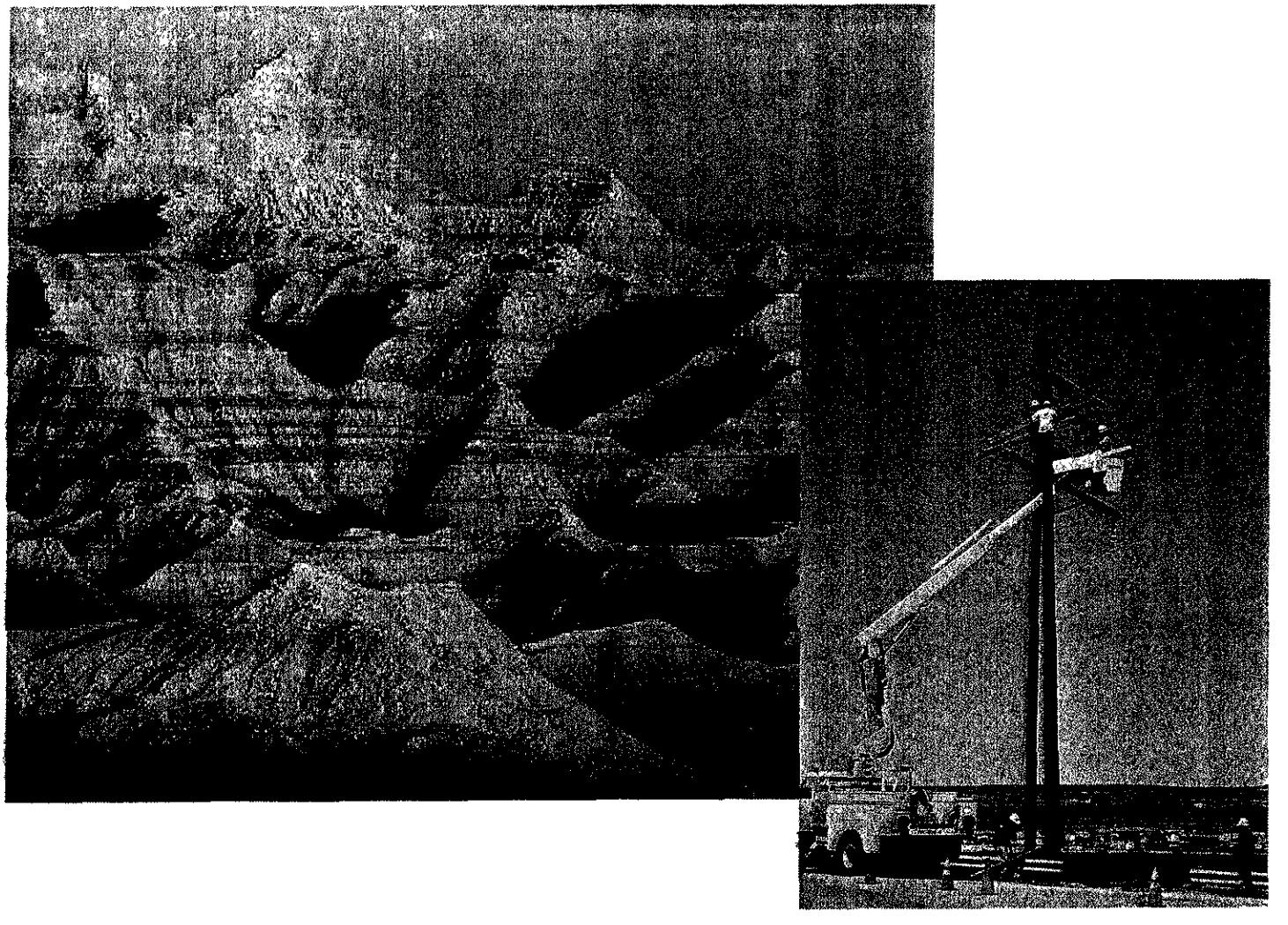
09PD007

West River Electric

A Touchstone Energy® Cooperative

REPORT ON A PROPOSED TOWER FOR: WEST RIVER ELECTRIC ASSOCIATION NEW RAPID VALLEY OFFICE



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09PD007

REPORT ON A PROPOSED TOWER FOR:

WEST RIVER ELECTRIC ASSOCIATION

NEW RAPID VALLEY OFFICE

MARCH 25, 2009

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RAPID CITY, SD

INTRODUCTION

As part of the process to construct a replacement office for West River Electric Association's Rapid Valley office, construction of a new communications tower will be required.

