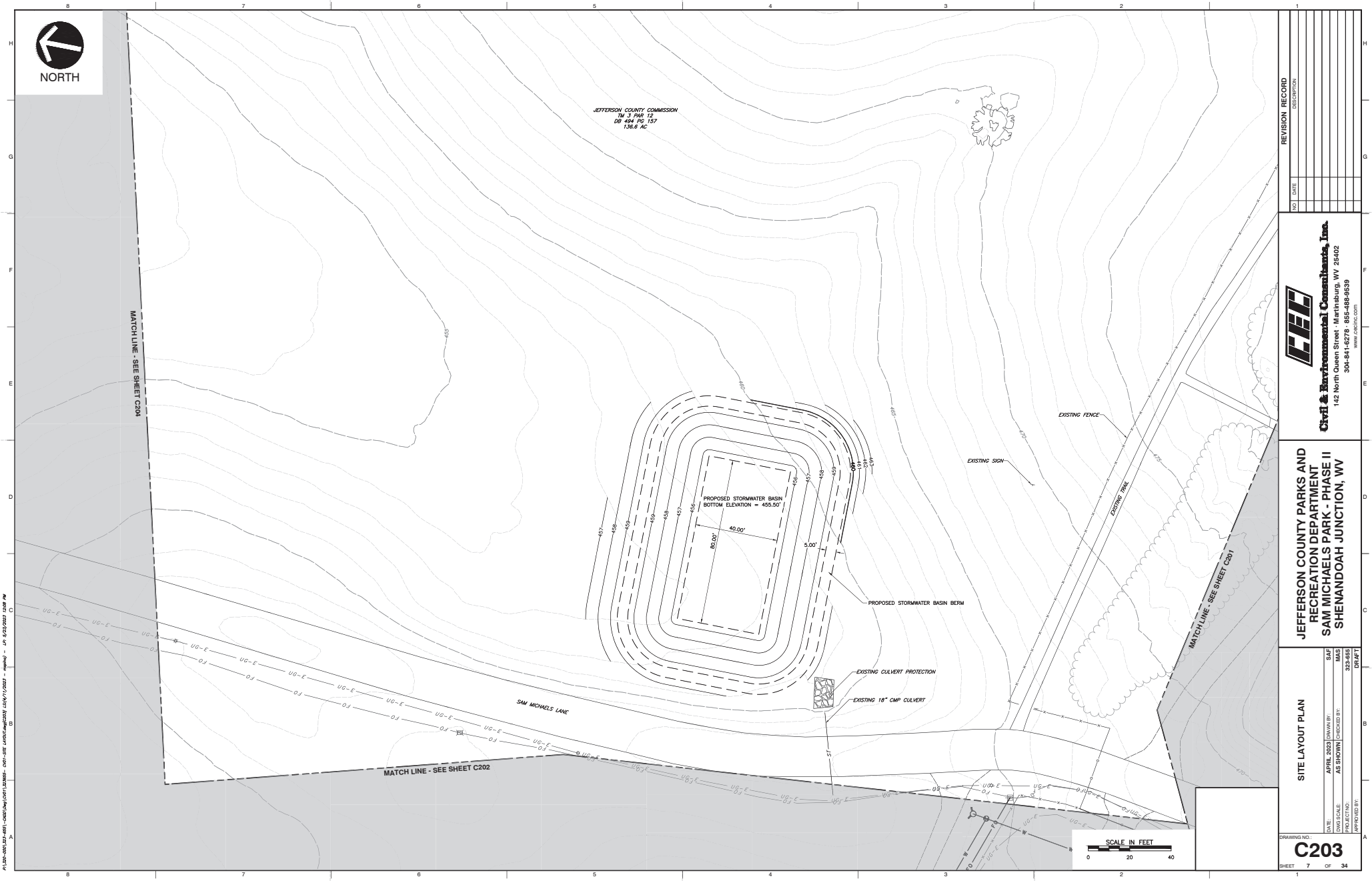
JEFFERSON COUNTY PARKS AND RECREATION DEPARTMENT
SAM MICHAELS PARK - PHASE II
SHENANDOAH JUNCTION, WV

SITE LAYOUT PLAN

DATE:	APRIL 2023
DWG SCALE:	AS SHOWN
PROJECT NO:	323-655
APPROVED BY:	DRAFT
DRAWN BY:	SAF
CHECKED BY:	MAS

DRAWING NO.:
C202
SHEET 6 OF 34

P:\323-655\323-655 - CAD\Dwg\CIVIL\323655 - CIVIL - SITE LAYOUT.dwg[C202 LSLV] 1/1/2023 - mpeloi - 05/23/2023 12:09 PM



REVISION RECORD

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DRAWN BY:	SAF
CHECKED BY:	MAS

DRAWING NO.:
C203
SHEET 7 OF 34

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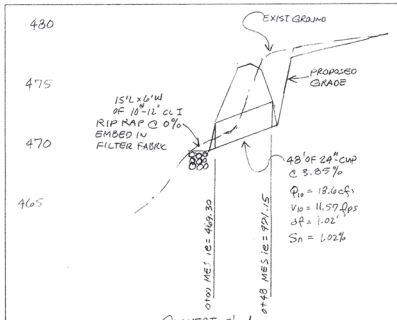
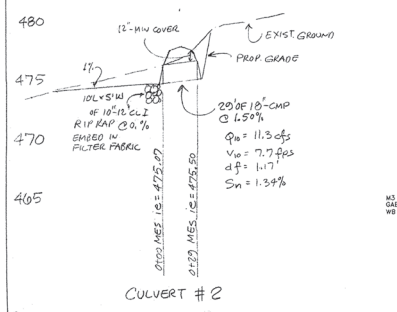
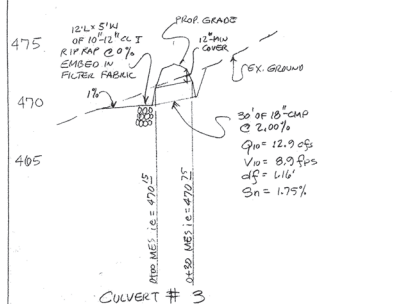
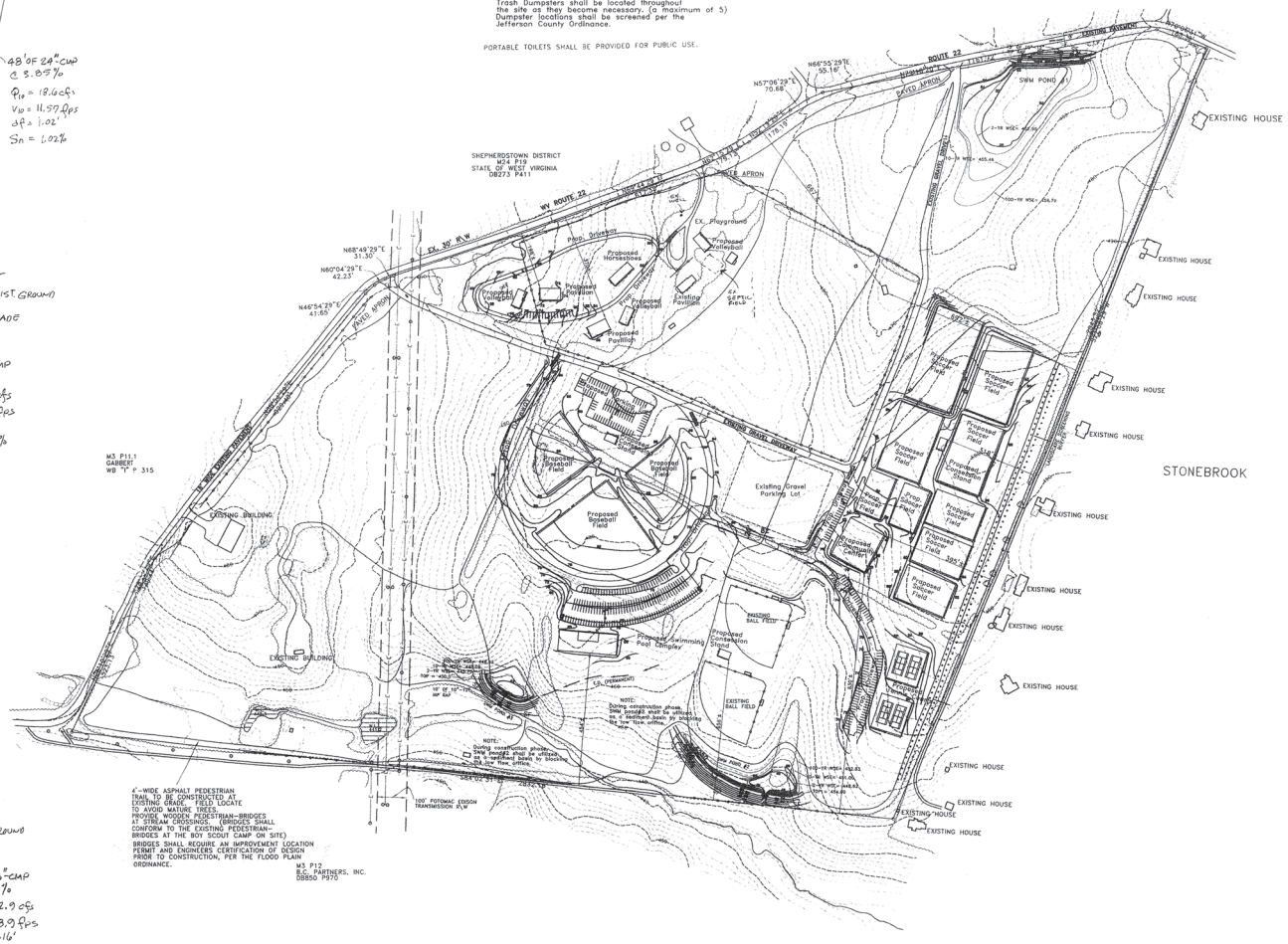






NOTE: Trash Dumpsters shall be located throughout the site as they become necessary. (a maximum of 5) Dumpster locations shall be screened per the Jefferson County Ordinance.

PORTABLE TOILETS SHALL BE PROVIDED FOR PUBLIC USE.



N

BUILDING SETBACK LIMITS
25'- FRONT/SIDE & REAR = 50'

NO.	REVISIONS	DATE	BY
1	PER JCPRC COMMENTS	11/00	JWR

Appalachian Surveys of West Virginia, LLC
120 N. George Street P.O. Box 35 Charles Town, WV 25414
Phone: 304-725-4572 Fax: 304-725-6896

Preliminary Plat showing SAM MICHAEL'S PARK

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WEST VIRGINIA

VARIANCES GRANTED - AUGUST 8, 2000

SECTION 11.2.C.2.B	INTERNAL ACCESS DR. FROM 22' WIDTH TO 20' WIDTH
SECTION 11.2.E.3.	INTERNAL GREEN SPACE WITH PARKING LOTS
SECTION 11.2.J.1.	INTERNAL DRIVES FOR PUBLIC USE FROM PAVED TO GRAVEL

0 100 200 400 600

Developed By:
JEFFERSON COUNTY PARKS AND RECREATION

SHEET:	2 OF 11
DATE:	JUNE 2000
DRAWN BY:	S.L.D.
CHECKED BY:	L.D.M.
APPROVED BY:	L.D.M.
ACAD DIR:	SAMMICHAELS
ACAD FILE:	SAM200
HOR. SCALE:	1"=200'
VER. SCALE:	1"=20'

© 2000 PENTREE, INC.

NO.	REVISIONS	DATE	BY

Appalachian Surveys of West Virginia, LLC
120 N. George Street P.O. Box 35 Charles Town, WV 25414
Phone: 304-725-4572 Fax: 304-725-6896

Preliminary Plat showing

SAM MICHAEL'S PARK

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WEST VIRGINIA

0 25 50 100 150

Developed By:

JEFFERSON COUNTY PARKS & RECREATION

SHEET:	8 OF 11
DATE:	JUNE 2000
DRAWN BY:	S.L.D.
CHECKED BY:	L.D.M.
APPROVED BY:	LDM
ACAD DIR:	SAMMICHAELS
ACAD FILE:	SAM50
HOR. SCALE:	1"=50'
VER. SCALE:	1"=5'

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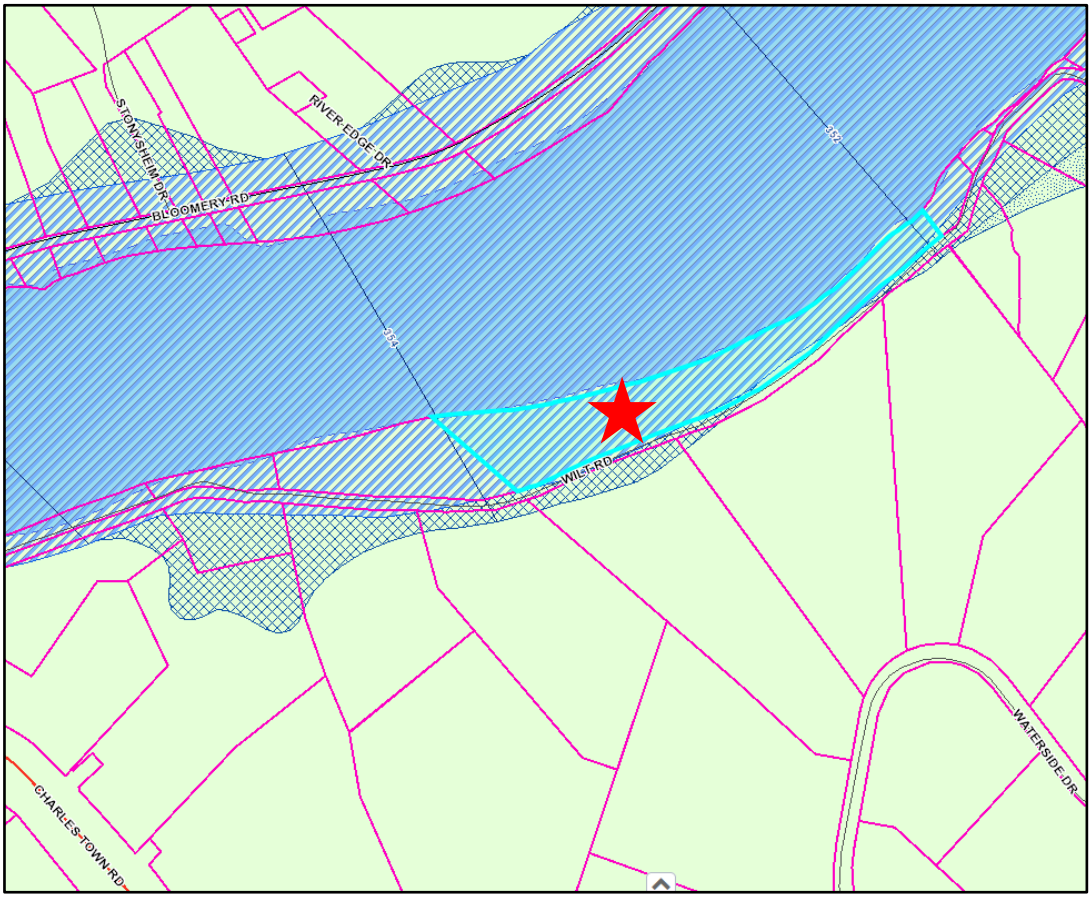
Staff Report

Jefferson County Planning Commission

June 13, 2023

Whisper Ridge (Campground) Waiver Request (File: 23-14-PCW)

Item #7: **Public Hearing:** Waiver from Section 24.202A of the 2008 Subdivision Regulations, requesting permission to amend the CIS and Final Plat for the purpose of excluding the 6.08 acre Open Space parcel from the Waterside Reserve subdivision via an administrative process.

Owner/Applicant	Whisper Ridge, LLC
Representative	Panhandle Legal / Christopher P. Stroech
Parcel Information	Vacant parcel on Wilt Road, Charles Town, WV; Parcel ID: 02020B0OS10000; Size: 6.08 acres; Zoning District: Rural 
Adjacent Zoning	North, East, South and West: Rural
Proposed Activity	Proposed separation of 6.08 acre open space parcel from the balance of the Waterside Reserve Subdivision
History	23-1-AP Appeal of Zoning Administrator's determination that campground was no longer a nonconforming use due the approved Waterside Reserve Subdivision (BZA overturned 4/27/23) 05-19 Waterside Reserve Phase II (Lots 21-28) – Approved 07/19/07 02-37 Beacon Hill Estates Subdivision (Lots 1-20) – Approved 07/30/04 02-37 Beacon Hill Estates Minor Plat Change – Approved 07/19/07 **Changed subdivision name to Waterside Reserve*

Staff Report

Jefferson County Planning Commission

June 13, 2023

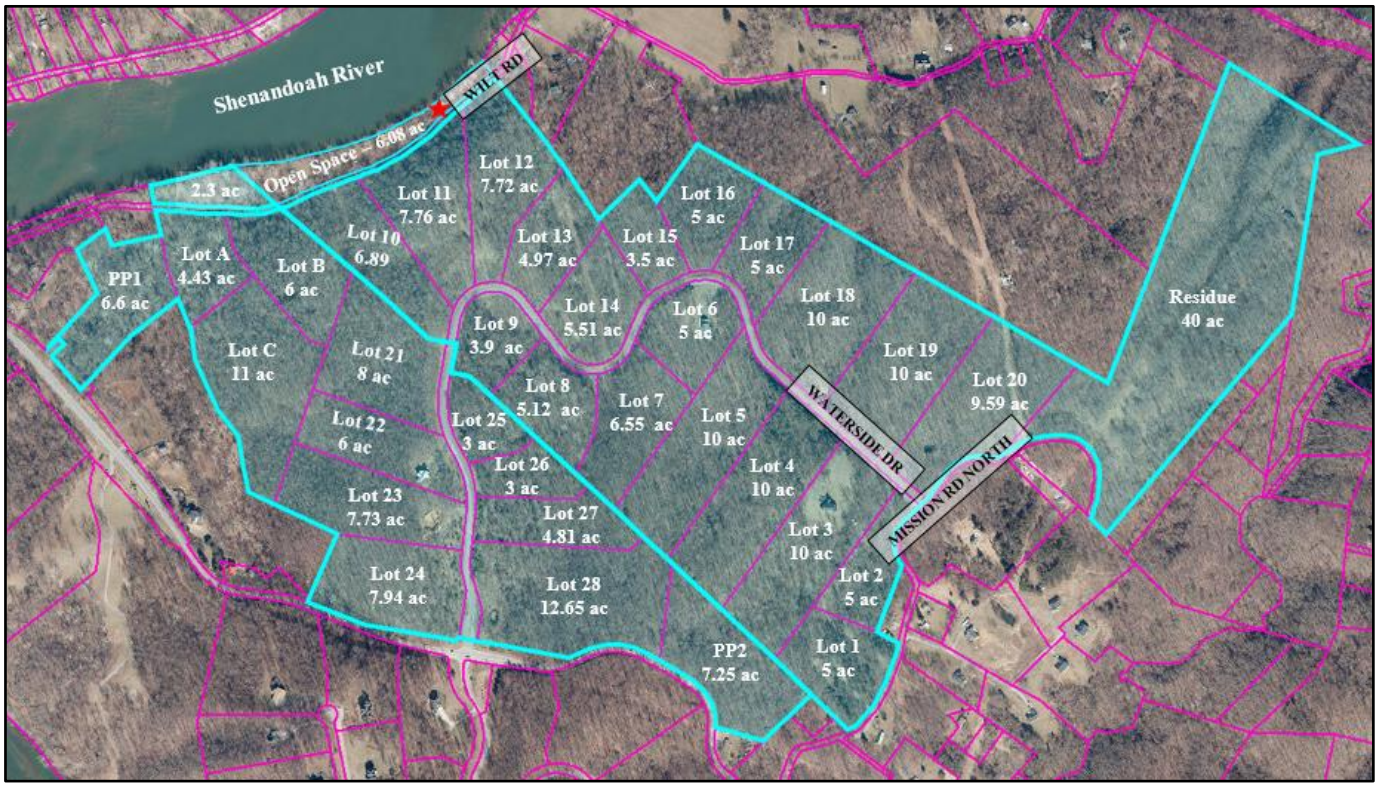
Whisper Ridge (Campground) Waiver Request (File: 23-14-PCW)

History of the Development

The Waterside Reserve Subdivision is comprised of 29 single family lots. The subdivision was created in two phases, with Phase I (originally Beacon Hill Estates) being approved in 2004 for the first 21 lots (Lots 1-20; PB21/PG21), subsequently amended, renamed, and recorded in 2007 (PB24/PG31). Phase II was approved and recorded in 2007 for an additional 8 lots and reconfiguration of some of the existing lots (PB24/PG32). The subdivision was created using a combination of the density provisions in Section 5.7D.1 of the Zoning Ordinance in effect at the time (1 lot per 10 acres), as well as a series of boundary line adjustments between existing, platted lots.

A Community Impact Statement (CIS) was required to process as part of each of the subdivisions' approval process. There is a CIS for Phase I of the Waterside Reserve Subdivision (fka Beacon Hill Estates) and a CIS for Phase II. Both documents state that a strip of land between Wilt Road and the Shenandoah River is being dedicated as open space for recreational purposes for the property owners (Page 4, Item #12 of the CIS approved 12-10-02 [File #02-37]; Page 10, Item #12 of the CIS approved 07-08-05 [File #05-19]; and Page 10, Item #12 of the CIS approved 07-11-05 [File #05-19]). There may be additional references throughout the CISs.

The Final Plat that was recorded in 2004, and amended in 2007, for the first 21 lots, delineates the 6.08-acre parcel as "Open Space". The Final Plat that was recorded in 2007 for File #05-19, for the additional eight lots, appears to refer to other unrelated open space areas.



The applicant has indicated that in 2011, a Quit Claim Deed transferring the 6.08-acre parcel to Whisper Ridge LLC was recorded (DB1091/PG160). This deed states that the conveyance of this 6.08-acre parcel results in this parcel no longer being a part of Waterside Reserve Subdivision and that it "intends to release

and relinquish all rights, if any, it and its successors in title have as an owner of a lot in Waterside Reserve Subdivision to use or occupy the said 6.08 acre parcel". They further noted that each deed transferring individual buildable lots within Waterside Reserve Subdivision has included the following language:

> **THIS CONVEYANCE IS FURTHER MADE SUBJECT to all rights-of-way and easements of record and in existence, including but not limited to the right of the Grantees, others and all property owners within Waterside Reserve, their guests and invitees, to use all subdivision roads and other common facilities (specifically including that 2.33-acre Open Space riverfront parcel shown on the said Plats, and specifically not including the adjacent 6.08-acre riverfront parcel owned by Whisper Ridge, LLC, which parcel is not part of Waterside Reserve.**

Stolen Copy Stolen Copy

While this language was included in these deeds, in order to accomplish this relinquishment legally, the two CIS reports and the Final Plat which allocates this lot as Open Space are required to be formally amended in the same manner in which they were originally created.

Summary of Waiver Request

As noted above, Section 24.202A of the 2008 Subdivision Regulations requires "an amendment to a subdivision plat to process in the same manner as the plat was originally approved". The Waterside Reserve Subdivision (Files #02-37 and 05-19) processed under the 1979 Subdivision Ordinance, which required both the Community Impact Statements (CIS) and Final Plat to be considered during a Public Hearing before the Planning Commission. The applicant is requesting permission to amend the CIS and Final Plat for the purpose of excluding the 6.08-acre Open Space parcel from the Waterside Reserve Subdivision, to allow for the continued use of an existing nonconforming campground, and to allow said amendment to process administratively, rather than through a Public Hearing process.

Additionally, the applicant is requesting that the required amendment to the CIS Statements be accomplished by a single page including a statement that all references to this parcel will be changed from Open Space to an adjoining property owner (see Exhibit E, pgs 30-31 of the Application).

Subdivision Regulation Requirements

Section 24.202A of the 2008 Subdivision Regulations states the following:

> "Sec. 24.202 Amendment, Modification, and the Vacating of Subdivision Plats
> A. Amendment. The Planning Commission (or staff, in the case of a minor subdivision plat) may approve an amendment to a subdivision plat in the same manner as the plat was originally approved, provided:
> 1. All of the property that is affected by the amendment is under the ownership of the applicant;
> 2. The amendment will not affect the ownership or right of convenient access of persons owning other parts of the subdivision; and
> 3. The amendment complies with all of the standards of these Regulations, including verification of compliance with the Zoning Ordinance."

Therefore, because Waterside Reserve Subdivision (Files #02-37 and 05-19) processed under the 1979 Subdivision Ordinance, which required both the Community Impact Statement (CIS) and Final Plat to be considered during a Public Hearing before the Planning Commission, any amendment to these documents would require a Public Hearing before the Planning Commission. The applicant is requesting permission to administratively amend the CIS and Final Plat for the purpose of excluding the Open Space parcel from the Waterside Reserve subdivision rather than via the required Public Hearing.

Staff Comments/Recommendation

The applicant understands that the amendment to both CIS documents and the Final Plat that created the 6.08-acre parcel is required to be processed, but they believe that because of the Quit Claim Deed and the language in each of the deeds to the individuals excluded this parcel from the Waterside Reserve Subdivision, that a public process is not required.

Staff agrees that because this waiver is providing a public process related to the proposed amendments, it may be reasonable to allow the revisions to process administratively; however, staff believes that the various sections throughout each of the CIS documents referencing the open space in this location should be redlined or at least identified on the amendment document for future reference.

Waiver Requirements

The applicant addresses the following requirements found in "Division 24.300 Waivers" of the Subdivision Regulations in the attached application. Waivers from the minimum standards in these Regulations may be granted by the Planning Commission only when the Planning Commission finds that granting a waiver will be consistent with all of the following criteria:

(1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature;

(2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents;

(3) that the waiver, if granted, will be in keeping with the intent and purpose of these Regulations; and

(4) that the waiver if granted will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

JEFFERSON COUNTY, WEST VIRGINIA
Dept. of Engineering, Planning, and Zoning
Office of Planning and Zoning
116 East Washington Street, P.O. Box 716
Charles Town, WV 25414
www.jeffersoncountywv.org

Email: planningdepartment@jeffersoncountywv.org
zoning@jeffersoncountywv.org

Phone: (304) 728-3228
Fax: (304) 728-8126

File Number: 23-14-PCW
Staff Initials: ME
Sketch Received: 5/23/23
List of Adjoiners: NO
Fees Paid: $100 ME

Waiver Request

Note: Waivers from the 2008 Amended Subdivision Regulations must comply with Division 24.300 of the Subdivision Regulations.

Sketch on a separate sheet of paper the shape and location of lot. Show the location of the intended construction or land use indicating building setbacks, size, and height. Identify existing buildings, structures, or land uses on the property. Sign and date the sketch. Provide a vicinity map of the area and a list of the adjoining property owner's mailing addresses.

Property Owner Information

Name: Whisper Ridge, LLC.
Mailing Address: 36 Bakerton Road, Harpers Ferry, WV 25425
Phone Number: 304-671-8181 Email: trishsandersonwv@gmail.com

Applicant Contact Information

Name: Christopher P. Stroech, Esquire/Panhandle Legal
Mailing Address: 116 W. Washington Street, P.O. Box 550, Charles Town, WV 25414
Phone Number: 304-930-1945 Email: cstroech@panhandle-legal.com

Applicant Registered Engineer(s), Surveyor(s), or Consultant(s)

Name:
Mailing Address:
Phone Number: Email:

Physical Property Details

Physical Address: Wilt Road
Tax District: Charles Town Map No: 20B Parcel No: 0OS1
Parcel Size: 6.08 acres Deed Book: 1091 Page No: 160

Zoning District (please check one)

Residential Growth (RG)	Industrial Commercial (IC)	Rural (R)	Residential-Light Industrial-Commercial (R-LI-C)	Village (V)	Neighborhood Commercial (NC)	General Commercial (GC)
☐	☐	☑	☐	☐	☐	☐

Highway Commercial (HC)	Light Industrial (LI)	Major Industrial (MI)	Planned Neighborhood Development (PND)	Office/Commercial Mixed-Use (OC)
☐	☐	☐	☐	☐

Place Date Stamp Here

What Section of the Subdivision Regulations are you Requesting to Waive?

Section 24.202A of the 2008 Subdivision Regulations which requires a public hearing to amend/correct a Community Impact Statement or a Final Plat.

Briefly Describe the Nature of Your Waiver Request:

We would like to waive the public hearing requirement to amend and correct the Community Impact Statement and the Final Plat for Waterside Reserve and allow staff to approve the amendment/correction.

Explain how the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County Parks Plan or benefits of a similar nature.

It will allow the Final Plat to accurately reflect the ownership of neighboring property.

Explain how the waiver, if granted, will not adversely affect the public health, safety, or welfare or the rights of adjacent property owners or residents.

The property use will stay as it is and will have not impact on the public health, safety, or welfare or the rights of adjacent property owners. It will correct the paperwork from 2002 and 2005.

Explain how the waiver, if granted, will be in keeping with the intent and purpose of this Ordinance.

This waiver, if granted, is in keeping with the intent of this Ordinance.

Explain how the waiver, if granted, will result in a project of better quality and/or character.

This waiver, if granted, will allow us to correct the 2002/2005 Community Impact Statement and Final Plat.

Original signature is required. The information given is correct to the best of my knowledge.

Signature of Property Owner Date

5-23-23

Signature of Property Owner Date

To Be Completed By Office

6/13/23 Date of Public Meeting/Public Hearing

_____ Official/Administrative Body

5/30/23 Date Property to be Posted By

5/30/23 Date Adjoiner Letters to be Mailed

Approved/Denied by a vote of _____ for and _____ against this _____ day of _____, _____

☐ ***Approved*** ☐ ***Denied***

JEFFERSON COUNTY PLANNING COMMISSION

In re: Whisper Ridge, LLC

WAIVER REQUEST

The Applicant, Whisper Ridge, LLC, by counsel, Christopher P. Stroech, Esq., does hereby request a waiver of process pursuant to Section 24.300 of the Subdivision Regulations. Specifically, the Applicant seeks a waiver of public hearings and other related process to amend and correct the Final Plat and related Community Impact Statements for the Beacon Hill / Waterside Reserve Subdivision and to allow staff to administratively approve the amendments as proposed.

These amendments will make clear that the subject 6.08 acres located in the Charles Town District, Map 20B, Parcel ID: 02020B0OS1000, Deed Book 1091, Page 160, is not part of the Beacon Hill / Waterside Reserve Subdivision. This parcel will be referenced only as adjoining property.

Facts and Procedural History

1. The subject property is an approximate six (6) – acre tract located off of Wilt Road along the Shenandoah River.
2. From 1940 to 2002, the property was owned by Lawrence Wilt and his family and operated as a campground known as "Hobo Flats."
3. In 2002, the property was transferred to Mission Mountain, LLC
4. The property was used as a campground under the ownership of Mission Mountain, LLC from 2002 to 2010.
5. On July 27, 2010, the property was transferred from Mission Mountain, LLC to Whisper Ridge, LLC. *See* Deed attached as Exhibit A.

6. The property has been used as a campground under the ownership of Whisper Ridge, LLC from 2010 to present.

7. The property was never dedicated by the Declaration or any amendments to the Declaration for the Beacon Hill / Waterside Reserve Subdivision.

8. On March 1, 2011, Waterford Bend, LLC amended its Declaration to make clear that the property is not part of the Beacon Hill / Waterside Reserve Subdivision.

9. On March 24, 2011, Waterford Bend, LLC made clear by quit claim deed that it did not have any interest in the property. *See* Deed attached as Exhibit B.

10. Waterford Bend, LLC has made clear in its individual deeds that the property is not part of the Beacon Hill / Waterside Reserve Subdivision. *See* exemplar Deed as Exhibit C. All Member Deeds contain the same language.

11. The Applicant acknowledges that the paper plan at one time was to incorporate the property as open space for the proposed Beacon Hill / Waterside Reserve Subdivision. This plan was never realized.

12. The property never ceased to be used as a campground and was never physically altered to transition to common space.

13. The property was identified as open space only on paper in the Community Impact Statements for Beacon Hill and in the 2007 recorded Plat for the Beacon Hill / Waterside Reserve Subdivision.

14. From 1940 to 2022, the campground operated continuously without issue.

15. In August, 2022, a notice of violation was issued to the Applicant for the use of the property as a campground.

16. The Applicant submitted an abundant amount of documentation to Staff confirming that the property has been used as a campground since 1940, well before the Zoning and Land Development Ordinance was adopted in 1988. This documentation includes letters from county commissioners, the Applicant's accountant, the WV State Health Department, family, and neighbors confirming the campground activity. *See* Campground Use Verifications attached as Exhibit D.

17. Notwithstanding, Staff determined that "any nonconforming use that may have existed on the subject parcel at the time the residential subdivision processed, would have been considered abandoned by the virtue of the approved residential subdivision."

18. The Applicant appealed this decision to the Board of Zoning Appeals, and a hearing was held on April 27, 2023. The BZA reversed this decision and determined that a valid nonconforming use as a campground existed on the parcel that had not been abandoned by virtue of the approved subdivision. The BZA further required that the Applicant amend the Final Plat for the Beacon Hill / Waterside Reserve Subdivision to make the record clear that the 6.08 acres is adjoining property and not part of the subdivision.

Standard for Waivers

Waivers from the minimum standards in the Subdivision Regulations may be granted by the Planning Commission only when the Commission finds that granting a waiver will be consistent with all the following criteria: (1) that the design of the project will provide public benefit in the form of reduction in County maintenance costs, greater open space, parkland consistent with the County parks plan, or benefits of a similar nature; (2) that the waiver, if granted, will not adversely affect the public health, safety or welfare, or the rights of adjacent property owners or residents; (3) that the waiver, if granted, will be in keeping with the intent

and purpose of these Regulations; and (4) that the waiver, if granted, will result in a project of better quality and/or character. Process and procedural waivers shall be reviewed and found consistent with the above criteria prior to approval.

Subject Waiver Request

The Applicant seeks a waiver of public hearing and any other required process to amend the Final Plat, as required by the BZA, and the related Community Impact Statements. The Applicant proposes the blanket amendment to the Community Impact Statements and the red-lined Final Plat attached hereto as Exhibit D.

The Applicant contends that the subject 6.08 acre parcel has been a campground from the 1940's to the present time. Whisper Ridge, LLC has owned and operated the property as a campground since 2010. The property was never dedicated by the Declaration or any amendments to the Declaration for Beacon Hill / Waterside Reserve Subdivision. In 2011, Waterford Bend, LLC amended its Declaration to make clear that the property is not part of the Beacon Hill / Waterside Reserve Subdivision. On March 24, 2011, Waterford Bend, LLC made clear by quit claim deed that it did not have any interest in the property. Waterford Bend, LLC has made clear in its individual deeds that the property is not part of the Beacon Hill / Waterside Reserve Subdivision. The property has never been used as common space for the Beacon Hill / Waterside Reserve Subdivision. None of the Members of the Beacon Hill / Waterside Reserve Subdivision have a legal right to use the property in any manner. The BZA has determined that the 6.08 acre parcel is a non-conforming use campground. For these reasons, this waiver request complies with the criteria noted above, as the subject parcel provides a public benefit not adverse to any adjacent owners or residents.

The Applicant requests that the Planning Commission direct Staff to administratively approve the amendments in the manner as proposed by the Applicant.

WHISPER RIDGE, LLC
Defendant, By Counsel

Christopher P. Stroech, Esq., WVSB #9387
Panhandle Legal
116 W. Washington Street, Suite 2E
P.O. Box 550
Charles Town WV 25414
P. (304) 930-1945
F. (304) 930-1387
E. cstroech@panhandle-legal.com

MICHAEL J NOVOTNY
36 BAKERTON ROAD
HARPERS FERRY, WV 25425-4106

DEED

THIS DEED is made effective as of the 27th day of July, 2010, by and between MISSION MOUNTAIN, L.L.C., party of the first part and hereinafter referred to as "Grantor", and WHISPER RIDGE, L.L.C., party of the second part and hereinafter referred to as "Grantee".

WITNESSETH: That for valuable consideration, the receipt of which is hereby acknowledged, the Grantor does hereby grant and convey unto the Grantee, with covenants of general warranty, all of that certain tract or parcel of real estate with improvements thereon and appurtenances thereunto belonging, located in Charles Town District, Jefferson County, West Virginia and being more particularly bounded and described as follows:

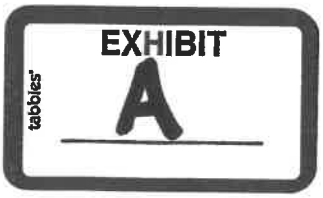
> All of that certain lot or parcel of real estate containing 6.08 acres and designated as "Open Space 6.08 Acres" as shown on the Final Plat of "Waterside Reserve" recorded in the Office of the Clerk of the County Commission of Jefferson County, West Virginia, in Plat Cabinet 24, at Slide 31.

AND BEING a portion of the real estate that was conveyed to the Grantor herein by deed dated December 18, 2002, and recorded in the said Clerk's Office in Deed Book 968, page 689.

DECLARATION OF CONSIDERATION AND WITHHOLDING EXEMPTION

Under the penalties of fine and imprisonment as provided by law, the undersigned Grantor hereby declares that the total consideration paid for the property transferred by this document is Fifteen Thousand Two Hundred Dollars ($15,200.00).

The undersigned, pursuant to the Withholding Tax on West Virginia Source Income of Non-Residents, hereby certifies under the penalties of perjury that the Grantor is a West Virginia limited liability company.



WITNESS the following signature:

Mission Mountain, L.L.C.

By: _____
Patricia M. Sanderson, member

STATE OF WEST VIRGINIA
COUNTY OF JEFFERSON, to-wit:

The foregoing instrument was acknowledged before me this 27th day of July, 2010, by Patricia M. Sanderson, as member of Mission Mountain, L.L.C.

OFFICIAL SEAL
Notary Public, State Of West Virginia
LORRIE J. BALDWIN
PO Box 1722
Martinsburg, WV 25402
My Commission Expires June 14, 2012

_____
NOTARY PUBLIC

Jennifer S Keghan
JEFFERSON County 01:10:15 PM
Instrument No 2010015319
Date Recorded 07/28/2010
Document Type DEED
Book-Page 1092-156
Recording Fee $11.00
Transfer Tax $68.20
HB4331 Tax $34.10
Additional $25.00

This instrument was prepared by Michael J. Novotny
36 Bakerton Road
Harpers Ferry, WV 25425

MICHAEL J NOVOTNY
36 BAKERTON RD
HARPERS FERRY, WV 25425-4106

Jennifer S Waghan
JEFFERSON County 04:21:48 PM
Instrument No 2011007719
Date Recorded 03/24/2011
Document Type DEED
Book-Page 1091-160
Recording Fee $11.00
Additional $5.00

Mail to: Michael J. Novotny 36 Bakerton Road, Harpers Ferry, WV 25425

DEED

(QUITCLAIM)

THIS QUITCLAIM DEED is made and entered into this 24th **day of March, 2011** by and between **WATERFORD BEND, LLC, Grantor, a Delaware limited liability company licensed to do business in West Virginia,** and **WHISPER RIDGE, L.L.C**, Grantee, a **West Virginia limited liability company.**

WITNESSETH: That for and in consideration of the sum of TEN DOLLARS ($10.00), cash in hand paid, the receipt of which is hereby acknowledged, and other good and valuable consideration, the receipt of which is also hereby acknowledged, Waterford Bend, LLC does hereby QUITCLAIM, grant and convey, without warranty of any kind, all of its right, title and interest if any there may be, including all rights of use and occupation unto Whisper Ridge, LLC, together with all rights, improvements, privileges, rights-of-way and appurtenances thereunto belonging or in any wise appertaining, the following-described lot, tract or parcel of real estate, situate, lying and being in Charles Town District, Jefferson County, West Virginia, being more particularly described as follows:

> All of that certain tract or parcel of real estate containing 6.08 acres as more fully shown and designated as "OPEN SPACE 6.08 AC." on the Final Plat of "Beacon Hill Estates Subdivision" dated July 11, 2002, prepared by Site Planning and Design, and recorded in the Office of the Clerk of the County Commission of Jefferson County, West Virginia, in Plat Cabinet 21 at Slide 21-21M, and also shown on the Final Plats of Waterside Reserve drawn by SP&D Planning & Design dated June 29, 2007, and recorded in the aforesaid Clerk's Office in Plat Book 24 at page 31 (Sheets 1 – 14) and at page 32.

Grantor intends by this conveyance to confirm that the said 6.08 acre parcel is not a part of Waterside Reserve Subdivision, fka Beacon Hill Subdivision, and further, intends to release and relinquish all rights if any it and its successors in title have as an owner of a lot in Waterside Reserve Subdivision to use or occupy the said 6.08 acre parcel.

THIS CONVEYANCE IS MADE SUBJECT AND TOGETHER WITH any matters of record pertaining thereto.

DECLARATION OF CONSIDERATION

As provided by law, the undersigned hereby declares that the total consideration paid for the real estate transferred by this document is less than ONE HUNDRED DOLLARS ($100.00), it being a quitclaim conveyance.

EXHIBIT
tabbies
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WITNESS the following signature and seal.

WATERFORD BEND, LLC
a Delaware limited liability company

By: _____
L. Hunter Wilson, Vice President

STATE OF WEST VIRGINIA,

COUNTY OF BERKELEY, to-wit

The foregoing instrument was acknowledged before me this 24 day of May, 2011, by L. Hunter Wilson, Vice President of WATERFORD BEND,LLC a Delaware limited liability company, on behalf of the limited liability company.

My commission expires:

June 18, 2012

(SEAL)

_____
Notary Public

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
KATHY CUMMINGS
133 ORA LEE COURT
MARTINSBURG, WV 25401
My commission expires June 18, 2012

THIS DOCUMENT PREPARED BY:

M. Shannon Brown, Esquire
M. SHANNON BROWN, P. L. L.C.
471 B & O Overpass Road
Hedgesville, WV 25427
West VA Bar License # 4228
VA Bar License # 42073

Mail to: Mr. and Mrs. Michael Christiani, 8701 Overlook Rd., McLean, VA 22102

DEED

THIS DEED, made and entered into this **9th day of March, 2011** by and between **WATERFORD BEND, LLC, a Delaware limited liability company authorized to do business in West Virginia,** party of the first part, Grantor, and **MICHAEL G. CHRISTIANI AND NANCY CHRISTIANI, husband and wife,** parties of the second part, Grantees.

WITNESSETH: That for and in consideration of the sum of TEN DOLLARS ($10.00), cash in hand paid, the receipt of which is hereby acknowledged, and other good and valuable consideration, the receipt of which is also hereby acknowledged, the said party of the first part does hereby bargain, sell, grant and convey unto the parties of the second part, as joint tenants with rights of survivorship and not as tenants in common, with covenants of General Warranty in fee simple, together with all rights, improvements, privileges, rights-of-way and appurtenances thereunto belonging or in any wise appertaining, the following-described lot, tract or parcel of real estate, situate, lying and being in Charles Town District, Jefferson County, West Virginia, being more particularly described as follows, to-wit:

> **Lot No. 8, containing 5.12 acres, "Waterside Reserve" as is more fully shown upon a Final Plat drawn by SP&D Site Planning & Design dated June 29, 2007, and recorded in the Office of the Clerk of the County Commission of Jefferson County, West Virginia, in Plat Book 24 at page 31 (Sheets 1 – 14), and Lot No. 9, containing 3.9007 acres, as resurveyed and re-platted from the aforesaid Plat by that Final Plat drawn by Huron Consulting dated April 2007, and recorded in the aforesaid Clerk's Office in Plat Book 24 at page 32 (Sheets 1 – 7).**

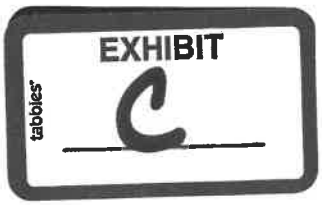
AND BEING a portion of the same real estate conveyed to Waterford Bend, LLC, Grantor herein, from Fifth Third Bank, an Ohio corporation, by Deed dated December 29, 2010, recorded in the aforesaid Clerk's Office in Deed Book 1088 at page 516.

THIS CONVEYANCE IS MADE SUBJECT to those covenants, restrictions and assessments more particularly set forth in that Declaration of Reservations and Restrictive Covenants for Waterside Reserve dated February 18, 2011, and any Supplemental Declaration thereto, to be recorded in the aforesaid Clerk's Office preceeding this instrument.

THIS CONVEYANCE IS FURTHER MADE SUBJECT to all rights-of-way and easements of record and in existence, including but not limited to the right of Grantor, others and all property owners within Waterside Reserve, their guests and invitees, to use all subdivision Roads and Other Common Facilities (specifically including that 2.33-acre Open Space riverfront parcel shown on the said Plats, and specifically not including the adjacent 6.08-riverfront parcel owned by Whisper Ridge, LLC, which parcel is not part of Waterside Reserve).

DECLARATION OF CONSIDERATION

As provided by law, the undersigned hereby declares that the total consideration paid for the real estate transferred by this document is TWO HUNDRED ONE THOUSAND EIGHT HUNDRED DOLLARS. ($201,800.00).



WITNESS the following signature and seal.

WATERFORD BEND, LLC
a Delaware limited liability company

By: _____
L. Hunter Wilson, Vice President

STATE OF WEST VIRGINIA,

COUNTY OF BERKELEY, to-wit

The foregoing instrument was acknowledged before me this 24 day of March, 2011, by L. Hunter Wilson, Vice President of WATERFORD BEND,LLC a Delaware limited liability company, on behalf of the limited liability company.

My commission expires:

June 18, 2012
(SEAL)

Kathy Cummings
Notary Public

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
KATHY CUMMINGS
133 ORA LEE COURT
MARTINSBURG, WV 25401
My commission expires June 18, 2012

MICHAEL G CHRISTIANI
8701 OVERLOOK RD.
MCCLEAN, VA 22102-1523

Jennifer S Maghan
JEFFERSON County 09:03:03 AM
Instrument No 2011007748
Date Recorded 03/25/2011
Document Type DEED
Book-Page 1091-180
Recording Fee $11.00
Transfer Tax $888.80
HB4331 Tax $444.40
Additional $25.00

THIS DOCUMENT PREPARED BY:

M. Shannon Brown, Esquire
M. SHANNON BROWN, P. L. L.C.
471 B & O Overpass Road
Hedgesville, WV 25427
West VA Bar License # 4228
VA Bar License # 42073

12-16-22
Submitted
to Engineering

Whisper Ridge, LLC.
36 Bakerton Rd
Harpers Ferry, WV 25425

December 15, 2022

EXHIBIT
tabbies
D

Jefferson County Planning and Zoning
116 East Washington Street
P.O. Box 716
Charles Town, WV 25414

Re: Charles Town District; tax map #20B, Parcel 0OS1.0000; Deed Book 1091, Page 160 ("Campground")

We are writing regarding your request to show that our Campground has been in existence since 1988.

Patricia (Trish) Sanderson, Wade Sanderson, and David Leonard, Jr. were the members of Mission Mountain, LLC. and Greenbrier Investments, LLC. These two entities are no longer operating as of 2012/2013. We are also the members of Whisper Ridge, LLC.

The Campground was owned by Lawrence Wilt from around 1940 until he passed away in 1980. At that time his wife, Grace Wilt, and daughter, Carolyn Young, became the owners. The Wilts/Young operated the Property as a Campground from the 1960's until 2002 when they sold the Property to Mission Mountain, LLC. Charlie Wilt, the brother of Lawrence Wilt, managed the Campground and collected the money from the campers for Lawrence until Charlie passed away in 1992. After that time, the Campground was managed by his wife and daughter (Grace and Carolyn) until it was sold to Mission Mountain in 2002.