This tower is needed to support the operations of West River Electric Association (West River), as well as the future operations of Rushmore Electric Power Cooperative (Rushmore), should Rushmore's office later be moved to the Rapid Valley location. In addition, it is possible that space could be made available on the tower for other uses if desired.

The cooperatives presently operate various radio systems on separately owned towers located at 1715 Cambell Street and at 3250 East Highway 44.

During the latter part of 2008, West River was directed to provide a design for the new Rapid Valley structure to Rapid City Growth Management that would emulate a flagpole, complete with flag. West River has proposed a monopole design, including a 95' structure height, a 100' height to tip of antennas and of a design to provide for externally mounted antennas. No flag or lighting is proposed.

BACKGROUND – FREQUENCY SPECTRUM

Radio spectrum can be thought of as a line, running from low frequencies up to much higher frequencies:

x	x	x	x x	x	x
50 MHz	150 MHz	450 MHz	800/900 MHz	2G	6G

Within this continuous line of possible frequencies, certain parts of the spectrum have been allocated by the FCC for commercial, public safety and utility use. Several of these bands have been marked for illustration purposes and include: VHF Low Band (50 MHz), VHF High Band (150 MHz), UHF (450 MHz), 800 (800 MHz), 2 Gig (2,000 Hz) and 6 Gig (6,000 Hz). Some of the operations located within these bands include the following:

50 MHz:
- Legacy 2-Way radio systems
- KOTA Channel 3 (60-66 MHz)
- KNBN Channel 5 (76-82 MHz)

150 MHz:
- Western South Dakota Rural Electric Cooperatives
- South Dakota State Radio
- Pennington County Sheriff
- City of Rapid City Water Department SCADA

450 MHz:
- Rapid City PD (Police)
- Black Hills Power & Light Company

800 MHz:
- Cellular (1rst Generation)

900 MHz:
- City of Rapid City Mobile Data System
- Cooperative & IOU SCADA
- Legacy microwave radio

2000 MHz:
- Cellular (2G, 3G)
- Unlicensed microwave radio
- Legacy microwave radio

6000 MHz:
- Licensed microwave radio

SCADA in this case refers to system control and data acquisition: essentially remote control and monitoring of remotely located utility devices, such as switches, substations, water pumps, etc.

Microwave radio refers to a point to point radio system, assigned to a wide frequency bandwidth with the capability of carrying multiple lines of communication and data traffic.

There is a tradeoff between operation at the lower frequencies such as 150 MHz and operation at the much higher frequencies (800 MHz and above).

All things being equal, the lower frequency channels are capable of traveling a much longer distance, and can bend around obstacles in terrain. As one moves higher in the frequency spectrum, especially to 800 MHz, signals at this frequency start become more distance limited and in fact cannot reach the far end unless the path is essentially line-of-sight. The problem becomes more acute past 1,000 MHz and at a high enough frequency, interruptions from foliage and rainfall begin to become a problem.

As a real world example, the lowest of the television broadcast channels are the frequencies most coveted, because they are capable of the farthest reach. Conversely, the highest of the television broadcast channels are typically the last to be used.

Because the higher frequencies are much more range limited, they can be re-used more often and typically will be prone to less interference from other distant stations. Substantially more base stations will be required to cover a given area as the operating frequency is increased.

With the progression of new technology and the urban need to re-use frequencies as often as possible, many users nationwide have moved their operations to the higher frequency bands.

In western South Dakota the use of channels located in the lower frequency bands remains a popular and cost effective solution. Especially at 150 MHz, radio systems operating in this band are much more capable of talking through the difficult terrain of the Black Hills area and fewer base stations are needed to provide full area coverage. The cost benefit becomes obvious.

Any given frequency can be measured by the length of its sinusoidal wave. This distance in *wavelength* becomes shorter as one moves up in frequency. At 150 MHz, a full wavelength measures approximately two meters. At 1000 MHz, a full wavelength measures approximately 30 centimeters.

The distance of these wavelengths becomes all important with respect to antenna design. Elements used to construct an antenna must match in the intended wavelength to achieve proper operation. All things being equal, lower frequency systems will require much larger antennas than higher frequency systems. In the old days of low band VHF 48 MHz 2-way radio, even the ¼ wavelength antennas typically used on service trucks measured four to five feet in length.

BACKGROUND - REPEATERS

In the world of land mobile (two-way) radio, the foremost goal is communications over a wide area of operation in a cost effective manner. In the case of West River Electric Association the coverage need goes beyond eastern Pennington County into the fringes of Haakon, Meade and Shannon as well. West River dispatches from both its Wall and Rapid Valley office locations.

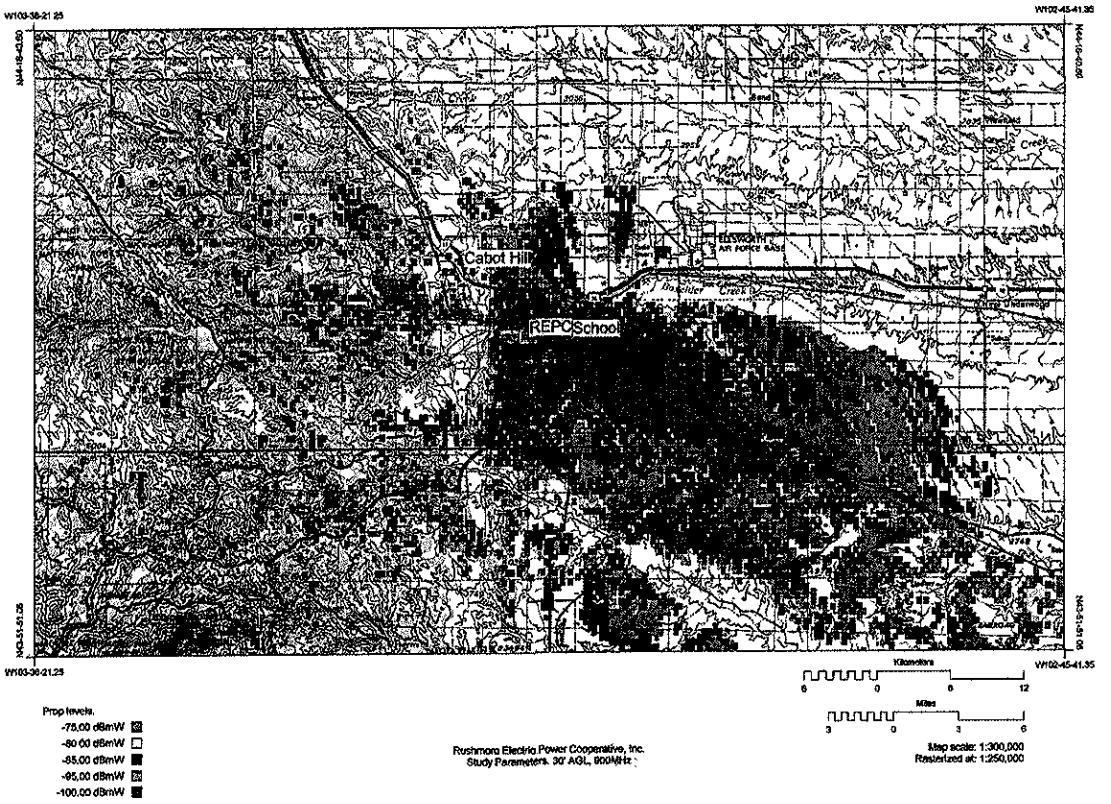
Small, low powered radios and their compromised antennae typically cannot reach to these great distances on their own. Most effective two-way systems make use of one or more repeaters. Repeaters involve an antenna placed at a high location, wired back to back, receiver to

transmitter. These systems can pick up the weak signals of a local radio and retransmit them for broadcast throughout a wide territory. Repeaters are an essential part of the radio systems located throughout the Black Hills area.