Several of the campers that had been camping at the Property while the Wilt's owned it remained as camping tenants after Mission Mountain took ownership. Jeannie Cross, one of the former Wilt campers, is still camping at the Campground, and we have included a letter from her.

In 2002, prior to purchasing the Property from Wilt/Young, we talked to many of the campers that were on site. There were approximately 40+ camp sites along the Property. At that time, they were paying their camping rent to Wilt/Young with many of them having camped on the Property since the beginning of 1970. Several of those campers talked about other campers who camped at Hobo Flats before they did dating back into the 1960's. We noted that there was electric to most of the campers and that there was an operational well on site with a stamped lid showing an install date of 1970. I contacted the Jefferson County Health Department to see if there were any records on the well depth, etc.. but since this well was drilled in 1970, there were no county records. With a well on site in 1970, there would also be electric.

After Mission Mountain purchased the Property in 2002, we rented it as a Campground until the Property was transferred to ~~Greenbrier Investments, LLC. in 2005.* Greenbrier rented the Property as a Campground until it was transferred~~ to Whisper Ridge, LLC. in 2010. Currently, Whisper Ridge is the owner and has collected the Campground rents from 2010 to present. I am including a letter from our

*Greenbrier only took ownership of Mountain | S/D property.

Whisper Ridge, LLC.
36 Bakerton Rd
Harpers Ferry, WV 25425

December 15, 2022

Jefferson County Planning and Zoning
116 East Washington Street
P.O. Box 716
Charles Town, WV 25414

Re: Charles Town District; tax map #20B, Parcel 0OS1.0000; Deed Book 1091, Page 160 ("Campground")

We are writing regarding your request to show that our Campground has been in existence since 1988.

Patricia (Trish) Sanderson, Wade Sanderson, and David Leonard, Jr. were the members of Mission Mountain, LLC. and Greenbrier Investments, LLC. These two entities are no longer operating as of 2012/2013. We are also the members of Whisper Ridge, LLC.

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Several of the campers that had been camping at the Property while the Wilt's owned it remained as camping tenants after Mission Mountain took ownership. Jeannie Cross, one of the former Wilt campers, is still camping at the Campground, and we have included a letter from her.

In 2002, prior to purchasing the Property from Wilt/Young, we talked to many of the campers that were on site. There were approximately 40+ camp sites along the Property. At that time, they were paying their camping rent to Wilt/Young with many of them having camped on the Property since the beginning of 1970. Several of those campers talked about other campers who camped at Hobo Flats before they did dating back into the 1960's. We noted that there was electric to most of the campers and that there was an operational well on site with a stamped lid showing an install date of 1970. I contacted the Jefferson County Health Department to see if there were any records on the well depth, etc.. but since this well was drilled in 1970, there were no county records. With a well on site in 1970, there would also be electric.

After Mission Mountain purchased the Property in 2002, we rented it as a Campground until the Property was transferred to Greenbrier Investments, LLC. in 2005. Greenbrier rented the Property as a Campground until it was transferred to Whisper Ridge, LLC. in 2010. Currently, Whisper Ridge is the owner and has collected the Campground rents from 2010 to present. I am including a letter from our

long-time accountant that verifies that we have received camping income each year since our purchase in 2002.

I am including a letter from Mr. Kenneth Wilt who was the son of Charlie Wilt. It attests to the fact that this property has been a Campground for over 60 years.

I am including a letter from David Wilt, another family relative that attests to the fact that this property has been a Campground since the 1960's.

I spoke with Alan Marchun, an Engineer with the WV State Health Department who has been working in this county for the state of WV Health Department since 1991. From his attached letter you can see that he has been aware of this Campground since 1991 when he first started to work here and surmised from his visit and the condition of the Property that the Campground had been in existence for many, many years prior to his visit and continues until the present time.

The Property history shows that this has been a Campground continuously since the 1960's to the present time. Prior to our purchase, the Property was known as "Hobo Flats." Ask any longtime resident of the county, and most will either know of the Campground or have camped there themselves.

I was able to find several google maps from 1988 to 2003 which show campers on the Property prior to our purchase. While some of the photos available were difficult to see due to the tree cover, etc...many were very clear and demonstrated that it was a Campground prior to our purchase in 2002.

We are including letters from several of the local people to further establish that this has been a Campground continuously since prior 1988.

Please consider this the proof necessary to show that this Campground is "grandfathered" in as a non-conforming use and is not subject to current zoning requirements.

Sincerely,

Patricia (Trish) Sanderson, Member

Attachments:
Letter from Kenneth Wilt, neighbor and relative of prior owner
Letter from David Wilt, relative
Letter from Alan Marchun, State Health Department
Letter from Donald Price, Accountant
Letter from Steve Stolipher, Jefferson County Commission
Letter from Mark Rodgers, neighbor and county resident
Letter from Trish Sanderson, county resident
Letter from Wade Sanderson, county resident
Letter from David Leonard, Jr., county resident
Letter from Garland Engle, county resident
Laurie Cook, camper
Norma Jean Cross, county resident and camper
Google Maps showing Campground from 1988-2003

December 11, 2022

To whom it may concern:

Re: 6 acres along Shenandoah River (across from Moulton Park), along Wilt Road., formerly owned by Lawrence Wilt, Grace Wilt, and Carolyn Young currently owned by Whisper Ridge.

I live at 1280 Wilt Road in Charles Town, WV at the end of Wilt Road. My property has been in our family for generations. Originally owned by my grandfather, Charles H. Wilt (passed away in 1949) it was then transferred to my father, C.W. (Charlie) Wilt (passed away in 1992) and then to me, Kenneth, L. Wilt in 1980.

The Whisper Ridge property referenced above was owned by my father's brother/my uncle, Lawrence Wilt. He bought the property around 1940, and it remained in the family until sold in 2002.

There has been a campsite continuously at the above referenced property for over 60 years. My father, Charlie Wilt, collected the rent from the campers on my uncle Lawrence's property for my uncle beginning in the 1950's. When my Uncle Lawrence passed away in 1980, he continued to collect the camping rent for my Aunt Grace and their daughter Carolyn Young until 1992 when my father passed away.

After my father's death, from 1992 to 2002, when the property was sold, the campers would either pay my Aunt Grace Wilt or their daughter, Carolyn Young. Since it was often more convenient, they would sometimes leave the payment with me or my wife, Libby, to pass along to Grace Wilt and Carolyn Young.

As my property is located at the end of Wilt Road, I pass the Whisper Ridge property often coming to or from my home. It appears that the property continued as a campsite continuously after it was sold in 2002 to present.

Sincerely,

Kenneth L Wilt

Kenneth L. Wilt

December 11, 2022

To whom it may concern:

Re: Campsite/Hobo Flats located across from Moulton Park, owned by Whisper Ridge, LLC.

My name is David Wilt, Jr. and I have lived at 1169 Hostler Road, Harpers Ferry since 1975. Prior to that I lived at Alstadt Farm on old Rt 340 in Harpers Ferry. My home has always been close to the campsite that was Hobo Flats and currently owned by Whisper Ridge.

I have lived in Jefferson County all my life and run the Wilt's Fruit Stand in Harpers Ferry. My father Harold Wilt started the business in 1959. Lawrence Wilt, Grace Wilt and Carolyn Young, the former owners of Hobo Flats were relatives.

I used to go to Hobo Flats to fish and boat every year since from the 1960's to the present. I would first go with my parents and then, once I had children, I would take them. There were well over 40 campsites on this property and most had electricity to their campsites. Rent from the campers was paid to Charlie Wilt, the brother of Lawrence, for most of that time. After Lawrence passed away, it was paid to his daughter Carolyn or his wife, Grace. When Trish Sanderson and David Leonard, purchased the property in 2002, camping rent began to be paid to them.

I haven't been able to go as often as I used to since my wife, Becky, passed away in 2018 but still manage at least once or twice a year.

Hobo Flats now called Whisper Ridge has continuously been a campsite since before the 1960's to this day

Sincerely,

David G. Wilt Sr.

David Wilt, Jr.

STATE OF WEST VIRGINIA
DEPARTMENT OF HEALTH AND HUMAN RESOURCES
Bureau for Public Health
Office of Environmental Health Services

Bill J. Crouch
Cabinet Secretary

December 6, 2022

Ref: Wilt Road Campground

To Whom it may concern:

My name is Alan Marchun, and I am the Supervisor of the WV Bureau for Public Health, Office of Environmental Health Services, Kearneysville District Health Office.

During the summer of 1991, this office investigated a potential public water system involving a campground, owned at that time by Mrs. Grace Wilt. The property was located about ½ mile on the left passed the bridge on Wilt Road, Charles Town.

Campers were observed all along the property, with a well located on the west end. It was apparent due to the condition of the campers, etc. that the property had likely been a campground many years.

The investigation revealed that while it was a campground and did have a well, the number of campers utilizing the well did not meet the EPA definition of a public water system and the facility did not require further regulation by this office.

This office monitors eight counties within the Eastern Panhandle, including Jefferson Co. I have regularly driven by this property since 1991 and in my opinion, it has likely been a campground since before 1991 until the present.

Sincerely,

Alan F. Marchun

Alan Marchun
Technical Analyst Supervisor
Kearneysville District Office

1948 Wiltshire Road, Suite 6
Kearneysville, WV 25430
Telephone: (304) 725-9453

Donald K. Price, CPA, PC

Certified Public Accountant and Consultant
114 Stonebrook Road, Winchester, VA 22602
Post Office Box 849, Stephens City, VA 22655
Office (540) 550-9677 Fax (888) 459-6634
donald@dkpcpa.biz

December 9, 2022

To whom it may concern:

I have been the accountant for Patricia Sanderson, David Leonard, Jr., and Wade Sanderson for the past 30 years. I have prepared their personal and related entity tax returns. This includes Mission Mountain, LLC (2002-2012/final), Greenbrier Investments, LLC (2005-2013/final), and Whisper Ridge, LLC (2006 to Present).

In 2002, Mission Mountain, LLC purchased the 6 acres along the Shenandoah River on Wilt Road, Charles Town, WV (along with other properties). Mission Mountain, LLC received camping income from 2002 to 2010 and then the property was transferred to Whisper Ridge, LLC. Whisper Ridge has received the camping income from 2010 to the present.

Sincerely yours,

Donald K Price

Donald K. Price, CPA

January 25, 2023

Jefferson County Planning and Zoning
116 East Washington Street
P.O. Box 719
Charles Town, WV 25414

RE: Whisper Ridge, LLC in Harpers Ferry, WV

To Whom It May Concern:

As a lifelong resident of Jefferson County, I am writing in support that the Whisper Ridge campground, also known to many as Hobo Flats, which has always been a campground.

While it appears the name of the LLC has changed several times over the last several years, even under the membership and interest of Patricia Sanderson, Wade Sanderson, and David Leonard, Jr. going from Mountain Mission to Greenbrier Investments, to now Whisper Ridge, the use of the land has remained consistent as a campground. The campsite predates the three entities previously named in the paragraph with ownership by the Wilt/Young families who also used the land for camping purposes.

Furthermore, tax records and assessment data support the fact that the land has been consistently used as a campground with no drastic changes to its characteristics that would make its use anything other than a campground.

It is my hope and recommendation that Whisper Ridge, LLC continue to operate and provide the much-needed recreational and family fun activities that are a rarity these days.

Please let me know if you have any questions.

Sincerely,

Tricia Jackson
Harpers Ferry, WV

December 12, 2022

RE: Whispering Ridge LLC Land Parcel ID 02 20B00S100000000

To Whom It May Concern:

I am writing in reference to the Whispering Ridge, LLC. Property that is adjacent to the Shenandoah River and is also known locally as Hobo Flats.

The property has been a campground site for as long as I can remember and well before 1987. I recall fishing and camping there along the riverbank when I was a child.

The Wilt family were the prior owners of the property. I am certain a family member could provide further details on the use and history of the property as they are very familiar with the land.

I would also recommend the use of aerial photography software such as Google Earth, with the historical photo feature, which would demonstrate the prior structures on the property over the course of time.

Please feel free to contact me with any questions.

Sincerely,

Steve Stolipher

304-283-0614

December 2, 2022

My name is Mark Rodgers, and I live at 1530 Wilt Road, Charles Town, WV. My Grandfather, Jesse Hawkins, purchased 1530 Wilt Road in 1987, and I moved here in the early 2000's after his death. Before I moved here, I often visited my Grandfather.

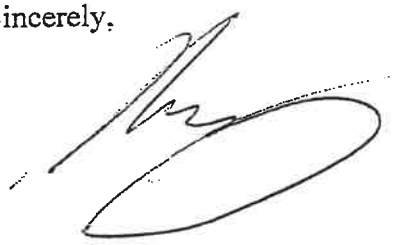
I can certify that the property containing about 6 acres, along Wilt Road, Charles Town, currently owned by Whisper Ridge, LLC. (across from Moulton Park) has continuously been a campsite since prior to 1987 to the present time. It was originally called Hobo Flats, and I would go to the property when visiting my Grandfather as well as visit after Sandersons/Leonard purchased the property from the Wilts.

I have spent time every year since prior to 1987 visiting with people that I know who camped at the property or camping their myself.

Before the Sandersons/Leonards purchased the property, the campers paid their rent to the Wilts or Carolyn Young. Most of the campers had been camping at the property since the 1960/1970's. There was a well on part of the property (that still exists) and electric to many of the campsites.

I have found this campsite and the people that camp here to be good neighbors and hope to see it continue.

Sincerely,



December 7, 2022

Re: Campsite containing 6 acres; Charles Town District; tax map #20B, Parcel 0OS1.0000; Deed Book 1091, Page 160

My name is Patricia (Trish) Sanderson, and I am a lifetime resident of Jefferson County.

Our father would take us to this Campsite to fish/swim/boat with other family members beginning in the early 1970's to around 1982 when I was able to go alone. At that time, Mr. (Pete) Peterson, a long-time camper and family friend, rented his camping lot from the Wilts.

When I first began going to the property in the early 1970's, it was known as Hobo Flats and had well over 40 campsites with electric to most.

I know it has been a campsite from the early 1970's to the present time. We would visit the campsite several times a year from the early 1970's to 2002 when we bought it. After 2002 to the present, we camped even more often.

Per the Wilt Family, it began as a campsite over 60 years ago and was managed as a campsite continuously with the Wilts collecting the rent until it was sold to us in 2002. We have managed the Property and collected rent continuously as a campground from our purchase in 2002 until the present time.

We currently call the property Whisper Ridge, but it is still known locally as Hobo Flats.

I hope this addresses all your questions regarding this campground.

Sincerely,

Patricia (Trish) Sanderson

December 7, 2022

Re: Charles Town District; tax map #20B, Parcel 0OS1.0000; Deed Book 1091, Page 160

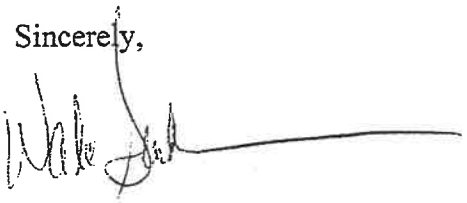
My name is Wade Sanderson, and I am a lifetime resident of Jefferson County.

My parents began taking us to this campsite in the 1970's. We would visit family friends, Judy and Pete Peterson, to fish and boat at their campsite. At that time, the rent was paid to the Wilts until 2002 and there were over 40 campers all along the site, much as it is now.

I have been at the campsite each year since I began going and can confidently say that this has continuously been a campsite from the early 1970's to present.

After our purchase of the property in 2002 to present, the rent was paid to us and has continued as a campsite.

Sincerely,



Wade Sanderson
45 Bridle Court
Charles Town, WV 25414

206 N. Fairfax Blvd.
Ranson, WV 25438
November 22, 2022

To whom it may concern:

Re: Charles Town District; tax map #20B, Parcel 0OS1.0000; Deed Book 1091, Page 160

My name is David Leonard, Jr. and I have lived in Jefferson County since 1985 but have been visiting the area since 1979.

When I first began to come to Jefferson County, my friends and I would go to Hobo Flats (the above referenced property) to fish and camp. The whole area had campers/trailers and was a campground. We have always enjoyed the river and when the property came on the market in 2002, we knew that it was something we wanted to buy.

This property has been a campground since the early 1970's to the present time. I can personally say that it has been a campground continuously since 1979 to present.

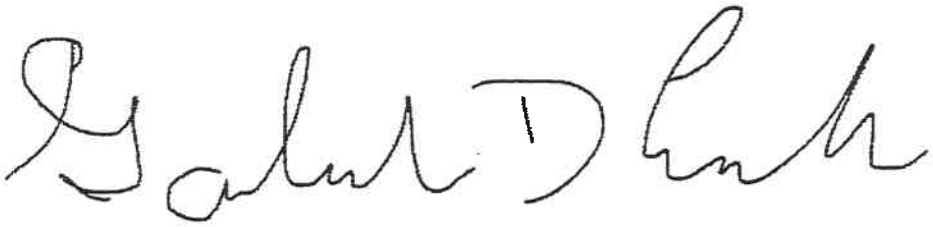
Sincerely,

David Leonard, Jr.

December 7, 2022

I am a resident of Jefferson County and have lived close to the property known as Hobo Flats (6 acres on the Shenandoah River/Wilt Road/Whisper Ridge) all my life. This property has been a campsite from (at least) 1979 to present. I was at the property in 1979 for my high school graduation party. There were campers all along the property with most having electric. Rent at that time was paid to the Wilts.
As I live close to the property, I have seen the campers there every year since. I have also been back many times to visit others that are camping there.
It is nice to have a local campsite available and hope that this will be allowed to continue.
Sincerely,

Garland David Engle
25 Family Tie Lane
Harpers Ferry, WV 25425



195 Radiant Drive
Martinsburg, WV 25404
November 22, 2022

To whom it may concern:

My name is Laurie Cook, and I was born and raised in Jefferson County, WV.

I have been camping at the 6 acres, along Wilt Road, Charles Town, currently owned by Whisper Ridge, LLC. from 2002-present. I paid my camping rent to Mission Mountain, then Greenbrier, and now Whisper Ridge. From 2002 to 2019 I helped Trish Sanderson manage the campsite.

From 1985 to 2002, I visited others who camped at the property (such as Bucky, Jeannie Cross, Mr. Peterson) and can verify that it has been a campsite from prior to 1985 to present with an average of 40 campers/campsites available. Most of the campsites had electric available to them, and it was my understanding the electric hookups had been on site from the 1960's. At that time it was called Hobo Flats.

We enjoy our time camping on the river and hope to continue.

Sincerely,

Laurie A. Cook

Laurie Cook

December 7. 2022

I am a lifetime resident of Jefferson County.

I began camping at Hobo Flats with my Aunt and Uncle (Bob & Joan Slusher) before 1970. At that time up until today, there were over 40 campers all along the entire property with electric to most. Some stayed all year and some were here 9 months or so. At that time the rent was paid to Charlie Wilt and then Mrs. Wilt or her daughter after Charlie he passed away.

I have had my own campsite since 1984. I paid my rent to the Wilts until it was sold to Leonard/Sanderson in 2002. After they bought it, I began paying Trish Sanderson and have paid her every year since.

I start camping as soon as the weather permits and visit when it is too cold to camp. I really enjoy having a local campsite available and trust that this will be allowed to continue.

Sincerely,

Norma Jean Cross

Norma Jean (Jeanie) Cross
422 W. Washington Street
Charles Town, WV 25414

Amendment

Community Impact Statement

Waterside Reserve Subdivision a/k/a

Beacon Hill Estates Subdivision

650' Northeast of intersection of US Route 9 and WV Route 9/5

02-37 and 05-19

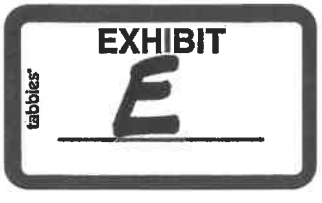
May 19, 2023

Submitted by:

Whisper Ridge, LLC.

36 Bakerton Road

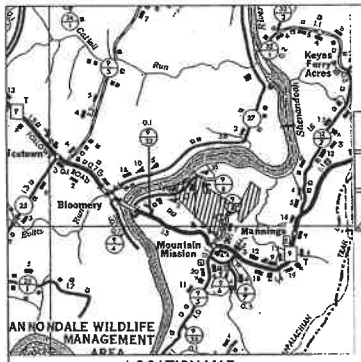
Harpers Ferry, WV 25425



Any and all reference in the approved Community Impact Statements to the following property is hereby removed:

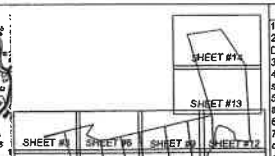
6.08 acres located in the district of Charles Town; Map 20B; Parcel 0OS1; deed book 1091; page 160; owned by Whisper Ridge LLC is hereby removed.

This property will be referenced only as an adjoining property owner and is not part of the Waterside Reserve or Beacon Hill subdivision.