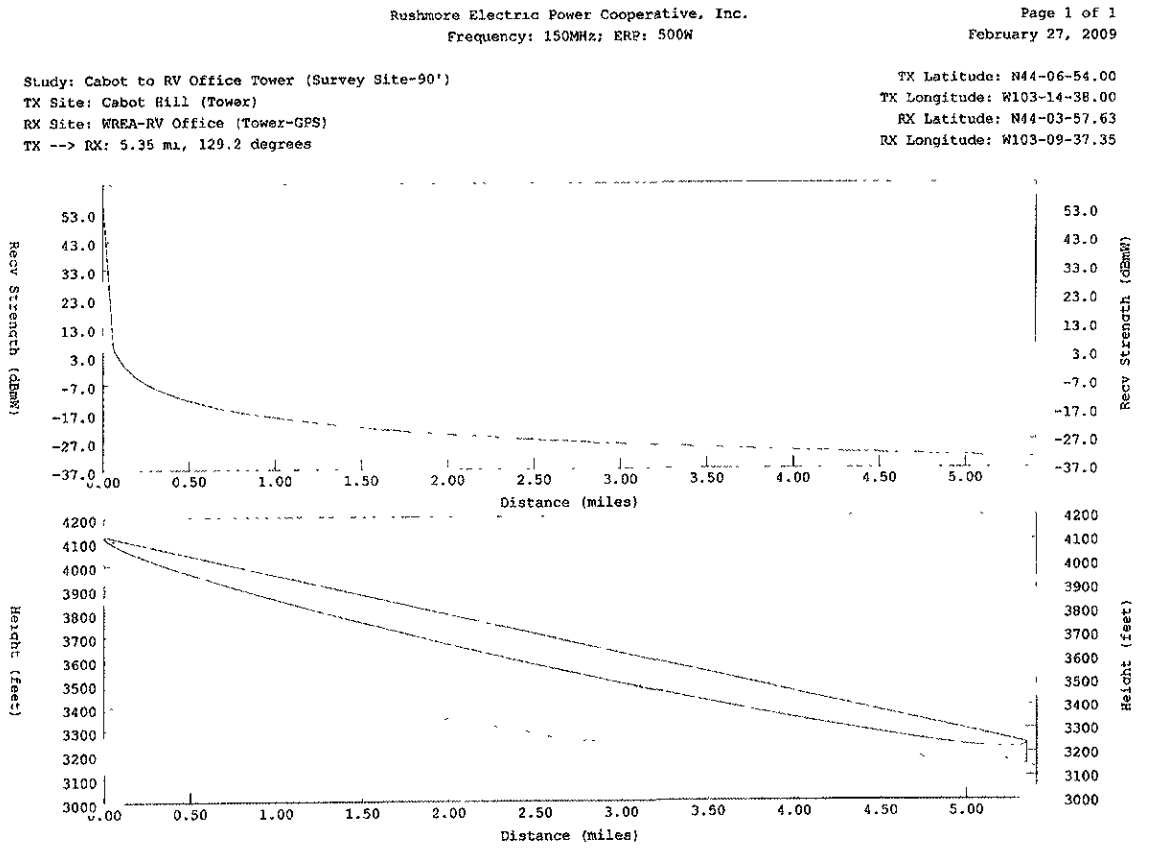
BACKGROUND – COVERAGE

For purposes of this report, two types of broadcast area will be discussed: Omni-directional and point to point.

TV, FM Broadcast and Cellular towers are examples of Omni-directional broadcast. Here, the intent is to try and radiate a signal in all directions as best can be done. Sometimes the antenna patterns can be offset or even divided into sectors, but the goal remains the same – to provide coverage to as many subscribers as is possible. Elevation and adjacent terrain can greatly affect coverage from a given site. 900 MHz Omni-directional coverage at 30' AGL from the West River Rapid Valley location (marked as School) can be seen below.



Point to point describes a radio system intended to transmit and receive traffic with a specific end point location. Two examples of point to point radio systems include microwave radio and VHF 2-way repeater control stations. Both of these system types are in use at the cooperative locations. A plot of the point to point microwave radio path from Cabot Hill to the Rapid Valley office follows:



Directional antennas used for point to point systems can require significant space. In the case of microwave dishes, these circular antennas commonly run anywhere from 2' up to 12' in diameter. Point to point 150 MHz directional antennas can measure 3' x 3' and up. The antenna size needed at a particular location relates to frequency, desired gain and restrictions on beam-width.

MONOPOLE DESIGNS

Monopole designs are numerous, but the towers to be discussed herein are generally constructed to diameters on the order of several feet at the base to one or two feet at the top.