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any rural right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.65%	25%	1.25	54,450.00
7	6.65	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,864.98
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,288.64
12	6.31	30.22%	85%	5.36	233,634.05
13	5.10	18.53%	40%	2.04	88,882.40
14	5.51	19.53%	40%	2.20	96,008.24
15	15.24	19.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,784.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.56%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	138.38	N 75°52'02" W	134.70	31°15'23"	68.93
R2	200.00	262.00	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.48
R4	200.00	137.90	S 06°09'29" W	135.18	39°30'19"	71.82
R5	200.00	418.46	S 40°03'29" W	345.19	119°18'21"	341.61

CURVE TABLE

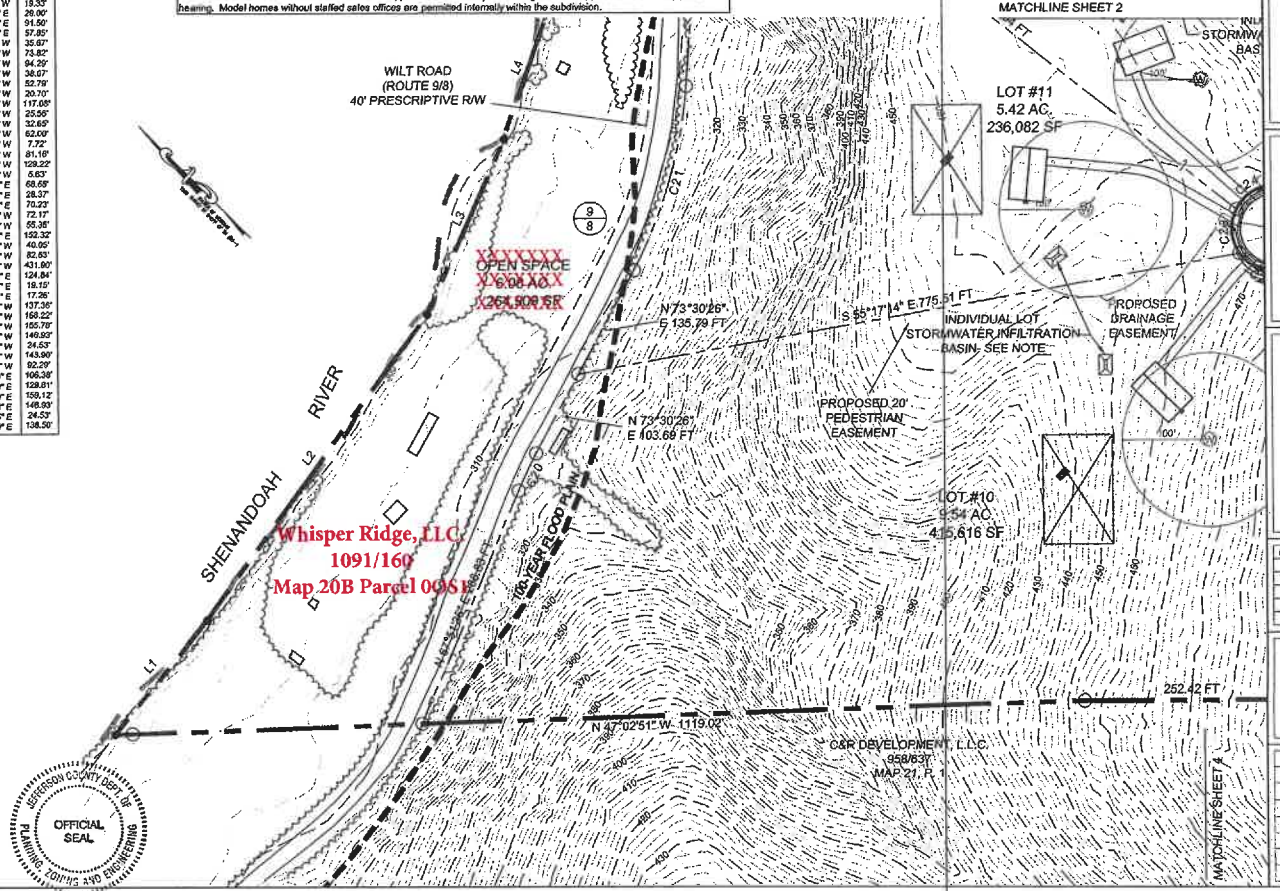
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.36	70.14	N 62°07'59" W	65.84	70°06'08"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.38
C3	251.50	116.74	S 63°32'21" W	115.76	26°35'44"	59.44
C4	232.94	220.43	S 68°30'57" W	211.86	56°39'03"	120.17
C5	1806.20	130.99	S 42°09'56" W	130.96	03°56'58"	65.52
C6	120.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	782.42	146.60	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	179.39	S 28°53'50" W	179.19	06°52'56"	89.78
C10	65.59	107.61	S 72°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'25" E	27.02	14°40'43"	13.62
C12	50.58	52.93	N 79°18'28" E	73.95	93°56'25"	54.18
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.89
C14	735.68	133.38	N 28°59'18" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°06'30" W	77.20	15°47'17"	38.97
C16	169.00	184.71	N 14°27'47" E	157.45	59°21'24"	90.51
C17	1870.20	138.91	N 43°09'56" E	138.88	03°58'58"	84.48
C18	252.94	259.09	N 68°30'57" E	248.03	58°39'03"	138.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 70°41'01" E	47.29	05°38'50"	23.67
C21	520.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°10'29" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.68	N 17°16'25" W	50.28	60°20'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°18'21"	298.61
C28	225.00	91.73	S 37°06'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.19
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.19
C32	225.00	39.66	N 65°28'46" W	39.61	10°06'01"	19.88
C33	225.00	255.90	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 39°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 39°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 82°53'49" E	213.83	75°18'56"	135.05
C37	175.00	74.84	N 77°10'41" E	74.37	24°30'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.36	N 58°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.36	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'23"	11.18
C42	50.00	3.67	S 01°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 85°44'59" E	169.77'
L2	N 81°15'15" E	433.26'
L3	N 69°11'15" E	219.61'
L4	N 64°31'53" E	161.37'
L5	N 58°50'14" E	236.67'
L6	N 49°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 69°32'45" W	431.07'
L9	N 48°57'44" E	29.70'
L10	S 77°52'55" W	234.78'
L11	S 21°32'38" W	315.48'
L12	N 25°39'01" W	154.00'
L13	N 43°48'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 12°53'56" E	26.00'
L16	N 36°09'23" E	91.50'
L17	N 47°11'59" E	57.85'
L18	N 22°34'56" W	35.67'
L19	N 12°27'05" W	73.82'
L20	N 09°26'52" W	94.29'
L21	N 32°18'56" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 30°56'43" W	25.55'
L26	S 58°14'20" W	32.65'
L27	S 45°56'46" W	62.00'
L28	N 45°06'52" W	7.72'
L29	S 40°11'27" W	81.16'
L30	S 44°08'25" W	129.22'
L31	S 46°27'59" W	5.63'
L32	S 41°19'55" E	68.58'
L33	S 29°16'30" E	28.57'
L34	S 01°43'44" E	70.23'
L35	S 16°21'12" W	72.17'
L36	S 42°49'31" W	55.38'
L37	N 16°22'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'48" W	82.63'
L40	S 20°42'08" W	431.60'
L41	S 68°11'52" E	124.84'
L42	N 16°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 45°16'22" W	160.22'
L46	N 45°15'46" W	155.76'
L47	S 44°54'39" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 15°14'20" E	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	128.81'
L53	N 29°24'19" E	158.12'
L54	N 64°54'58" E	148.93'
L55	N 89°26'45" E	24.53'
L56	S 35°17'20" E	138.50'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07
DATE

540-289-7772

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Sanderson — 7/17/07
DEVELOPER — DATE

FINAL PLAT APPROVED:

Sherry Kelly Asst Dir — 7/19/07
DIRECTOR OF PLANNING AND ZONING — DATE

Approved - Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 21200 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

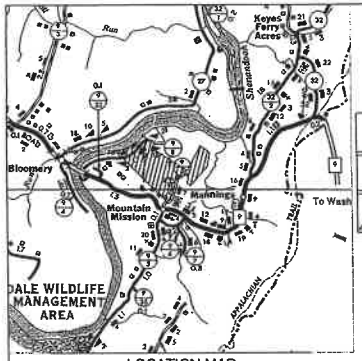
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 1 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

Beacon Hill Estates 02-



LOCATION MAP

SCALE: 1" = 1 MILE

SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
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10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 8000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall direct all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	% LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	6.00	10.34%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,800.00
5	10.00	14.89%	25%	2.50	108,800.00
6	5.00	14.55%	25%	1.25	54,450.00
7	6.55	21.83%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	18.53%	40%	2.20	96,006.24
15	15.24	19.81%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,800.00
20	8.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.96%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 76°52'02" W	134.70	31°15'23"	69.93
R2	200.00	262.90	S 62°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.90	S 00°09'29" W	135.18	38°30'19"	71.82
R5	200.00	416.46	S 46°03'29" W	345.19	119°18'21"	341.61

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'58" W	65.84	70°08'08"	40.22
C2	205.62	151.52	S 67°34'22" W	148.11	42°13'15"	79.36
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 68°39'57" W	211.56	56°39'03"	120.17
C5	1900.30	130.99	S 42°09'56" W	130.96	03°56'56"	65.52
C6	129.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.68	S 23°37'09" E	73.38	16°48'37"	37.09
C8	792.42	148.80	S 20°43'14" W	148.59	10°45'51"	74.61
C9	1492.68	178.50	S 28°25'52" W	178.19	06°51'05"	89.36
C10	66.58	107.61	S 75°20'53" W	96.84	94°01'12"	70.35
C11	165.78	27.16	S 64°39'25" E	27.02	14°40'43"	13.62
C12	50.58	92.93	N 79°16'29" E	79.95	93°56'25"	54.18
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.89
C14	736.08	133.38	N 20°59'16" E	133.20	10°23'47"	66.87
C15	251.04	77.44	N 23°06'30" W	77.20	15°49'77"	38.97
C16	159.00	164.71	N 14°27'47" E	157.45	59°23'24"	90.61
C17	1870.20	128.81	N 42°09'56" E	128.88	03°56'56"	64.48
C18	252.94	260.69	N 68°36'37" E	249.03	58°39'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	466.00	47.31	N 70°41'01" E	47.29	05°38'50"	23.67
C21	620.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	53.62	S 41°49'29" W	50.49	60°31'36"	29.17
C24	50.00	53.33	N 76°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.16
C26	50.00	52.68	N 17°16'25" W	50.25	60°20'54"	29.07
C27	175.00	364.40	S 86°03'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 57°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 63°16'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°28'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 36°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 36°52'02" E	148.17	31°15'23"	76.83
C36	175.00	230.04	S 52°53'49" E	213.83	75°18'56"	135.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.38	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.36	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.16
C42	50.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'50" E	169.77'
L2	N 81°15'19" E	433.20'
L3	N 69°11'15" E	219.61'
L4	N 84°31'55" E	161.37'
L5	N 58°50'14" E	236.67'
L6	N 49°42'27" E	274.39'
L7	N 36°01'15" E	235.33'
L8	N 69°28'45" W	431.67'
L9	N 48°57'44" E	29.70'
L10	S 77°52'55" W	254.76'
L11	S 21°32'38" W	315.48'
L12	N 23°30'01" W	154.09'
L13	N 43°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 27°33'56" E	29.00'
L16	N 36°58'23" E	91.50'
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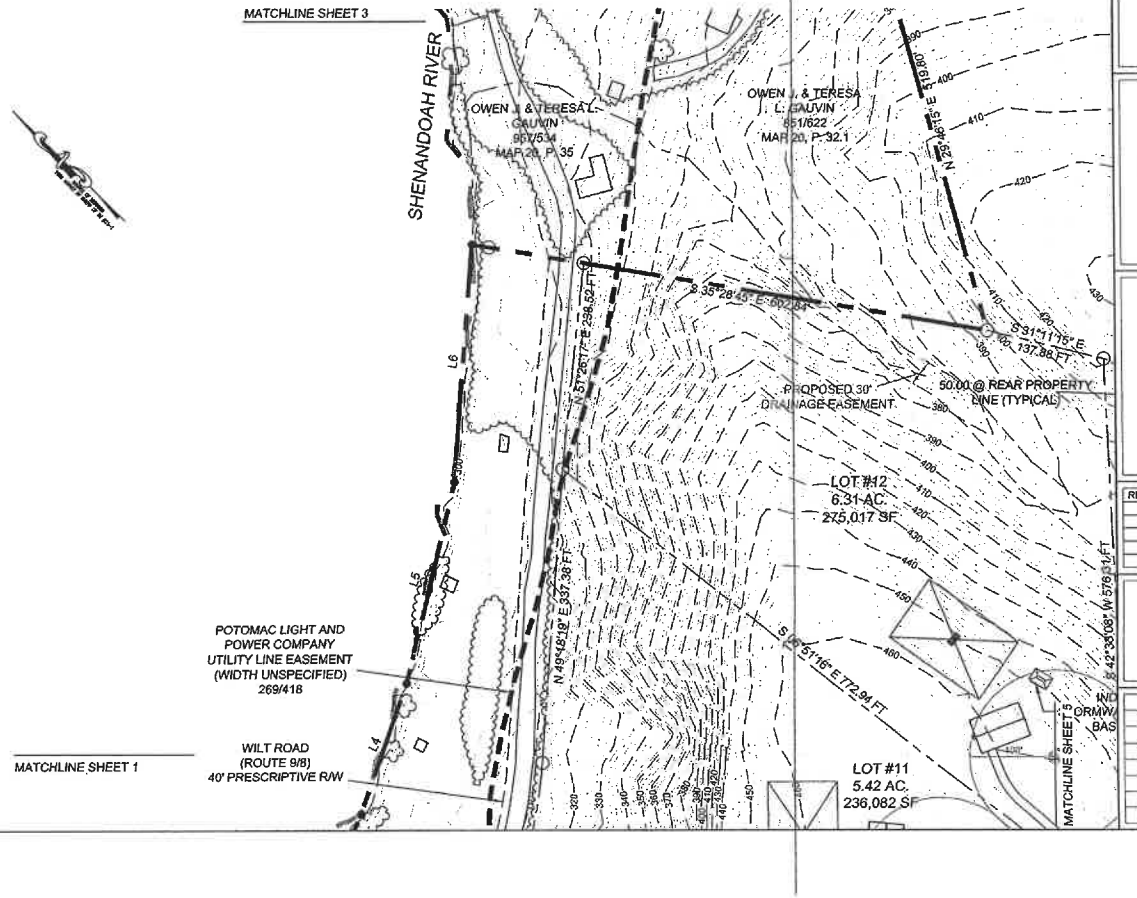

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The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade S. Gauvin — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED: Thomas Wilson AICP — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
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WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 21201 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

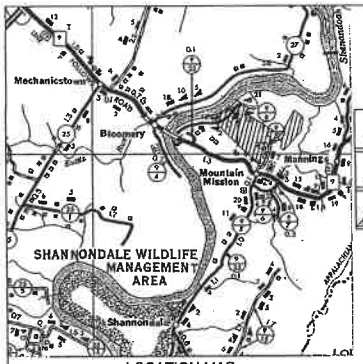
FINAL PLAT

REV.	DATE	REQUESTED BY

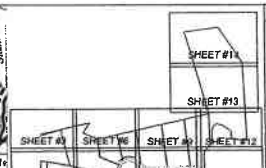
SHEET 2 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP
SCALE: 1" = 1 MILE



SHEET INDEX KEY

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18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.65%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,165.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.65%	70%	3.79	165,286.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,006.24
15	15.24	18.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'
SCALE: 1" = 100'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

ROAD ALIGNMENT CURVE DATA

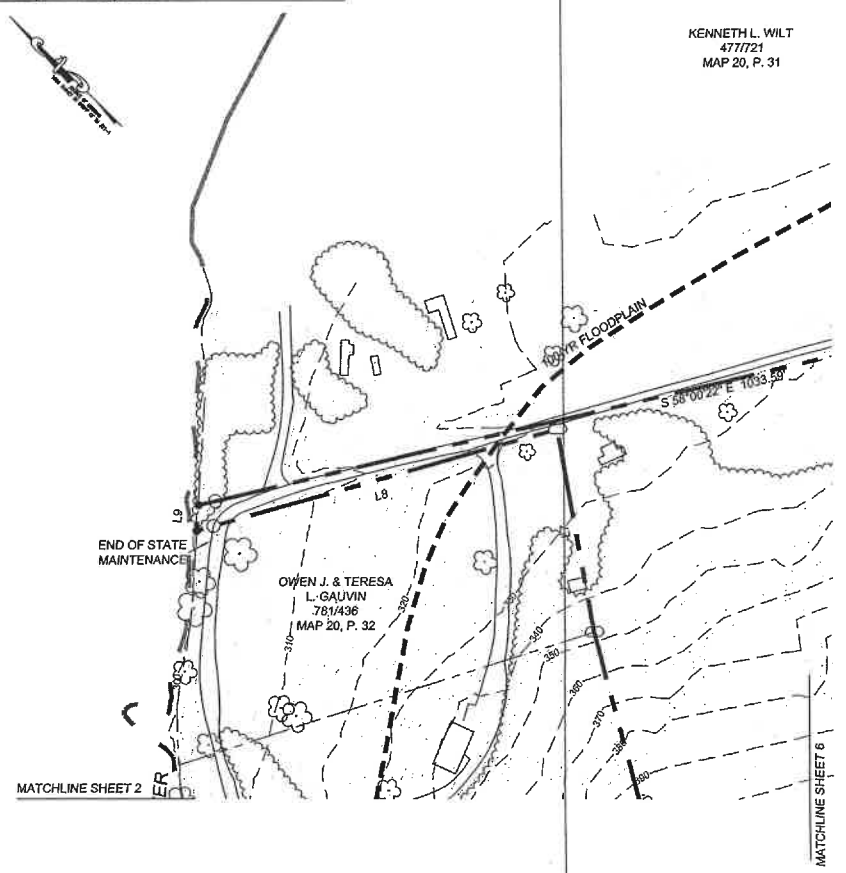
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.39	N 75°52'02" W	134.70	31°15'23"	69.93
R2	200.00	262.90	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.84	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.00	S 00°08'28" W	135.16	38°30'19"	71.62
R5	200.00	418.48	S 40°03'29" W	345.19	119°51'21"	341.81

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'50" W	65.84	70°08'06"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.36
C3	251.50	116.74	S 63°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 68°30'57" W	211.56	56°38'03"	120.17
C5	1900.20	130.99	S 42°09'56" W	130.96	03°56'58"	65.52
C6	129.00	133.84	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.94	73.65	S 23°37'09" E	73.39	16°46'02"	37.09
C8	792.42	146.90	S 30°43'14" W	146.69	10°36'51"	73.61
C9	1492.68	179.30	S 26°53'50" W	179.19	06°52'58"	89.76
C10	65.58	107.61	S 76°20'53" W	95.94	94°01'12"	70.35
C11	105.76	27.19	S 64°39'25" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°18'28" E	73.95	93°56'25"	54.18
C13	1477.68	177.57	N 26°53'45" E	177.46	06°53'07"	88.88
C14	735.08	133.38	N 26°39'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°06'30" W	77.20	15°47'17"	39.07
C16	159.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°06'56" E	128.88	03°56'56"	64.48
C18	252.94	250.09	N 68°30'57" E	249.03	56°39'03"	136.34
C19	221.50	102.82	N 63°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 76°41'01" E	47.29	05°38'50"	23.67
C21	520.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	76.76	S 37°10'51" E	70.62	88°01'03"	48.16
C23	50.00	52.82	S 41°10'26" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'16" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.88	N 17°16'25" W	50.28	60°36'54"	29.07
C27	175.00	364.40	S 85°03'28" W	302.84	119°18'21"	298.91
C28	225.00	91.73	S 32°05'05" W	91.10	23°21'33"	46.51
C29	225.00	62.69	S 58°48'46" W	62.39	15°57'44"	31.51
C30	225.00	48.17	S 71°02'36" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	38.55	N 85°28'45" W	38.51	10°39'01"	19.08
C33	225.00	255.90	N 47°49'15" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.63	75°18'56"	135.05
C37	175.00	74.84	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.68	N 45°09'26" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 69°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 61°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	169.77'
L2	N 81°15'19" E	433.20'
L3	N 89°11'15" E	219.61'
L4	N 64°31'53" E	161.37'
L5	N 59°56'14" E	238.67'
L6	N 46°45'23" E	274.39'
L7	N 35°01'13" E	235.33'
L8	N 60°28'46" W	451.67'
L9	N 46°57'44" E	20.70'
L10	S 77°52'53" W	254.79'
L11	S 21°32'36" W	315.48'
L12	N 28°30'01" W	164.00'
L13	N 43°49'01" W	282.11'
L14	N 47°08'24" W	19.33'
L15	N 27°33'56" E	28.00'
L16	N 38°06'23" E	91.56'
L17	N 47°11'05" E	57.85'
L18	N 22°34'50" W	35.67'
L19	N 12°27'05" W	73.82'
L20	N 08°28'52" W	94.29'
L21	N 32°18'56" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°15'14" W	117.08'
L25	S 30°56'43" W	25.56'
L26	S 56°14'20" W	32.85'
L27	S 45°58'48" W	62.00'
L28	N 49°06'32" W	7.72'
L29	S 49°11'27" W	61.16'
L30	S 44°06'25" W	129.22'
L31	S 49°27'59" W	5.83'
L32	S 41°19'55" E	66.55'
L33	S 29°18'30" E	28.37'
L34	S 01°40'44" E	70.23'
L35	S 18°21'12" W	72.17'
L36	S 42°49'31" W	55.35'
L37	N 18°22'37" E	152.22'
L38	N 25°27'14" W	49.08'
L39	N 38°22'46" E	62.63'
L40	S 26°42'08" W	431.90'
L41	S 88°11'12" E	124.84'
L42	N 18°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 45°18'22" W	168.22'
L46	N 45°18'48" W	155.78'
L47	S 64°54'38" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 15°14'20" W	140.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	196.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L55	N 89°26'43" E	24.53'
L56	S 35°17'20" E	138.80'



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07
540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade Gardner — 7/17/07
DEVELOPER — DATE

FINAL PLAT APPROVED:

Shawn Kline RLA / CPC — 7/19/07
DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN
DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 988 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 21201 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

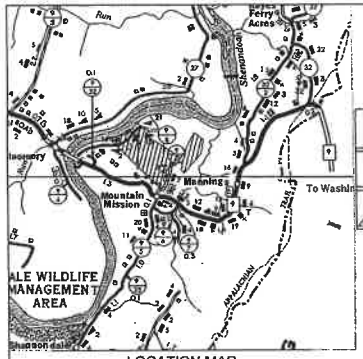
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 3 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP
SCALE: 1" = 1 MILE

SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
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RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'
SCALE: 1" = 100'

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- MONUMENT FOUND
- REBAR FOUND
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R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.90	S 06°09'29" W	135.18	39°30'19"	71.82
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C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.84	220.43	S 69°30'57" W	211.56	56°39'03"	120.17
C5	1900.20	130.98	S 42°09'56" W	130.96	03°56'56"	65.52
C6	128.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	792.42	146.80	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	65.58	107.87	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'25" E	27.02	14°40'43"	13.62
C12	58.58	82.93	N 79°18'29" E	73.65	93°58'26"	54.18
C13	1477.58	177.57	N 28°53'45" E	177.46	06°53'07"	88.89
C14	735.08	133.36	N 28°59'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°06'30" W	77.20	15°47'17"	38.97
C16	158.00	164.71	N 14°27'47" E	157.19	59°43'24"	90.61
C17	1870.20	138.91	N 42°09'56" E	138.89	03°56'56"	64.48
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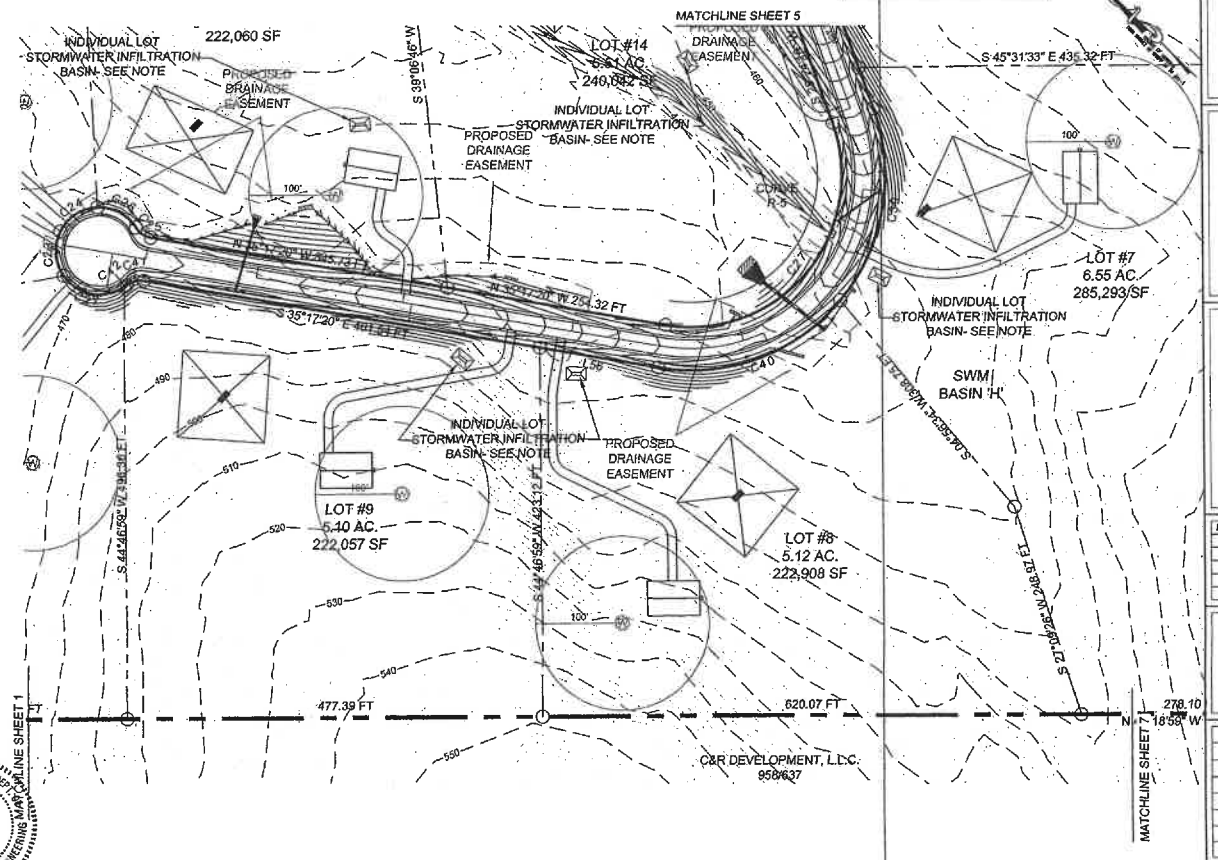
C19	221.50	102.62	N 83°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 70°41'01" E	47.29	05°38'50"	23.67
C21	520.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°10'29" W	50.46	60°31'36"	29.17
C24	50.00	53.33	N 76°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.68	N 17°16'25" W	50.26	60°20'54"	29.07
C27	175.00	384.49	S 85°03'29" W	302.04	119°18'21"	258.91
C28	225.00	91.73	S 37°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.80	S 56°48'46" W	63.59	16°14'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°26'46" W	39.81	10°09'01"	19.98
C33	225.00	255.80	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'52" W	121.23	31°15'23"	62.84
C35	275.00	150.02	S 30°52'52" E	148.17	31°15'23"	76.83
C36	175.00	230.04	S 52°53'49" E	213.83	75°18'56"	135.65
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.56	N 46°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 56°13'54" E	223.82	59°38'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 91°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 63°44'59" E	169.77'
L2	N 81°16'19" E	433.20'
L3	N 69°11'15" E	219.67'
L4	N 64°31'33" E	161.37'
L5	N 58°50'14" E	236.67'
L6	N 48°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 46°57'44" E	29.70'
L10	S 77°52'56" W	254.76'
L11	S 21°32'58" W	315.48'
L12	N 25°30'01" W	154.00'
L13	N 43°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 27°33'56" E	39.00'
L16	N 36°08'23" E	91.50'
L17	N 47°11'05" E	57.85'
L18	N 22°34'50" W	35.97'
L19	N 13°27'05" W	73.82'
L20	N 08°26'52" W	94.29'
L21	N 32°48'56" W	38.67'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 30°55'43" W	25.66'
L26	S 58°14'20" W	32.65'
L27	S 45°58'46" W	62.00'
L28	N 45°01'14" W	7.72'
L29	S 40°11'27" W	81.16'
L30	S 44°08'25" W	129.22'
L31	S 46°27'59" W	5.85'
L32	S 41°19'55" E	66.55'
L33	S 29°16'30" E	28.37'
L34	S 61°43'44" E	70.23'
L35	S 18°21'12" W	72.17'
L36	S 42°49'31" W	55.35'
L37	N 16°22'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'49" W	82.61'
L40	S 20°42'08" W	431.90'
L41	S 88°11'12" E	124.84'
L42	N 16°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 45°18'22" W	169.22'
L46	N 61°12'46" W	155.78'
L47	S 64°54'38" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.25'
L51	S 15°14'20" E	108.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L55	N 89°26'45" E	24.53'
L56	S 35°17'20" E	138.50'