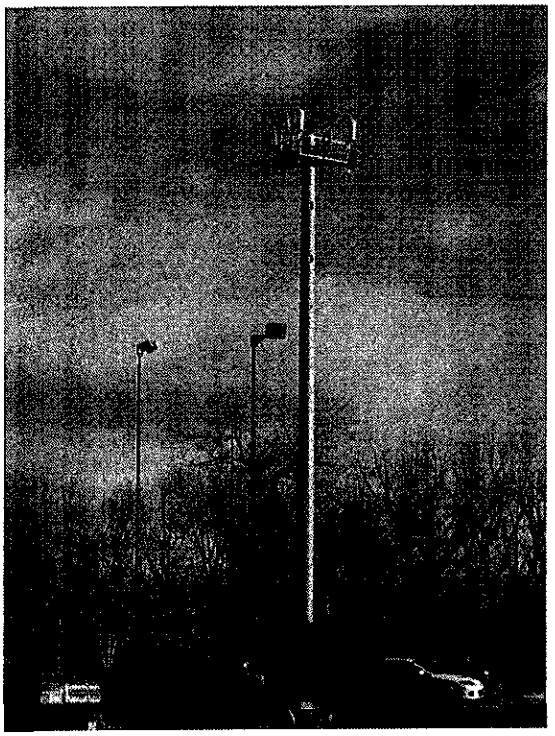
In more recent years, special sections have been designed for the tops of these monopoles to hold a stack of sectored cellular antennae, enclosed on the outside by a fiberglass cover. The cover is more commonly referred to as a radome.

The antenna space within these commercially offered products is limited. Microwave dishes and low frequency VHF control antennas generally cannot be fit within the radomes of these structures. And the sectored antenna design needed for these towers is a poor solution for the Omni-directional pattern needed for a typical land mobile radio system.

CELLULAR USE

The broadcast applications for cellular operation most typically are licensed in the 800 and 2G spectrum. Antennas used for cellular broadcast can be of an Omni-directional design or they may be comprised of a sectored arrangement, whereby the broadcast pattern is split to three or

more sectors. Sector antennas take the shape of a rectangular panel arrangement and they can be seen at locations throughout Rapid City, including the downtown MDU lot.

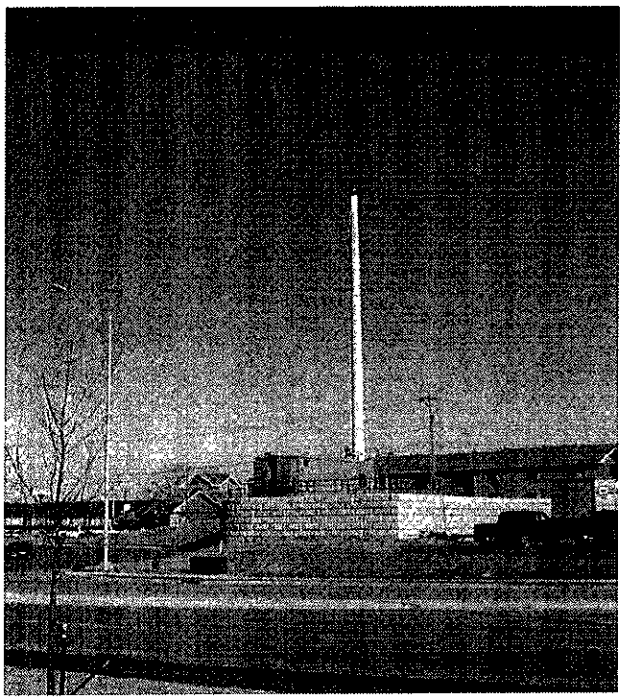


MDU Cell

All cellular sites require a high speed, high bandwidth connection back to the central control – a point more commonly referred to as the *switch*. This connection can be made with leased line or with a point to point microwave connection.

The use of leased line comes with a significant monthly cost, typically on the order of several hundred dollars or more per month. More importantly, any use of leased line means that the site in question is now dependent upon the reliability of the land based phone or fiber optic system. When these lines go out, a trouble report must be initiated with the leasing party and in spite of everyone's best intentions, service restoration can often be lengthy and frustrating process. Multi-day outages on a failed leased line are not uncommon.