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07
540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Dawson — 7/17/07
DEVELOPER — DATE

FINAL PLAT APPROVED: James Rockwell AICP / CFC — 7/19/07
DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor Plat Change

JEFFERSON COUNTY DEPARTMENT OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN
4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENCED — No. 21201 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

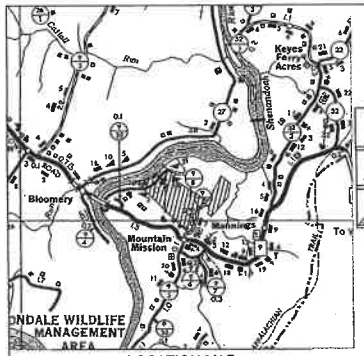
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 4 OF 14

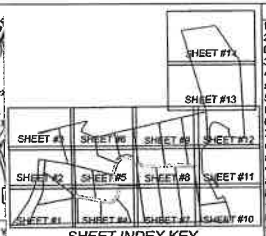
PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES

LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	NONE
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-38.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.46%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.85%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.80
8	5.12	20.73%	55%	282	122,654.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.08
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,006.24
15	15.24	19.83%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.80%	70%	3.51	152,784.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.59%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	135.38	N 75°52'02" W	134.70	31°15'23"	69.53
R2	200.00	262.60	S 82°08'11" W	244.38	75°16'56"	154.34
R3	200.00	85.84	S 32°16'41" W	84.99	24°35'05"	43.49
R4	200.00	137.08	S 00°09'29" W	135.18	39°16'19"	71.62
R5	200.00	416.46	S 40°03'29" W	345.19	119°18'21"	341.61

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.36	70.14	N 62°07'59" W	65.84	70°05'08"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.38
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 58°30'57" W	211.58	56°38'03"	120.17
C5	1000.29	130.99	S 43°08'56" W	130.90	07°30'58"	65.52
C6	129.90	133.64	S 14°27'47" W	127.74	59°21'25"	73.61
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	792.42	146.80	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	85.58	107.61	S 79°20'53" W	95.04	84°01'42"	70.38
C11	105.78	27.19	S 64°39'25" E	27.02	14°43'43"	13.62
C12	50.58	82.93	N 79°16'29" E	73.96	93°56'25"	54.16
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.89
C14	736.08	133.38	N 20°56'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°08'30" W	77.20	15°47'17"	38.97
C16	159.00	104.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°09'56" E	128.69	03°56'58"	64.48
C18	252.94	250.09	N 68°30'57" E	240.03	56°39'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 79°41'01" E	47.29	05°38'50"	23.67
C21	528.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°10'29" W	50.40	60°31'38"	29.17
C24	50.00	53.33	N 78°00'16" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.16
C26	58.00	52.68	N 17°16'25" W	50.86	60°30'54"	29.07
C27	175.00	364.49	S 85°53'29" W	302.04	119°18'21"	296.91
C28	225.00	91.73	S 37°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.88	N 85°28'46" W	39.81	10°09'01"	19.99
C33	225.00	255.30	N 47°46'58" E	242.33	65°00'54"	143.60
C34	225.00	122.74	N 30°52'02" E	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.83	75°18'56"	135.05
C37	175.00	74.94	N 72°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 85°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 45°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.16
C42	50.00	3.67	S 81°27'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
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L17	N 47°11'05" E	57.85'
L18	N 22°34'56" W	35.87'
L19	N 12°37'05" W	73.62'
L20	N 08°26'02" W	84.29'
L21	N 32°18'56" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 30°56'43" W	25.56'
L26	S 58°14'20" W	32.65'
L27	S 45°56'48" W	62.00'
L28	N 45°06'32" W	7.72'
L29	S 40°11'27" W	81.16'
L30	S 44°30'25" W	129.22'
L31	S 46°27'58" W	5.83'
L32	S 41°19'55" E	86.55'
L33	S 29°16'39" E	28.37'
L34	S 01°42'44" E	70.33'
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L48	S 89°28'43" W	24.53'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	196.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	148.93'
L55	N 89°28'43" E	24.53'
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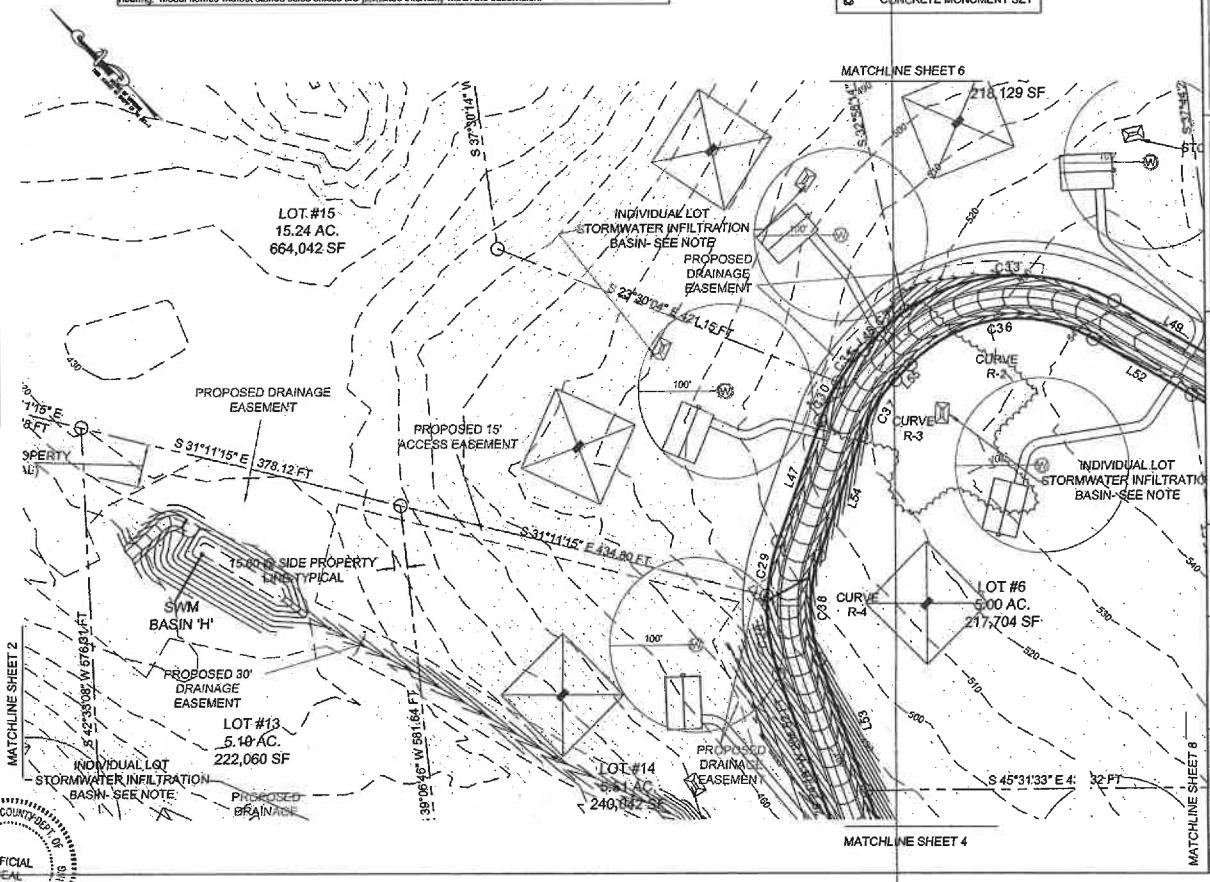


LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade A. Gardner — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED: Sherri Kitts AICP/CSE — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

Conditional Final Plat Approval

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED No. 2120 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

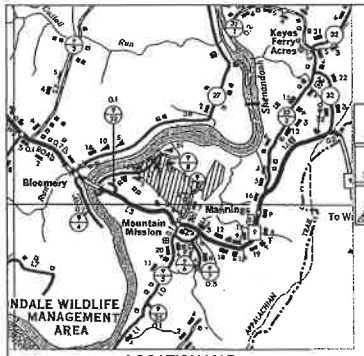
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 5 OF 14

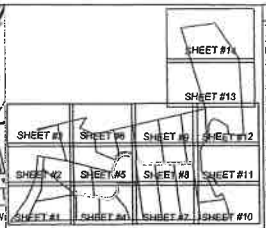
PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
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8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

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8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	% LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.65%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,684.98
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,008.24
15	15.24	19.83%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	138.38	N 75°52'02" W	134.70	31°15'23"	69.93
R2	206.00	262.90	S 82°06'11" W	244.38	75°18'58"	154.34
R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	206.00	137.96	S 00°09'29" W	135.46	38°30'19"	71.62
R5	200.00	418.46	S 40°03'28" W	345.19	119°51'21"	341.61

CURVE TABLE

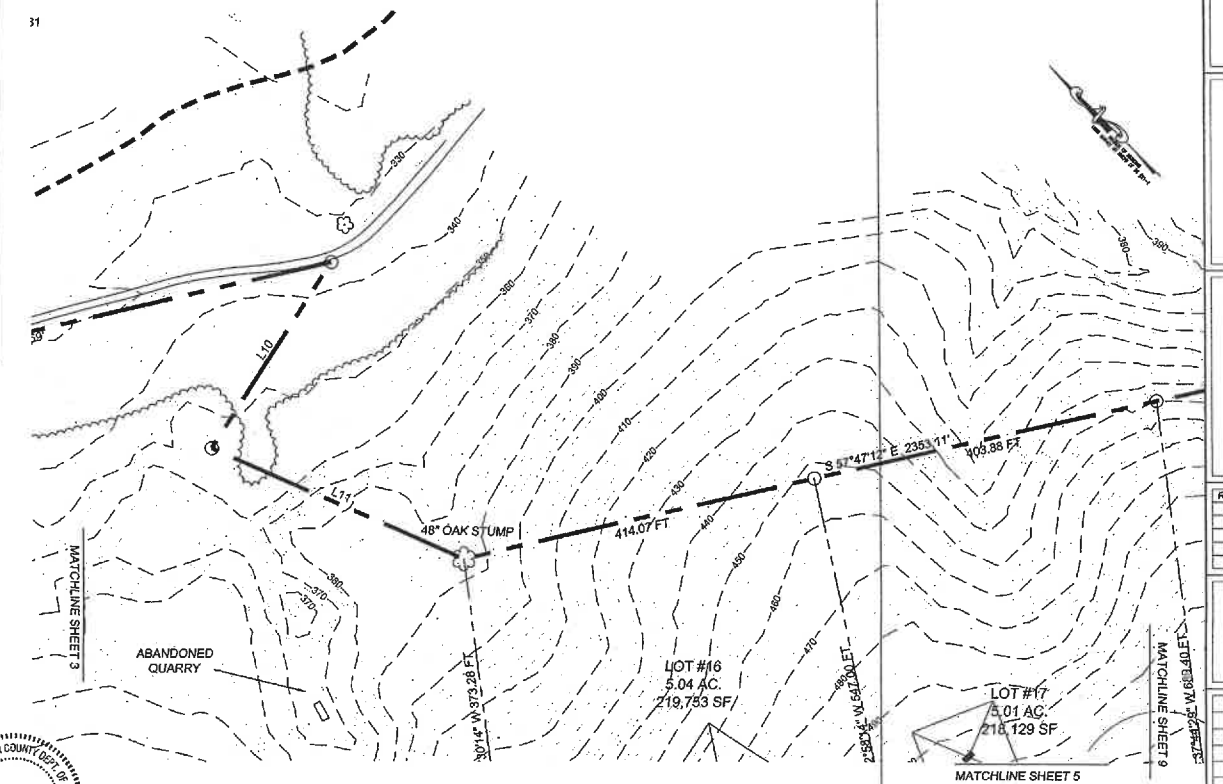
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.36	70.14	N 62°07'58" W	65.84	70°05'05"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.38
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 69°30'05" W	211.56	56°39'03"	120.17
C5	1900.20	130.99	S 42°09'55" W	130.96	03°56'58"	65.52
C6	129.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.06
C8	792.42	146.80	S 28°43'14" W	146.59	10°36'51"	73.61
C9	1492.58	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 84°38'25" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°15'29" E	73.85	93°58'25"	54.18
C13	1477.65	177.57	N 26°53'45" E	177.46	06°53'07"	88.89
C14	735.08	133.39	N 20°59'16" E	133.20	10°23'47"	66.87
C15	281.64	77.44	N 23°06'30" W	77.20	15°47'17"	38.97
C16	150.00	154.71	N 14°27'47" E	157.45	59°21'24"	90.81
C17	1870.20	128.81	N 42°09'56" E	128.88	03°56'58"	64.48
C18	253.84	253.09	N 88°38'57" E	240.83	56°36'00"	136.34
C19	221.50	102.62	N 83°32'37" E	101.90	26°32'44"	52.35
C20	480.00	47.31	N 70°47'01" E	47.29	05°38'59"	23.67
C21	520.00	220.95	N 81°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	62.82	S 41°10'29" W	58.90	60°31'36"	29.17
C24	50.00	53.33	N 78°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'38" W	20.41	48°11'20"	11.18
C26	50.00	53.68	N 17°46'26" W	50.26	60°20'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 37°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'48" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.06	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.06	12°16'03"	24.18
C32	225.00	39.86	N 85°28'46" W	39.81	10°09'01"	19.98
C33	225.00	293.80	N 47°49'18" W	242.33	80°30'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.83	76°18'56"	135.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 05°10'54" E	223.82	59°39'10"	128.06
C40	225.00	234.26	S 65°09'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 58°29'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	160.77'
L2	N 81°15'19" E	433.20'
L3	N 69°11'15" E	219.81'
L4	N 64°31'53" E	161.37'
L5	N 61°58'54" E	236.67'
L6	N 49°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 46°57'44" E	29.70'
L10	S 77°52'55" W	254.76'
L11	S 21°32'38" W	316.48'
L12	N 23°30'01" W	154.00'
L13	N 43°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 27°09'58" E	29.00'
L16	N 36°06'23" E	61.50'
L17	N 47°11'05" E	57.85'
L18	N 22°34'59" W	35.67'
L19	N 12°27'05" W	73.62'
L20	N 08°26'52" W	64.29'
L21	N 32°16'56" W	39.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	26.70'
L24	S 46°11'14" W	117.08'
L25	S 30°56'43" W	25.56'
L26	S 58°14'20" W	32.63'
L27	S 45°58'46" W	62.00'
L28	N 46°08'32" W	7.72'
L29	S 40°11'27" W	61.16'
L30	S 44°08'25" W	129.22'
L31	S 46°27'59" W	5.83'
L32	S 41°19'55" E	66.55'
L33	S 29°16'30" E	28.37'
L34	S 01°43'44" E	76.23'
L35	S 16°21'12" W	72.17'
L36	S 42°49'31" W	55.35'
L37	N 16°22'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'49" W	82.63'
L40	S 20°42'08" W	431.90'
L41	S 68°11'12" E	124.84'
L42	N 16°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 45°18'22" W	169.22'
L46	N 45°15'46" W	165.76'
L47	S 64°54'38" W	148.53'
L48	S 69°26'43" W	24.83'
L49	N 15°14'20" W	143.50'
L50	N 15°14'20" W	92.28'
L51	S 15°14'20" E	105.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	148.53'
L55	N 69°26'43" E	24.83'
L56	S 35°17'20" E	138.50'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

David F. Lilley — 7/11/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Sanderson — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED:

DIRECTOR OF PLANNING AND ZONING — DATE

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7623

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN
DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — NO. 2120 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

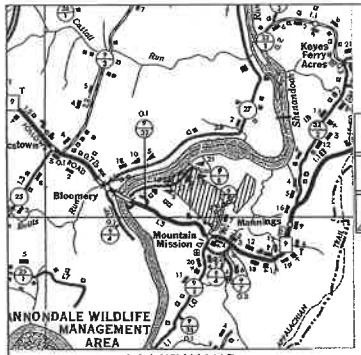
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 6 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP

SCALE: 1" = 1 MILE

SHEET INDEX KEY

DRIVEWAY CULVERT SIZES

LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
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5	10.00	14.39%	25%	2.50	108,800.00
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9	5.10	20.30%	55%	2.81	122,185.80
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0' 100' 200' 300'

SCALE: 1" = 100'

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R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.90	S 00°09'29" W	135.18	39°30'19"	71.82
R5	200.00	416.46	S 46°03'29" W	346.19	119°18'21"	341.61

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'59" W	65.84	70°08'08"	40.22
C2	205.82	151.52	S 67°34'33" W	148.13	42°12'15"	79.38
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 68°30'57" W	211.56	56°38'03"	120.17
C5	1900.20	130.99	S 42°09'56" W	130.96	03°56'58"	65.52
C6	120.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.84	73.65	S 23°37'09" E	73.38	16°46'32"	37.09
C8	792.42	146.60	S 20°43'14" W	146.59	10°36'01"	73.61
C9	1492.68	179.50	S 28°53'30" W	179.19	06°52'58"	89.76
C10	85.58	107.61	S 79°26'53" W	95.94	94°01'12"	70.35
C11	165.78	27.10	S 84°38'25" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°18'29" E	73.96	93°56'25"	54.18
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.88
C14	735.08	133.38	N 29°59'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°08'36" W	77.20	15°47'17"	38.97
C16	150.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.81
C17	1870.20	128.91	N 42°09'56" E	128.89	03°56'58"	64.48
C18	262.94	250.09	N 68°30'57" E	240.63	56°30'03"	136.24
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	460.00	47.31	N 76°41'51" E	47.29	05°53'50"	23.67
C21	520.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°50'51" E	70.82	90°11'53"	50.16
C23	50.00	52.82	S 41°10'29" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'16" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 17°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.86	N 17°16'25" W	50.28	60°32'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 37°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.16
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.16
C32	225.00	39.86	N 85°28'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'18" W	242.33	65°09'55"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.63	75°16'56"	138.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.68	N 45°06'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'55" E	223.82	59°39'10"	129.00
C41	25.00	21.05	S 59°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	169.71'
L2	N 81°15'19" E	433.20'
L3	N 89°11'15" E	219.61'
L4	N 84°31'53" E	161.57'
L5	N 66°59'14" E	238.57'
L6	N 49°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 49°57'44" E	29.70'
L10	S 77°52'55" W	254.76'
L11	S 21°32'38" W	315.48'
L12	N 25°39'01" W	154.00'
L13	N 49°49'01" W	282.11'
L14	N 47°39'24" W	18.33'
L15	N 27°33'56" E	28.00'
L16	N 36°00'23" E	91.50'
L17	N 47°41'05" E	57.85'
L18	N 25°34'14" W	35.57'
L19	N 12°27'05" W	73.82'
L20	N 09°28'52" W	94.29'
L21	N 32°18'56" W	38.07'
L22	N 37°19'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 30°58'43" W	25.56'
L26	S 58°14'26" W	32.65'
L27	S 43°58'48" W	62.00'
L28	N 48°06'32" W	7.72'
L29	S 49°11'27" W	81.16'
L30	S 44°08'25" W	129.22'
L31	S 46°27'58" W	5.83'
L32	S 41°18'55" E	66.59'
L33	S 29°16'36" E	38.37'
L34	S 61°43'44" E	70.23'
L35	S 18°21'52" W	72.17'
L36	S 67°49'31" W	55.36'
L37	N 16°22'30" E	152.32'
L38	N 25°27'14" W	49.05'
L39	N 36°27'46" W	52.63'
L40	S 30°42'58" W	431.90'
L41	S 66°11'12" E	124.64'
L42	N 16°22'30" E	15.15'
L43	S 45°16'01" E	17.28'
L44	S 32°20'19" W	137.36'
L45	N 45°19'22" W	168.22'
L46	N 45°19'46" W	155.78'
L47	S 64°54'38" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	129.81'
L53	N 25°34'19" E	156.12'
L54	N 64°24'39" E	146.93'
L55	N 89°26'45" E	24.53'
L56	S 35°17'20" E	138.50'

NOTE:

ALL ROOF DOWNSPOUTS AND DRIVEWAY RUNOFF TO BE DIVERTED TO INFILTRATION BASIN.

SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

David F. Lilley — DATE 7/16/07

540-289-7772

STATEMENT OF ACCEPTANCE

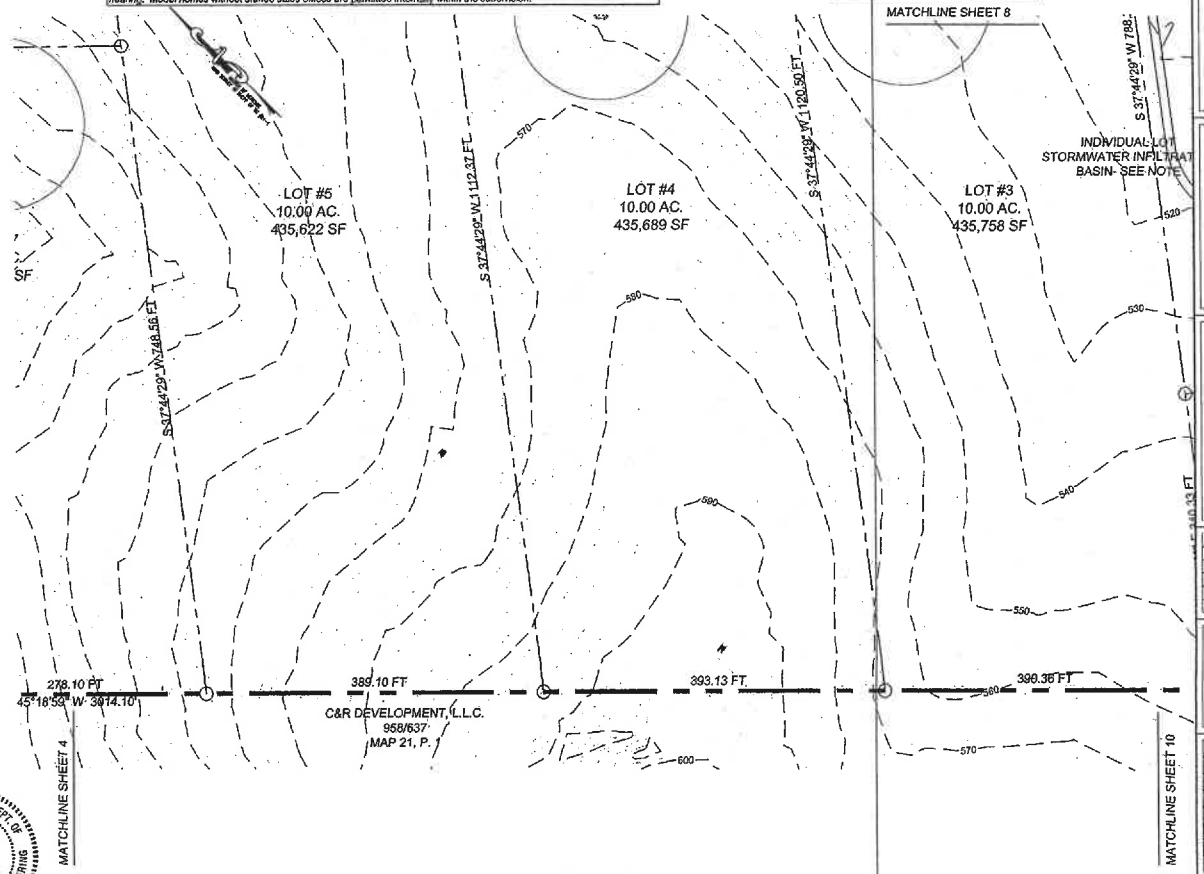
The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Anderson — DEVELOPER — DATE 7/17/07

FINAL PLAT APPROVED: Jennifer Robles AICP/CZO — DIRECTOR OF PLANNING AND ZONING — DATE 7/19/07

Approved Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL



LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

SITE PLANNING & DESIGN

4803 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 688
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 21201 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

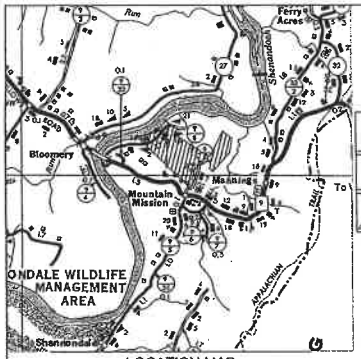
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 7 OF 14

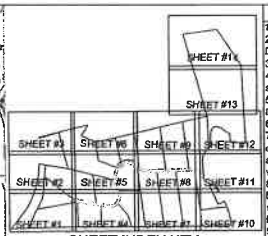
PROJECT #:	SCM-0702-02
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

7. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 6-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.66%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.86%	85%	8.11	353,228.04
11	5.42	25.83%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.61	19.53%	40%	2.20	96,008.24
15	15.24	19.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.82
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,800.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 75°52'02" W	134.70	31°15'23"	69.93
R2	200.00	262.90	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.84	S 32°19'41" W	84.99	24°37'05"	43.49
R4	200.00	137.90	S 90°09'29" W	135.18	39°30'19"	71.82
R5	200.00	416.46	S 40°09'29" W	345.19	119°16'21"	341.51

CURVE TABLE

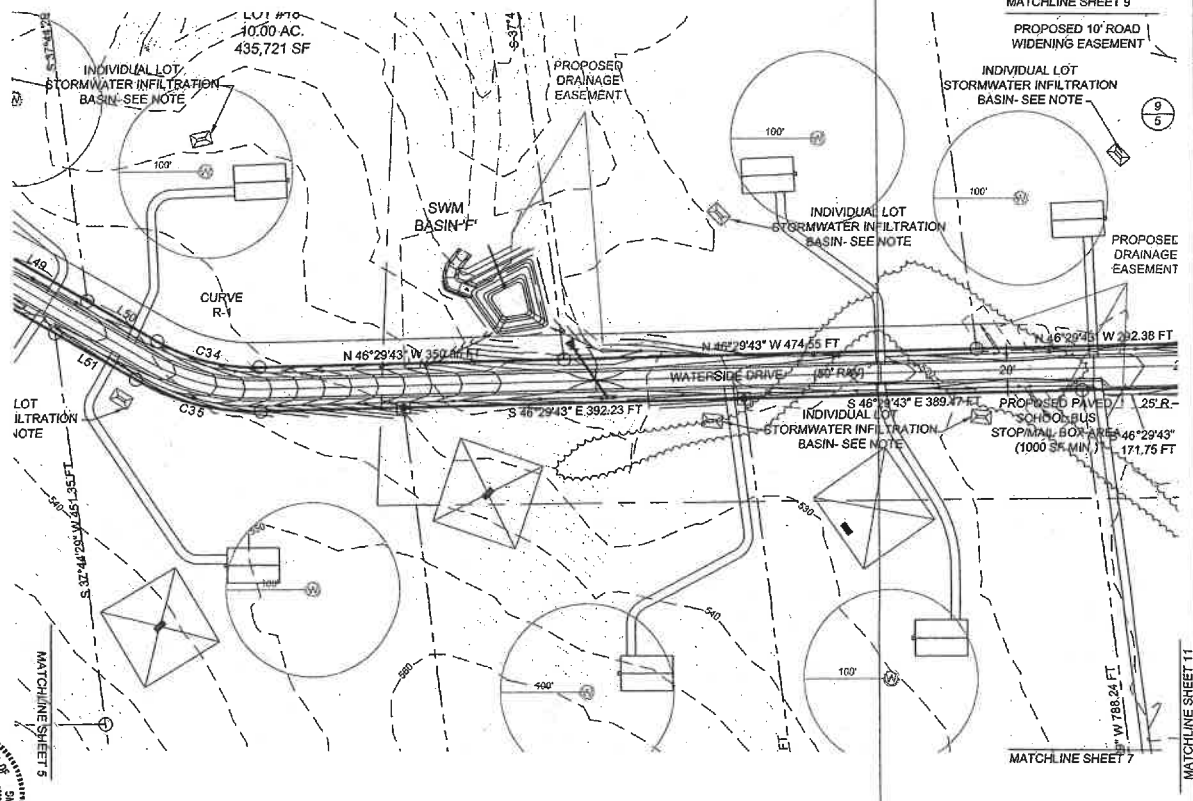
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'59" W	65.84	70°08'06"	40.22
C2	205.62	151.53	S 87°24'23" W	148.11	42°13'15"	79.38
C3	251.50	118.74	S 83°32'37" W	115.70	26°35'44"	60.44
C4	222.94	220.43	S 58°36'57" W	211.56	56°39'03"	120.17
C5	1900.20	130.99	S 42°09'56" W	130.96	03°56'58"	65.52
C6	125.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	782.42	146.80	S 20°43'14" W	146.58	10°36'51"	73.61
C9	1492.68	179.30	S 28°53'56" W	179.19	06°52'56"	89.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'25" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°18'29" E	73.95	93°56'26"	54.18
C13	1477.88	177.57	N 28°53'45" E	177.46	06°53'07"	88.88
C14	735.08	133.39	N 20°59'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°06'30" W	77.20	15°47'17"	38.97
C16	159.00	164.71	N 14°27'47" E	157.46	59°21'24"	90.61
C17	1870.20	128.91	N 42°09'56" E	128.89	03°56'58"	64.48
C18	252.94	250.09	N 68°36'57" E	240.03	56°36'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 70°41'01" E	47.29	05°38'50"	23.67
C21	520.00	228.95	N 61°20'06" E	216.29	34°30'41"	112.17
C22	50.00	78.79	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°10'29" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.16
C26	50.00	52.68	N 17°16'25" W	50.26	60°20'54"	29.07
C27	175.00	364.48	S 85°03'29" W	302.04	119°18'21"	298.81
C28	225.00	91.73	S 37°08'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.38	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.06	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.06	12°16'03"	24.18
C32	225.00	39.86	N 85°26'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.84
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 62°53'48" E	213.83	75°18'56"	135.65
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.86	N 45°89'29" E	118.29	39°28'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.16
C42	50.00	3.87	S 81°22'33" E	3.67	04°12'21"	1.94

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'56" E	186.77'
L2	N 89°15'18" E	433.20'
L3	N 69°11'15" E	219.61'
L4	N 64°31'33" E	191.37'
L5	N 58°50'14" E	238.87'
L6	N 49°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 46°57'44" E	29.70'
L10	S 77°52'55" W	254.78'
L11	S 21°32'38" W	315.46'
L12	N 25°30'01" W	154.00'
L13	N 13°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 27°33'56" E	29.00'
L16	N 36°08'23" E	91.50'
L17	N 47°11'05" E	57.65'
L18	N 42°34'50" W	35.67'
L19	N 12°27'05" W	73.62'
L20	N 08°26'53" W	94.29'
L21	N 32°18'58" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.79'
L24	S 46°11'14" W	117.08'
L25	S 30°56'43" W	26.58'
L26	S 58°14'20" W	32.65'
L27	S 45°56'46" W	62.00'
L28	N 45°05'52" W	7.72'
L29	S 40°11'27" W	81.18'
L30	S 44°09'25" W	129.22'
L31	S 46°27'59" W	5.83'
L32	S 41°19'55" E	66.55'
L33	S 29°16'36" E	26.37'
L34	S 01°43'44" E	70.23'
L35	S 16°21'12" W	72.47'
L36	S 42°49'31" W	55.35'
L37	N 18°22'37" E	152.32'
L38	N 35°27'14" W	40.66'
L39	N 35°27'49" W	82.63'
L40	S 20°42'05" W	431.90'
L41	S 68°11'12" E	134.84'
L42	N 18°22'37" E	19.10'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 46°18'22" W	158.22'
L46	N 45°15'46" W	155.78'
L47	S 64°54'38" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L55	N 89°26'43" E	24.53'
L56	S 35°17'26" E	138.59'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Sanderson — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED: Thomas Kelly AICP LEED — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

(approval thereon Plat Change)

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 2120 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

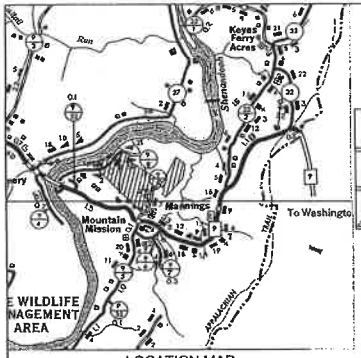
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 8 OF 14

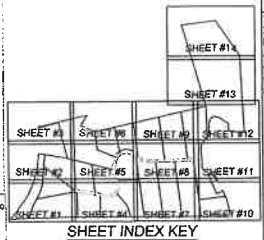
PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3'



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1998 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
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10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
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19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
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HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.85%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,006.24
15	15.24	19.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	6.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.96%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

ROAD ALIGNMENT CURVE DATA

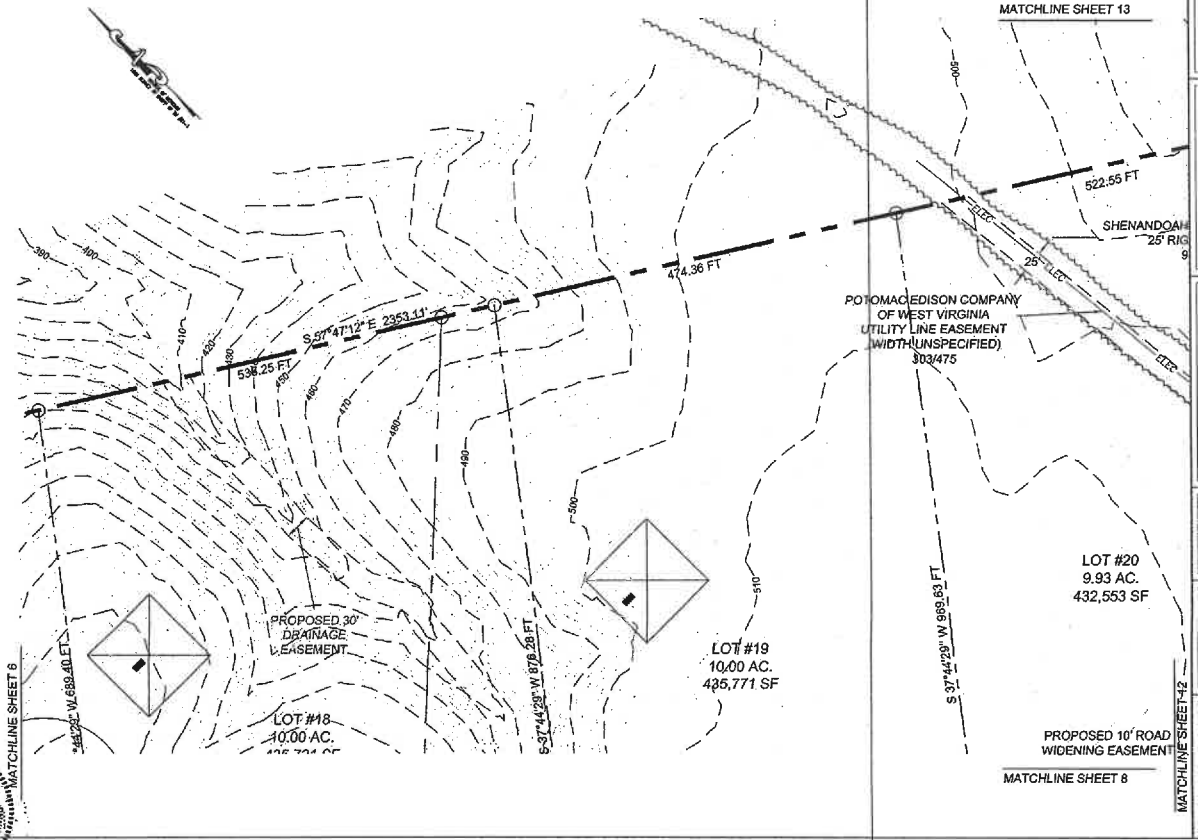
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 75°52'02" W	134.70	31°15'23"	69.93
R2	200.00	262.90	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.84	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.50	S 06°09'29" W	135.18	39°30'19"	71.62
R5	200.00	416.46	S 46°03'29" W	345.19	119°16'21"	341.61

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.50	70.14	N 62°07'58" W	65.84	70°09'08"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.38
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 58°30'57" W	211.56	56°38'03"	120.17
C5	1900.20	130.99	S 42°09'56" W	130.96	03°56'58"	65.52
C6	128.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	792.42	146.80	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	175.30	S 28°53'58" W	175.19	06°43'56"	87.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'25" E	27.02	14°40'43"	13.62
C12	58.58	82.93	N 78°18'29" E	73.95	83°55'25"	64.18
C13	1477.88	177.57	N 28°53'45" E	177.46	06°53'07"	88.88
C14	735.09	133.38	N 29°58'16" E	133.20	10°23'47"	66.87
C15	251.04	77.44	N 23°08'30" W	77.20	15°49'17"	38.97
C16	109.00	164.71	N 14°27'47" E	157.46	86°21'24"	80.61
C17	1870.20	128.91	N 42°09'56" E	128.88	03°56'58"	64.48
C18	252.94	250.09	N 66°30'57" E	240.63	56°39'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 70°41'01" E	47.29	05°38'50"	23.67
C21	520.00	228.95	N 61°20'08" E	219.39	34°36'41"	116.17
C22	60.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.62	S 41°16'29" W	50.40	60°18'36"	29.17
C24	50.00	53.33	N 78°09'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'38" W	20.41	48°11'23"	11.18
C26	50.00	52.68	N 17°16'25" W	50.26	60°20'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°18'21"	258.91
C28	225.00	91.73	S 37°05'09" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'38" W	48.08	12°16'03"	24.19
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°28'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'16" W	242.93	65°09'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.83	75°18'56"	135.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.56	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.18
C42	59.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	169.77'
L2	N 81°16'16" E	433.20'
L3	N 69°11'15" E	219.61'
L4	N 64°31'53" E	151.37'
L5	N 68°50'14" E	236.67'
L6	N 49°42'23" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 80°28'45" W	431.67'
L9	N 46°57'44" E	29.70'
L10	S 77°52'55" W	254.76'
L11	S 21°33'38" W	315.48'
L12	N 25°30'01" W	154.00'
L13	N 03°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 22°34'59" W	35.87'
L16	N 36°08'23" E	91.50'
L17	N 47°11'05" E	57.85'
L18	N 22°34'59" W	35.87'
L19	N 12°27'05" W	73.82'
L20	N 08°26'52" W	94.29'
L21	N 32°18'56" W	38.67'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	30.70'
L24	S 48°11'14" W	117.08'
L25	S 30°56'45" W	25.56'
L26	S 58°14'20" W	32.65'
L27	S 45°58'48" W	62.00'
L28	N 45°06'32" W	7.72'
L29	S 40°11'27" W	81.15'
L30	S 44°09'25" W	129.22'
L31	S 46°27'30" W	5.63'
L32	S 41°19'55" E	66.58'
L33	S 29°16'30" E	28.37'
L34	S 01°43'44" E	70.23'
L35	S 16°21'12" W	72.17'
L36	S 42°49'31" W	55.35'
L37	N 16°22'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'45" W	82.63'
L40	S 20°42'08" W	431.90'
L41	S 68°11'12" E	124.84'
L42	N 16°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'19" W	137.36'
L45	N 45°18'22" W	168.22'
L46	N 45°15'46" W	155.78'
L47	S 64°54'38" W	146.63'
L48	S 69°20'43" W	24.53'
L49	N 15°14'20" W	143.00'
L50	N 15°14'20" W	92.28'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L55	N 69°26'45" E	24.53'
L56	S 35°17'20" E	138.50'



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

David F. Llewellyn — 7/16/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade S. Anderson — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED: — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

(Approved Minor Plat Only)

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

LICENSED — DANIEL F. LLEWELLYN — No. 2128 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

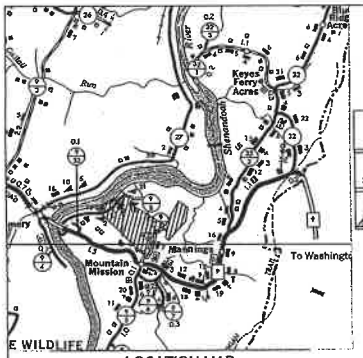
FINAL PLAT

REV.	DATE	REQUESTED BY

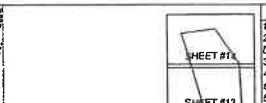
SHEET 9 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP
SCALE: 1" = 1 MILE



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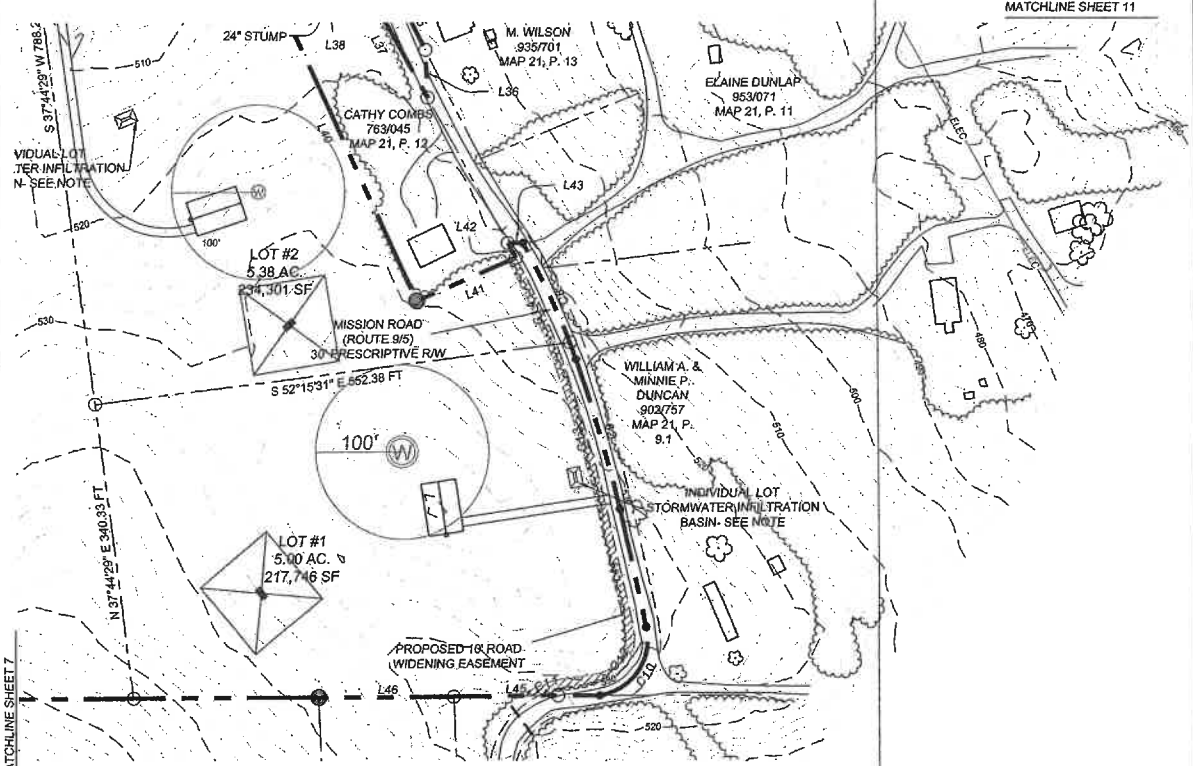
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	85.58	107.61	S 78°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'26" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°18'28" E	73.86	93°56'25"	54.16
C13	1477.68	177.57	N 26°53'45" E	177.46	06°53'07"	88.89
C14	735.98	133.38	N 20°58'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°06'38" W	77.20	15°47'17"	38.97
C16	159.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°09'56" E	128.89	03°56'58"	64.48
C18	262.94	250.09	N 68°30'57" E	240.63	56°29'03"	136.34
C19	221.55	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	460.00	47.31	N 70°41'01" E	47.29	05°53'50"	23.67
C21	520.00	220.85	N 61°20'06" E	219.20	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°16'25" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'16" W	50.84	61°06'52"	29.52
C25	25.00	21.63	N 11°11'39" W	20.41	49°11'23"	11.16
C26	60.00	62.86	N 17°16'25" W	60.26	60°20'04"	29.97
C27	175.00	364.40	S 85°09'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 37°55'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 58°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'39" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°26'46" W	39.81	10°09'01"	19.98
C33	225.00	255.96	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°53'02" W	121.23	31°15'23"	62.94
C35	275.00	150.05	S 30°53'02" E	148.17	31°15'23"	76.83
C36	175.00	230.04	S 52°52'49" E	213.63	75°18'56"	135.06
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.68	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 58°13'34" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	128.00
C41	25.00	21.63	S 59°23'01" E	20.41	49°11'22"	11.16
C42	50.00	3.87	S 81°22'33" E	3.87	04°12'21"	1.94

LINE TABLE

LINE	BEARING	DIST.
L1	N 63°44'29" E	169.77'
L2	N 61°15'19" E	433.20'
L3	N 09°11'15" E	219.61'
L4	N 64°31'53" E	161.37'
L5	N 58°50'14" E	236.67'
L6	N 66°26'27" E	274.35'
L7	N 35°01'15" E	235.33'
L8	N 60°26'45" W	431.67'
L9	N 48°57'44" E	29.70'
L10	S 71°32'55" W	254.76'
L11	S 21°32'38" W	315.48'
L12	N 28°30'01" W	154.00'
L13	N 43°49'01" W	262.11'
L14	N 47°09'24" W	19.33'
L15	N 27°53'56" E	29.00'
L16	N 36°08'28" E	61.50'
L17	N 47°11'05" E	57.85'
L18	N 22°34'30" W	35.67'
L19	N 12°27'05" W	73.82'
L20	N 08°28'52" W	94.25'
L21	N 32°18'56" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.06'
L25	S 30°56'43" W	25.56'
L26	S 58°14'20" W	32.65'
L27	S 45°58'48" W	62.00'
L28	N 45°06'32" W	7.72'
L29	S 40°13'27" W	81.16'
L30	S 44°06'25" W	129.22'
L31	S 46°27'56" W	5.83'
L32	S 41°19'55" E	66.53'
L33	S 29°16'30" E	38.37'
L34	S 01°43'44" E	70.23'
L35	S 18°21'12" W	72.17'
L36	S 42°49'31" W	55.35'
L37	N 16°22'27" E	152.32'
L38	N 25°27'14" W	40.62'
L39	N 35°27'49" W	62.63'
L40	S 20°42'08" W	431.80'
L41	S 68°11'12" E	124.64'
L42	N 16°22'27" E	19.15'
L43	S 45°18'01" E	17.28'
L44	S 32°20'16" W	137.36'
L45	N 45°18'22" W	166.22'
L46	N 45°15'46" W	155.78'
L47	S 64°54'38" W	146.93'
L48	S 89°26'43" W	24.52'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.35'
L52	S 15°14'20" E	129.81'
L53	N 25°24'10" E	159.12'
L54	N 84°54'38" E	146.93'
L55	N 89°26'45" E	24.53'
L56	S 35°17'20" E	138.50'



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/16/07
540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Anderson — 7/17/07
DEVELOPER — DATE

FINAL PLAT APPROVED: Sharon Rivers, AICP /ose 7/19/07
DIRECTOR OF PLANNING AND ZONING — DATE
Approved Minor plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 21201 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

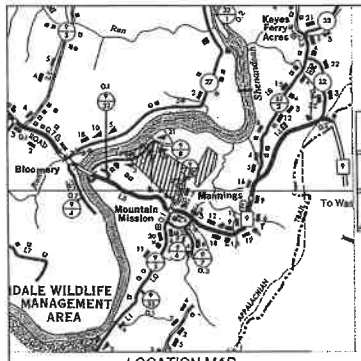
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 10 OF 14

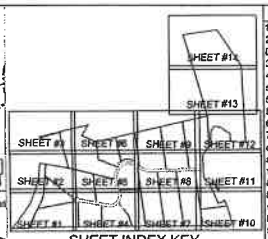
PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 8000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Modal homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	%LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,800.00
5	10.00	14.89%	25%	2.50	108,800.00
6	5.00	14.65%	25%	1.26	54,450.00
7	6.55	21.83%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,684.96
9	5.10	20.30%	55%	2.81	122,195.80
10	9.54	30.88%	85%	8.11	353,220.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,006.24
15	15.24	19.83%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.80%	70%	3.51	152,784.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,800.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 75°52'02" W	134.70	31°15'23"	69.83
R2	200.00	262.90	S 82°06'11" W	244.38	75°16'56"	154.34
R3	200.00	85.84	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.96	S 90°09'29" W	135.18	39°30'19"	71.82
R5	200.00	416.46	S 40°03'29" W	345.19	119°18'21"	341.61

CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'59" W	65.84	70°08'08"	40.22
C2	295.62	151.52	S 67°24'23" W	148.11	42°15'15"	78.36
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 58°30'57" W	211.68	56°39'08"	120.17
C5	1900.20	130.99	S 42°06'56" W	130.96	03°56'58"	65.52
C6	129.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.94	73.85	S 23°37'09" E	73.59	16°48'37"	37.09
C8	792.42	146.80	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	179.30	S 26°53'50" W	179.19	06°52'56"	89.76
C10	85.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.76	27.10	S 84°39'25" E	27.02	14°40'43"	13.62
C12	50.58	82.93	N 79°18'29" E	73.96	93°56'23"	54.16
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.89
C14	736.98	133.38	N 20°59'16" E	133.20	10°22'47"	66.87
C15	281.04	77.44	N 23°06'36" W	77.20	15°47'17"	38.97
C16	159.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°06'56" E	128.89	03°56'58"	64.48
C18	252.94	250.09	N 68°36'57" E	240.03	56°39'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	460.00	47.31	N 70°41'01" E	47.29	05°53'50"	23.67
C21	500.00	220.85	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.18
C23	50.00	52.82	S 41°16'29" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°00'16" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.19
C26	50.00	52.68	N 17°16'26" W	50.26	60°20'54"	29.07
C27	175.00	384.40	S 85°03'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 37°05'05" W	91.10	23°21'33"	46.51
C29	225.00	63.80	S 58°46'46" W	63.59	16°14'44"	32.01
C30	225.00	46.17	S 71°02'39" W	46.08	12°16'03"	24.16
C31	225.00	46.17	S 83°18'42" W	46.08	12°16'03"	24.16
C32	225.00	39.66	N 85°28'46" W	39.61	10°09'01"	19.96
C33	225.00	255.90	N 47°48'18" W	242.33	85°08'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.83
C36	175.00	230.04	S 62°53'48" E	213.85	75°18'56"	136.05
C37	175.00	74.94	N 77°18'41" E	74.37	24°32'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 89°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	169.77'
L2	N 81°16'19" E	453.20'
L3	N 69°11'15" E	219.61'
L4	N 84°31'53" E	161.37'
L5	N 58°50'14" E	236.67'
L6	N 49°42'23" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 48°57'44" E	29.70'
L10	S 77°52'30" W	254.78'
L11	S 21°32'38" W	315.48'
L12	N 25°30'01" W	154.00'
L13	N 63°49'01" W	382.11'
L14	N 47°09'24" W	19.33'
L15	N 27°35'58" E	29.00'
L16	N 36°58'23" E	91.50'
L17	N 47°11'05" E	67.85'
L18	N 23°34'50" W	35.57'
L18	N 12°27'05" W	73.82'
L20	N 06°38'53" W	94.29'
L21	N 32°19'56" W	38.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 30°56'43" W	25.56'
L26	S 58°14'29" W	32.65'
L27	S 45°58'48" W	62.90'
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L32	S 41°19'55" E	66.55'
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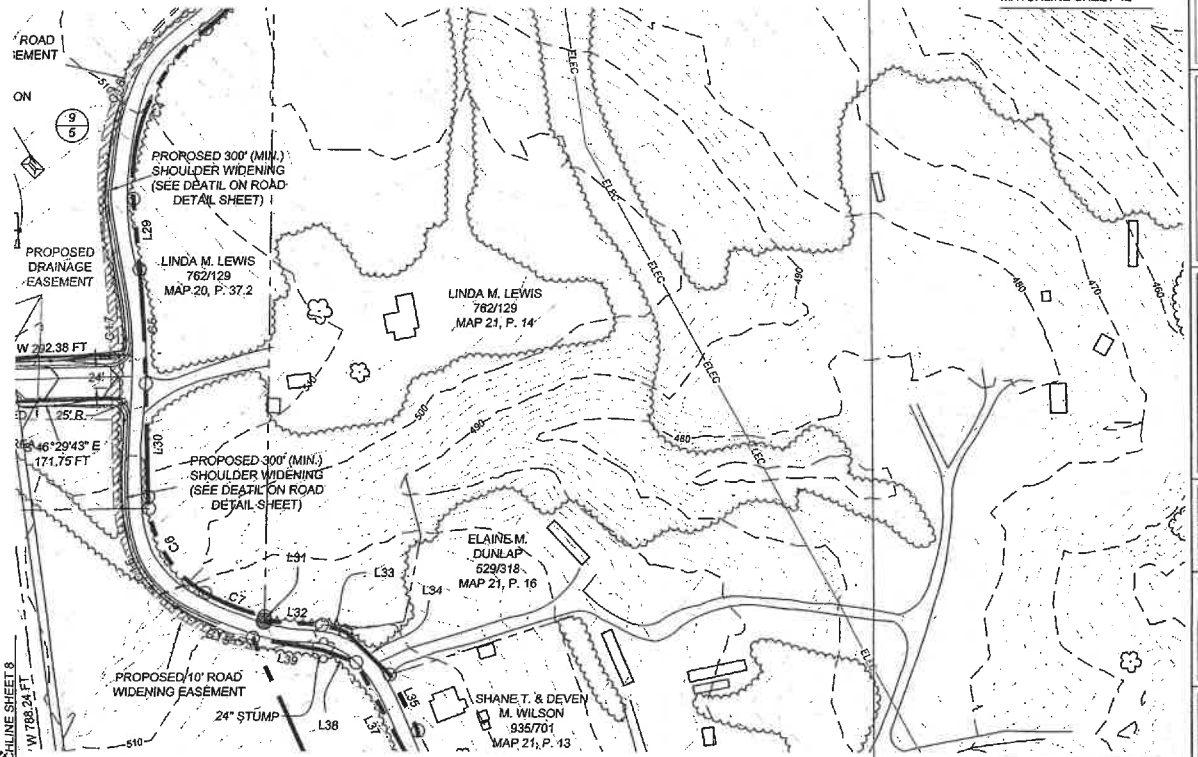
L45	N 45°18'22" W	168.22'
L46	N 45°18'48" W	155.78'
L47	S 64°54'36" W	146.93'
L48	S 89°26'43" W	24.53'
L49	N 16°14'20" W	143.59'
L50	N 15°14'20" W	92.28'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	128.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'36" E	146.93'
L55	N 89°26'43" E	24.53'
L56	S 36°17'20" E	136.50'



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The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

David F. Llewellyn — 7/16/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade D. Danderam — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED:

Sherri Kelly AICP [illegible] — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

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DEED BOOK 968 PAGE 689
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36 BAKERTON ROAD
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WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 2129 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

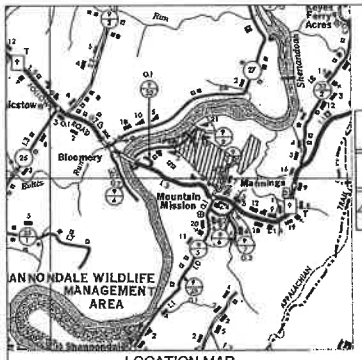
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 11 OF 14

PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-3



LOCATION MAP
SCALE: 1" = 1 MILE

SHEET INDEX KEY

DRIVEWAY CULVERT SIZES

LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of commonly-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to ensure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road/ right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	% LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.89%	25%	2.50	108,900.00
6	5.00	14.65%	25%	1.25	54,450.00
7	6.55	21.63%	55%	3.60	156,924.90
8	6.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.66%	85%	8.11	353,226.04
11	5.42	25.63%	70%	3.79	165,266.64
12	6.31	30.22%	85%	5.36	233,634.06
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	96,006.24
15	15.24	19.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,900.00
20	9.59	8.59%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'
SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 76°37'02" W	134.76	31°15'23"	69.93
R2	200.00	262.90	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.90	S 00°09'29" W	135.18	39°30'19"	71.82
R5	200.00	416.46	S 40°00'29" W	345.19	119°18'21"	341.61

CURVE TABLE

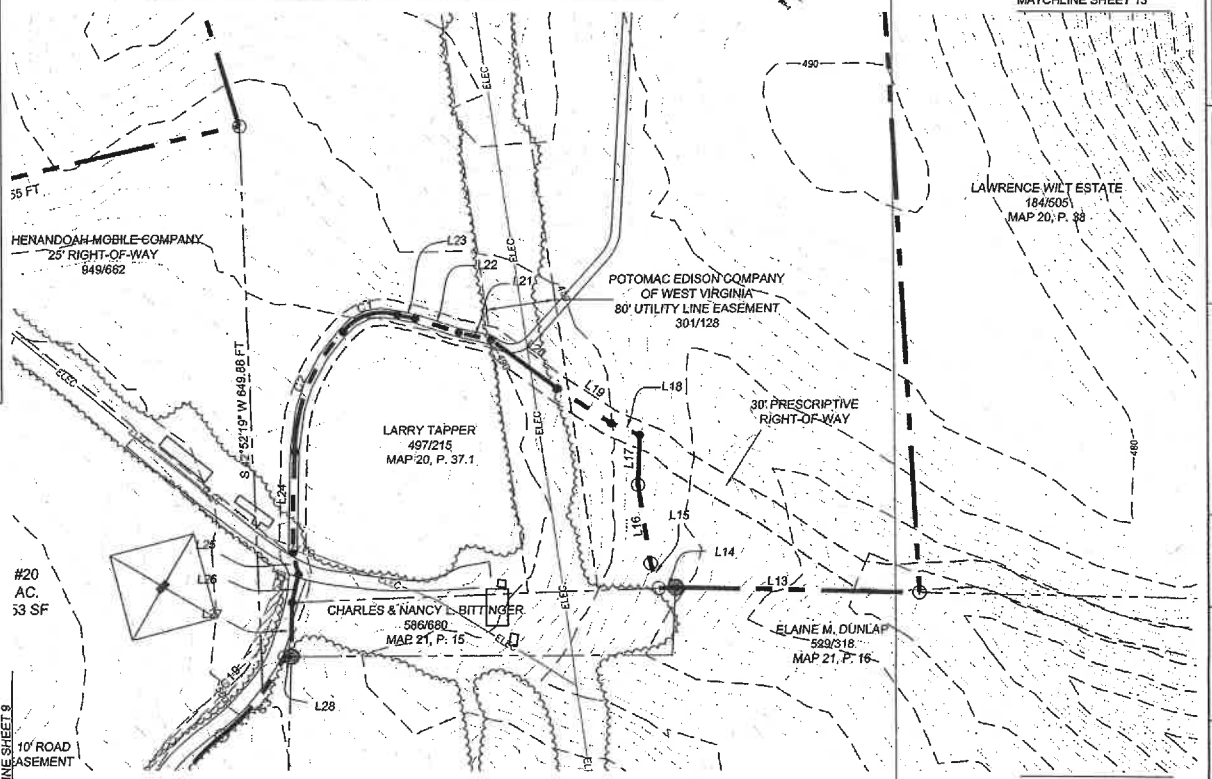
NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
C1	57.30	70.14	N 62°07'50" W	65.84	70°08'08"	40.22
C2	205.62	151.52	S 67°24'23" W	148.11	42°13'15"	79.38
C3	251.50	118.74	S 83°33'57" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 88°30'57" W	211.58	56°39'03"	120.17
C5	1900.20	130.09	S 42°09'58" W	130.06	03°55'58"	65.52
C6	129.00	133.84	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'27"	37.09
C8	782.42	146.80	S 30°43'14" W	146.59	10°45'31"	73.61
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	106.78	27.10	S 64°39'25" E	27.02	14°49'43"	13.62
C12	50.58	82.93	N 79°18'25" E	73.95	93°56'25"	54.16
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'09"	88.89
C14	735.08	153.36	N 26°59'16" E	153.05	10°42'47"	76.87
C15	281.04	77.44	N 25°06'30" W	77.20	15°47'17"	38.97
C16	156.00	184.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°09'56" E	128.89	03°56'58"	64.49
C18	252.94	250.09	N 88°30'57" E	240.03	56°39'03"	136.34
C19	221.50	102.82	N 83°33'27" E	101.90	26°35'44"	52.35
C20	480.00	47.31	N 70°41'01" E	47.29	05°38'56"	23.67
C21	520.00	220.85	N 81°20'08" E	219.20	24°20'41"	112.17
C22	50.00	78.79	S 34°05'51" E	70.82	90°11'00"	50.16
C23	50.00	52.82	S 41°10'29" W	50.40	60°31'36"	29.17
C24	50.00	53.33	N 78°06'18" W	50.84	61°06'52"	29.52
C25	26.00	21.03	N 11°11'39" W	20.41	46°21'23"	11.18
C26	50.00	52.08	N 77°16'25" W	50.26	60°20'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°18'21"	298.91
C28	225.00	91.73	S 37°08'06" W	91.10	23°21'30"	46.51
C29	225.00	63.56	S 56°48'46" W	63.39	16°11'14"	32.01
C30	225.00	48.17	S 71°02'29" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°28'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'16" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'09" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.83
C36	175.00	230.04	S 82°53'49" E	213.63	75°18'56"	135.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.66	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°38'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°38'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 81°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	169.77'
L2	N 81°15'19" E	433.20'
L3	N 68°11'15" E	219.81'
L4	N 84°31'53" E	181.37'
L5	N 58°59'14" E	236.87'
L6	N 49°42'27" E	274.30'
L7	N 35°01'15" E	235.33'
L8	N 60°28'45" W	431.67'
L9	N 46°57'44" E	29.70'
L10	S 77°52'55" W	264.79'
L11	S 21°32'38" W	315.48'
L12	N 25°30'01" W	164.00'
L13	N 43°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 21°37'58" E	29.00'
L16	N 36°08'23" E	91.66'
L17	N 68°11'05" E	67.69'
L18	N 22°34'50" W	35.87'
L19	N 12°27'05" W	73.62'
L20	N 08°28'52" W	94.26'
L21	N 32°18'56" W	38.07'
L22	N 27°10'01" W	62.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.06'
L25	S 30°56'43" W	25.96'
L26	S 58°14'20" W	32.65'
L27	S 45°56'40" W	62.00'
L28	N 45°06'32" W	7.72'
L29	S 40°11'27" W	81.16'
L30	S 44°08'25" W	129.22'
L31	S 46°27'39" W	5.83'
L32	S 41°19'55" E	68.55'
L33	S 29°16'30" E	26.37'
L34	S 01°43'44" E	70.23'
L35	S 18°31'12" W	72.17'
L36	S 42°48'31" W	55.35'
L37	N 16°22'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'49" W	82.83'
L40	S 20°42'08" W	431.90'
L41	S 68°11'12" E	124.84'
L42	N 19°22'37" E	19.15'
L43	S 45°18'01" E	17.26'
L44	S 32°20'18" W	137.36'
L45	N 45°16'22" W	169.22'
L46	N 45°57'48" W	155.76'
L47	S 84°54'36" W	148.63'
L48	S 89°36'43" W	24.63'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	108.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L56	N 89°26'45" E	24.53'
L58	S 35°17'20" E	138.50'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Dale F. Jeffery — 7/16/07
540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade Gardner — 7/17/07
DEVELOPER — DATE

FINAL PLAT APPROVED:
Sherry Keller AICP ICZO — 7/19/07
DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN
4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN
DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37
OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

DANIEL F. LLEWELLYN — LICENSED — No. 2139 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 12 OF 14

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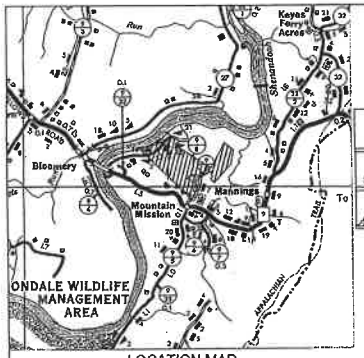

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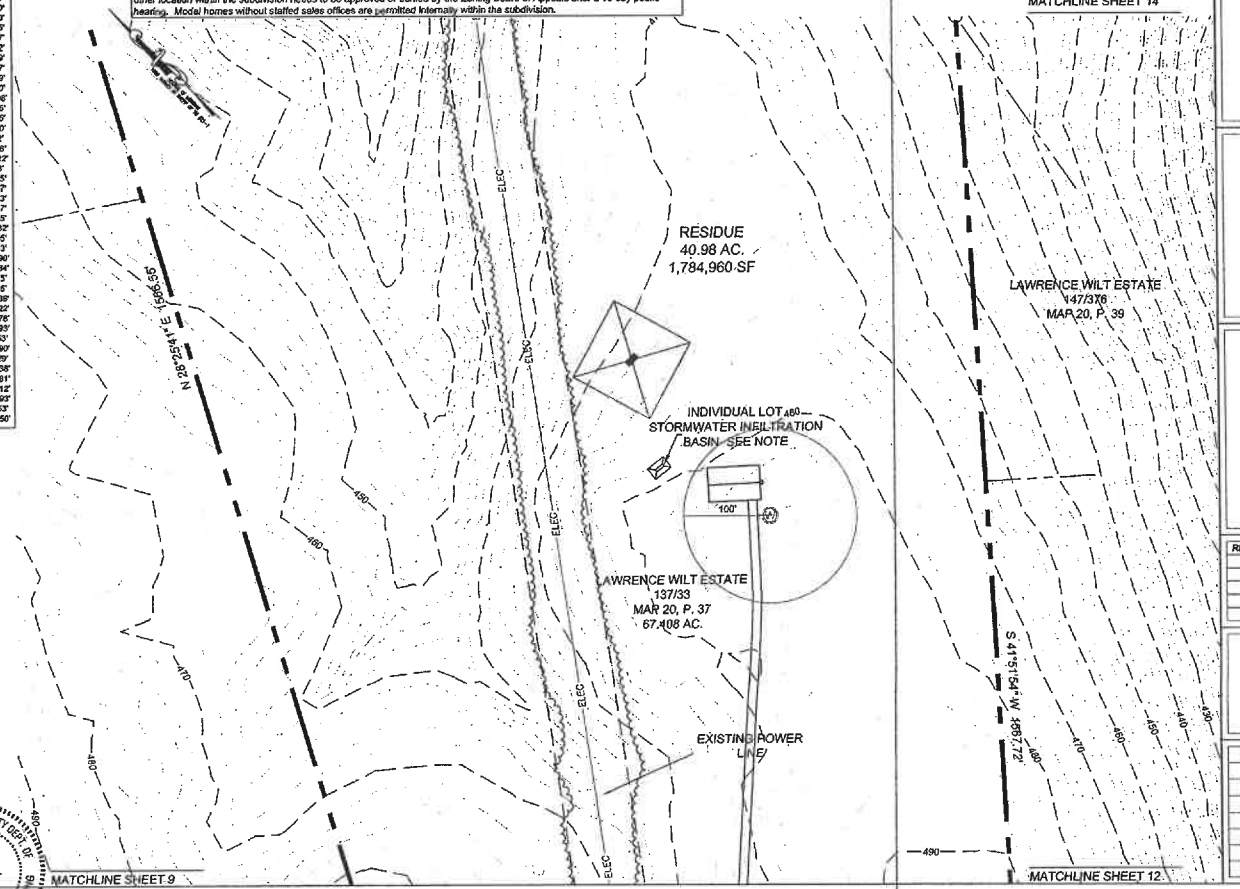
C8	792.42	146.96	S 20°43'14" W	146.59	10°36'51"	73.61
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'56"	89.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'26" E	27.02	14°40'43"	13.62
C12	50.58	82.53	N 75°18'28" E	73.95	93°56'25"	54.18
C13	1477.68	177.57	N 28°53'45" E	177.46	06°53'07"	88.88
C14	735.08	133.38	N 20°59'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 25°06'30" W	77.20	15°47'17"	38.97
C16	150.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	128.91	N 42°09'56" E	128.89	03°56'58"	64.46
C18	252.94	250.09	N 68°30'57" E	240.03	56°39'03"	136.34
C19	221.50	102.62	N 83°32'37" E	101.90	26°32'44"	52.35
C20	480.00	47.31	N 70°44'01" E	47.29	05°38'59"	23.67
C21	520.00	229.85	N 61°20'06" E	219.29	24°32'41"	112.17
C22	50.50	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.82	S 41°10'29" W	50.49	60°31'06"	29.17
C24	50.00	53.33	N 78°00'18" W	50.84	61°06'32"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.66	N 17°16'25" W	50.26	60°20'54"	29.07
C27	175.00	364.40	S 85°03'29" W	302.04	119°16'21"	298.91
C28	225.00	91.73	S 37°08'08" W	91.10	23°21'25"	46.51
C29	225.00	83.60	S 56°48'46" W	83.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'29" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 85°26'46" W	39.81	10°09'01"	19.96
C33	225.00	255.00	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
C35	275.00	150.02	S 30°52'02" E	148.17	31°15'23"	76.93
C36	175.00	230.04	S 52°53'49" E	213.83	75°18'58"	135.05
C37	175.00	74.94	N 77°10'41" E	74.37	24°32'05"	38.05
C38	175.00	120.68	N 45°09'29" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 55°13'54" E	223.82	59°39'10"	129.00
C40	225.00	234.26	S 65°06'56" E	223.82	59°39'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.18
C42	50.00	3.67	S 89°22'33" E	3.67	04°12'21"	1.84

LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'59" E	188.77'
L2	N 81°15'16" E	433.26'
L3	N 89°11'15" E	216.81'
L4	N 64°31'53" E	161.37'
L5	N 56°50'14" E	236.87'
L6	N 46°04'27" E	274.30'
L7	N 35°01'15" E	235.33'
L8	N 69°26'45" W	431.87'
L9	N 45°57'44" E	28.70'
L10	S 77°32'55" W	264.78'
L11	S 21°32'38" W	315.48'
L12	N 25°30'01" W	194.00'
L13	N 43°49'01" W	283.11'
L14	N 47°09'24" W	19.30'
L15	N 27°33'56" E	29.00'
L16	N 36°06'23" E	91.50'
L17	N 47°11'05" E	52.83'
L18	N 22°34'50" W	35.67'
L19	N 12°27'05" W	73.62'
L20	N 08°29'52" W	94.29'
L21	N 32°18'56" W	38.09'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.06'
L25	S 30°58'43" W	25.56'
L26	S 58°14'26" W	32.85'
L27	S 45°58'48" W	62.80'
L28	N 45°06'32" W	7.72'
L29	S 46°11'27" W	81.16'
L30	S 44°06'26" W	129.33'
L31	S 46°27'56" W	5.83'
L32	S 41°19'55" E	65.65'
L33	S 28°16'30" E	28.39'
L34	S 01°43'44" E	79.23'
L35	S 18°21'12" W	72.17'
L36	S 42°48'31" W	55.35'
L37	N 15°32'37" E	152.32'
L38	N 25°27'14" W	40.05'
L39	N 35°27'49" W	82.63'
L40	S 20°42'06" W	431.90'
L41	S 68°11'12" E	124.84'
L42	N 16°42'37" E	19.15'
L43	S 45°18'01" E	17.25'
L44	S 32°20'19" W	137.39'
L45	N 45°18'22" W	163.22'
L46	N 45°15'48" W	155.76'
L47	S 64°54'38" W	146.93'
L48	S 69°26'43" W	24.53'
L49	N 13°14'20" W	143.80'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	159.12'
L54	N 64°54'38" E	146.93'
L55	N 88°26'45" E	24.53'
L56	S 35°17'20" E	136.50'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET



SURVEYOR'S CERTIFICATION

The perimeter and all lot boundaries shown hereon have been established by a network of traverse control having a relative error of closure of 1:7,500 or better.

Daniel F. Llewellyn — 7/14/07

540-289-7772 — DATE

STATEMENT OF ACCEPTANCE

The developer, in signing this plat, agrees to abide by all conditions, terms and specifications provided hereon.

Wade N. Anderson — 7/17/07

DEVELOPER — DATE

FINAL PLAT APPROVED: Nancy Rice, AICP/CZO — 7/19/07

DIRECTOR OF PLANNING AND ZONING — DATE

Approved Minor Plat Change

JEFFERSON COUNTY DEPT. OF PLANNING, ZONING AND ENGINEERING — OFFICIAL SEAL

SITE PLANNING & DESIGN

4603 PALMER ROAD
McGAHEYSVILLE, VA 22840
PHONE: 540-289-7772
FAX: 540-289-7823

WATERSIDE RESERVE SUBDIVISION

CHARLES TOWN DISTRICT
JEFFERSON COUNTY, WV

DEED BOOK 968 PAGE 689
TAX MAP 20, PARCEL 36
TAX MAP 20, PARCEL 37

OWNER/DEVELOPER
GREENBRIER, L.L.C.
36 BAKERTON ROAD
HARPERS FERRY,
WEST VIRGINIA 25425
PHONE:(304) 725-3721

LICENSED — DANIEL F. LLEWELLYN — No. 2120 — STATE OF WEST VIRGINIA — PROFESSIONAL SURVEYOR

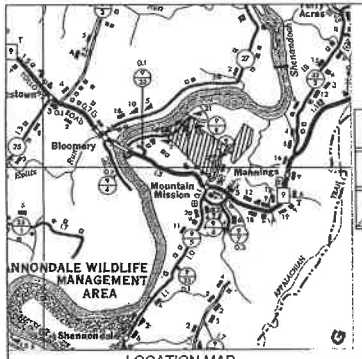
FINAL PLAT

REV.	DATE	REQUESTED BY

SHEET 13 OF 14

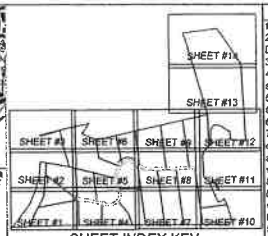
PROJECT #:	SCM-0702-32
DATE:	JUNE 29, 2007
DRAFT:	JUNE 29, 2007
SCALE:	1" = 100'
FIELD BOOK:	SPD 001
DRAWN BY:	DFL
CHECKED BY:	DLL
APPROVED BY:	GDG

02-1



LOCATION MAP

SCALE: 1" = 1 MILE



SHEET INDEX KEY

DRIVEWAY CULVERT SIZES			
LOT #	CULVERT SIZE	LOT #	CULVERT SIZE
1	NONE	11	NONE
2	NONE	12	NONE
3	NONE	13	NONE
4	15"	14	NONE
5	15"	15	NONE
6	NONE	16	NONE
7	15"	17	NONE
8	15"	18	15"
9	15"	19	NONE
10	15"	20	NONE

PLAT NOTES

1. Boundary shown hereon was determined by a field run survey by Artz & Associates on October 4, 2002.
2. Topography obtained from an aerial photo mission flown on January 30, 1999 and field checked by Site Planning & Design.
3. FEMA 100-year Floodplain as delineated from FEMA FIRM panel 51 of 70.
4. Underground utilities, if any, are not shown. Seventy-two (72) hours prior to excavation in public right-of-way or in areas served by underground utilities, call MISS UTILITY @ 1-800-245-4848.
5. The proposed subdivision is comprised of two parcels for a combined acreage of 200.383. The total right-of-way within the subdivision to be dedicated is 4.03 acres.
6. Building Setbacks: Front - 40 feet, Side - 15 feet, Rear - 50 feet.
7. The Seller of any lot within this subdivision shall provide the Buyer with a reasonable opportunity, before settlement, to determine that the lot is suitable for the construction of a septic disposal system. If, before settlement, the Buyer is denied a septic system construction permit by the Jefferson County Health Department, the Buyer may refuse to purchase the lot without penalty.
8. Verification from a well driller that a pressure grouted well has been drilled and is producing water at a quantity approved by the local or State Health Department prior to the issuance of an Improvement Location Permit. Certification that this water is potable must be submitted to the Planning Commission within 6 months of the issuance of an Improvement Location Permit.
9. The Jefferson County Public Service District may require hooking up to a centralized system when and if one becomes available. A blanket easement shall be reserved in all of the subdivision rights-of-way for the Jefferson County Public Service District for the purpose of constructing water and/or sewer line facilities.
10. A blanket easement shall be provided along the frontage of all lots for the grading associated with the installation of Beacon Hill Drive. The easement shall revert back to the individual lot owner upon completion of grading and approval from the Jefferson County Engineering Department.
11. There are no non-tidal wetlands on or immediately adjacent to the proposed subdivision.
12. There is no off-site borrow area proposed for the development of the site.
13. No variances from the Jefferson County Zoning & Subdivision Ordinances have been requested for the proposed project.
14. Jefferson County Health Department Individual On-site Well and Sewage Disposal System Permit No. SDA-19-0203-36.
15. West Virginia Division of Highways Entrance Permit No. 5-03-0703.
16. Each lot to construct an individual stormwater infiltration basin based on each lot to contain an individual stormwater infiltration basin based on 3000sf (avg.) rooftop and 6000sf (avg.) of driveway. Building contractor to direct all rooftop and drainage runoff to infiltration basin. See sheet C-3 for data.
17. A Common Interest Ownership Agreement must be established to provide for the maintenance of community-owned land, including, but not limited to the private road system within the subdivision. This Common Interest Ownership Agreement must be developed in accordance with the Uniform Common Interest Ownership Act of West Virginia.
18. Individual lot stormwater management basins shall be installed on each lot as shown on the attached subdivision plat. Minimum basin dimensions are 11 feet long, 3 feet wide and 2 feet deep (see detail on sheet C-3). The developer shall install all basins. The building contractor shall divert all rooftop and driveway runoff to basin during house construction. Individual lot owner shall be required to maintain the stormwater management infiltration basin to assure that the designed storage stormwater management basins will have standing water and all problems and/or benefits associated with standing water.
19. Once a Homeowner's Association is formed they shall petition the County Commission to adopt a Leash Law.
20. Model homes with a staffed sales office for sales exclusively within the residential subdivision that they are contained on the first lot on either or both sides of any road right-of-way that enter the subdivision; provided also that they are so designed on the preliminary and final plats during the subdivision process. Model homes with a staffed sales office in any other location within the subdivision needs to be approved or denied by the Zoning Board of Appeals after a 15 day public hearing. Model homes without staffed sales offices are permitted internally within the subdivision.

HILLSIDE DEVELOPMENT REGULATIONS
NATURAL AREA PRESERVATION

LOT#	LOT ACREAGE	AVERAGE LOT SLOPE	% LOT TO REMAIN IN NATURAL CONDITION	LOT AREA TO REMAIN IN NATURAL CONDITION (ACRES)	LOT AREA TO REMAIN IN NATURAL CONDITION (SQUARE FOOTAGE)
1	5.00	10.24%	25%	1.25	54,450.00
2	5.00	11.11%	25%	1.25	54,450.00
3	10.00	12.32%	25%	2.50	108,900.00
4	10.00	13.48%	25%	2.50	108,900.00
5	10.00	14.80%	25%	2.50	108,900.00
6	5.00	14.65%	25%	1.25	54,450.00
7	8.55	21.63%	55%	3.60	156,924.90
8	5.12	20.73%	55%	282	122,664.96
9	5.10	20.30%	55%	2.81	122,185.80
10	9.54	30.68%	85%	8.11	353,228.04
11	5.42	25.63%	70%	3.79	165,268.64
12	6.31	30.22%	85%	5.36	233,634.05
13	5.10	18.53%	40%	2.04	88,862.40
14	5.51	19.53%	40%	2.20	98,006.24
15	15.24	19.63%	40%	6.10	265,541.78
16	5.04	23.51%	55%	2.77	120,748.32
17	5.01	25.60%	70%	3.51	152,764.92
18	10.00	24.47%	55%	5.50	239,580.00
19	10.00	10.55%	25%	2.50	108,900.00
20	9.59	8.69%	0%	0.00	0.00
RESIDUE	40.42	12.98%	25%	10.11	440,173.80

0' 100' 200' 300'

SCALE: 1" = 100'

ROAD ALIGNMENT CURVE DATA
CURVE TABLE

NUMBER	RADIUS	ARC	CH. BEARING	CHORD	DELTA ANGLE	TANGENT
R1	250.00	136.38	N 76°52'02" W	134.70	31°15'23"	69.83
R2	200.00	262.90	S 82°06'11" W	244.38	75°18'56"	154.34
R3	200.00	85.64	S 32°10'41" W	84.99	24°32'05"	43.49
R4	200.00	137.90	S 90°09'29" W	135.18	39°30'19"	71.62
R5	200.00	416.46	S 40°03'29" W	345.19	119°18'21"	341.61
C1	87.30	70.14	N 62°07'58" W	65.84	76°46'06"	40.22
C2	208.62	151.52	S 67°24'23" W	148.11	42°13'16"	79.38
C3	251.50	116.74	S 83°32'37" W	115.70	26°35'44"	59.44
C4	222.94	220.43	S 68°30'57" W	211.56	56°39'03"	120.17
C5	1900.20	130.09	S 42°09'56" W	130.06	03°56'56"	65.52
C6	129.00	133.64	S 14°27'47" W	127.74	59°21'25"	73.51
C7	251.04	73.65	S 23°37'09" E	73.39	16°48'37"	37.09
C8	792.42	146.39	S 30°45'14" W	146.19	10°35'01"	73.51
C9	1492.68	179.30	S 28°53'50" W	179.19	06°52'50"	89.76
C10	65.58	107.61	S 79°20'53" W	95.94	94°01'12"	70.35
C11	105.78	27.10	S 64°39'25" E	27.02	14°40'43"	13.62
C12	50.56	82.93	N 79°18'29" E	73.95	93°58'25"	54.18
C13	1477.69	177.57	N 26°53'45" E	177.46	06°53'07"	88.89
C14	735.08	133.39	N 26°59'16" E	133.20	10°23'47"	66.87
C15	281.04	77.44	N 23°08'30" W	77.20	15°47'17"	38.97
C16	150.00	164.71	N 14°27'47" E	157.45	59°21'24"	90.61
C17	1870.20	129.91	N 42°09'56" E	128.89	03°58'58"	64.46
C18	252.94	250.09	N 68°30'57" E	240.03	56°38'03"	136.34
C19	221.50	102.82	N 83°32'37" E	101.90	26°35'44"	52.35
C20	490.00	47.31	N 70°47'01" E	47.29	05°31'50"	23.67
C21	520.00	220.95	N 61°20'06" E	219.29	24°20'41"	112.17
C22	50.00	78.70	S 34°10'51" E	70.82	90°11'03"	50.16
C23	50.00	52.62	S 41°17'29" W	50.40	60°18'36"	29.17
C24	50.00	53.33	N 78°00'18" W	50.84	61°06'52"	29.52
C25	25.00	21.03	N 11°11'39" W	20.41	48°11'23"	11.18
C26	50.00	52.68	N 17°16'25" W	50.26	60°20'54"	29.07
C27	175.00	364.40	S 85°03'28" W	302.04	119°18'21"	288.91
C28	225.00	91.73	S 37°09'05" W	91.10	23°21'33"	46.51
C29	225.00	63.60	S 56°48'46" W	63.39	16°11'44"	32.01
C30	225.00	48.17	S 71°02'06" W	48.08	12°16'03"	24.18
C31	225.00	48.17	S 83°18'42" W	48.08	12°16'03"	24.18
C32	225.00	39.86	N 68°28'46" W	39.81	10°09'01"	19.98
C33	225.00	255.90	N 47°49'18" W	242.33	65°09'56"	143.80
C34	225.00	122.74	N 30°52'02" W	121.23	31°15'23"	62.94
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C38	175.00	120.66	N 45°09'25" E	118.29	39°30'19"	62.84
C39	225.00	234.26	N 35°13'54" E	223.82	59°36'10"	129.00
C40	225.00	234.26	S 65°09'56" E	223.82	59°36'10"	129.00
C41	25.00	21.03	S 59°23'01" E	20.41	48°11'22"	11.18
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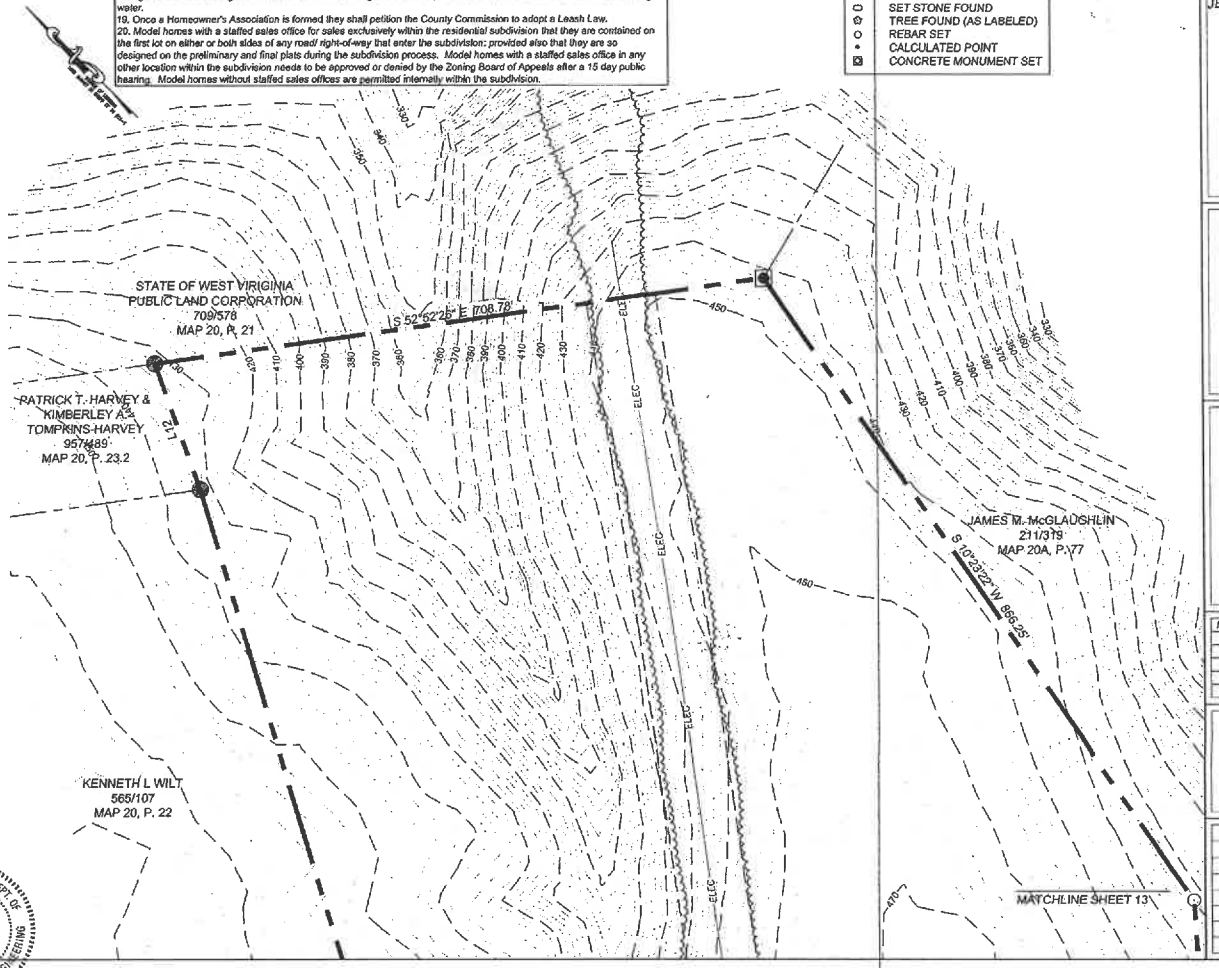
LINE TABLE

LINE	BEARING	DIST.
L1	N 83°44'58" E	169.77'
L2	N 81°13'18" E	433.20'
L3	N 69°11'15" E	218.01'
L4	N 64°31'53" E	161.37'
L5	N 58°50'14" E	236.87'
L6	N 49°42'27" E	274.39'
L7	N 35°01'15" E	235.33'
L8	N 80°28'45" W	431.67'
L9	N 48°57'44" E	29.77'
L10	N 77°52'55" W	264.76'
L11	S 21°32'38" W	315.49'
L12	N 25°30'01" W	154.00'
L13	N 43°49'01" W	282.11'
L14	N 47°09'24" W	19.33'
L15	N 27°33'56" E	29.00'
L16	N 36°08'33" E	81.59'
L17	N 42°11'06" E	57.85'
L18	N 23°34'59" W	35.57'
L19	N 12°27'05" W	73.82'
L20	N 08°26'52" W	94.29'
L21	N 32°16'58" W	36.07'
L22	N 27°10'01" W	52.79'
L23	N 33°21'22" W	20.70'
L24	S 46°11'14" W	117.08'
L25	S 33°56'43" W	25.66'
L26	S 58°44'20" W	32.65'
L27	S 45°58'48" W	62.00'
L28	N 46°08'32" W	7.72'
L29	S 40°11'27" W	61.16'
L30	S 44°03'25" W	129.22'
L31	S 46°27'59" W	5.83'
L32	S 41°19'58" E	68.55'
L33	S 25°16'30" E	28.37'
L34	S 01°45'44" E	70.23'
L35	S 18°21'12" W	72.17'
L36	S 42°48'31" W	55.35'
L37	N 16°22'37" E	152.33'
L38	N 25°22'14" W	40.05'
L39	N 35°27'49" W	82.63'
L40	S 20°42'08" W	431.90'
L41	S 66°11'12" E	124.84'
L42	N 16°22'37" E	19.15'
L43	S 46°18'01" E	17.28'
L44	S 32°20'19" W	137.36'
L45	N 45°16'22" W	168.22'
L46	N 45°12'48" W	155.70'
L47	S 64°54'38" W	146.93'
L48	S 68°28'43" W	24.53'
L49	N 15°14'20" W	143.90'
L50	N 15°14'20" W	92.29'
L51	S 15°14'20" E	106.38'
L52	S 15°14'20" E	129.81'
L53	N 25°24'19" E	169.12'
L54	N 64°54'38" E	146.93'
L55	N 89°26'45" E	24.53'
L56	S 35°17'20" E	138.56'

LEGEND

- MONUMENT FOUND
- REBAR FOUND
- SET STONE FOUND
- TREE FOUND (AS LABELED)
- REBAR SET
- CALCULATED POINT
- CONCRETE MONUMENT SET


STATE OF WEST VIRIGINIA
PUBLIC LAND CORPORATION
709/578
MAP 20, P. 21
S 52°22'25" E 708.78'
PATRICK T. HARVEY &
KIMBERLEY A.
TOMPKINS-HARVEY
957/489
MAP 20, P. 23.2
KENNETH L WILT
565/107
MAP 20, P. 22
JAMES M. McGLAUGHLIN
211/319
MAP 20A, P. 77
S 10°23'22" W 865.25'
MATCHLINE SHEET 13
ELEC
ELEC
ELEC

CORPORATION OF SHEPHERDSTOWN

104 NORTH KING STREET
P.O. BOX 248
SHEPHERDSTOWN, WEST VIRGINIA 25443-0248
TEL: (304) 876-2312
FAX: (304) 876-1473

May 9, 2023

Mike Shepp, President
Jefferson County, WV Planning Commission
116 E. Washington Street, Suite 200
P.O. Box 716
Charles Town, WV 25414

Jennifer Brockman
Director of Planning & Zoning
116 E. Washington Street, Suite 200
P.O. Box 716
Charles Town, WV 25414

Re: Request for a Memorandum of Understanding

Dear Mr. Shepp & Ms. Brockman:

The Corporation of Shepherdstown requests that a Memorandum of Understanding be drafted between the Town and the County of Jefferson, WV. The primary purpose of which is to ensure that the Town will be notified timely in writing of any requests for or proposals to amend the county zoning and/or land use maps as it relates to parcels located within Shepherdstown's Growth Management Boundary. In addition, the MOU should require that any requests for or proposals to amend Shepherdstown's Preferred Growth Area will be forwarded to the Town in writing as well.

The Town requests that it be notified within seven (7) business days upon the County's receiving requests for rezoning, land use changes or changes to the Preferred Growth Area. The Town should be notified prior to any actions taken by the Planning Commission and the County Commission independent of any public notice requirements. Upon notification, the Town will have fourteen (14) days to respond, in writing, to the change requests and will be allowed to voice any concerns.

As was discussed in the early stages of the UGB/GMB designation process, the desire is to keep an open line of dialogue between the County and the Town and for the Corporation to have a voice as to how land within the Growth Management Boundary is developed. We look forward to reviewing the proposed MOU.

Respectfully,

Arthur J. Auxer, III

Mayor of Shepherdstown