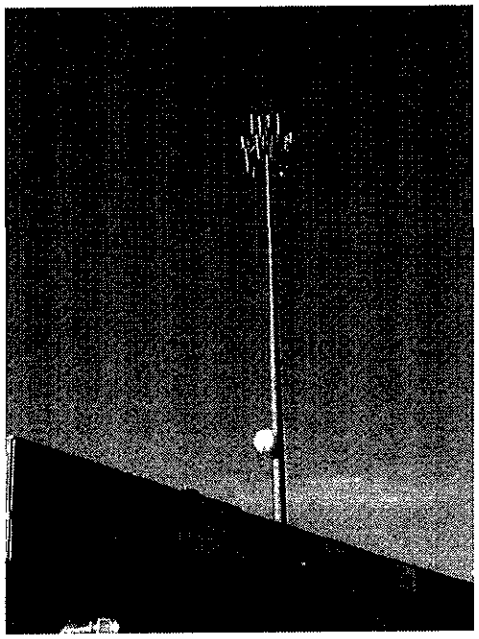
When a flagpole design becomes the mandate, the cellular company likely has no recourse other than to provide connectivity from the tower back to the switch with a leased line. Since no microwave antennas can be seen at the Lacrosse Street location, it is likely that this site is connected back to the switch by a dedicated, high speed, 24/7 leased line. A photo of this site follows.



Lacrosse Street Flagpole

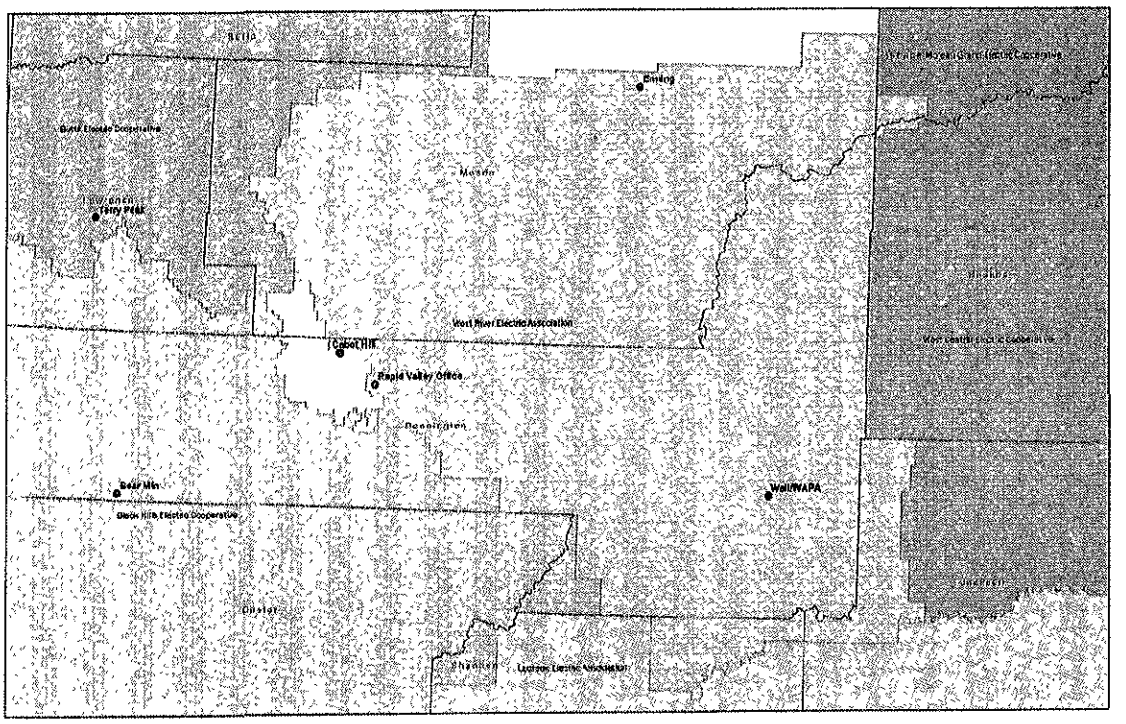
Point to point microwave radio provides an alternative to the use of leased line and it is generally usually is the preferred solution. Microwave radio can pencil in at a lower cost than leased line and with the use of this alternative, the cell system can stand alone from any failures on the landline side of the telephone world. Service management and outage times are also improved with the use of microwave radio.

Microwave antennas, as seen on the West Omaha monopole, are circular in diameter and cannot fit within the radome of a typical monopole structure.



COOPERATIVE USE

West River Electric Association, Wall, SD provides electrical service to consumers in the South Dakota counties of Haakon, Jackson, Meade, Pennington, Shannon and Ziebach. The cooperative service area extends from the eastern edge of the Black Hills north of Rapid City to the rolling prairie surrounding the town of Wall and south to the Cheyenne River, which includes the Badlands and Interior. West River Electric Association provides electricity to the north and east fringes of Rapid City and other small towns within its service area.

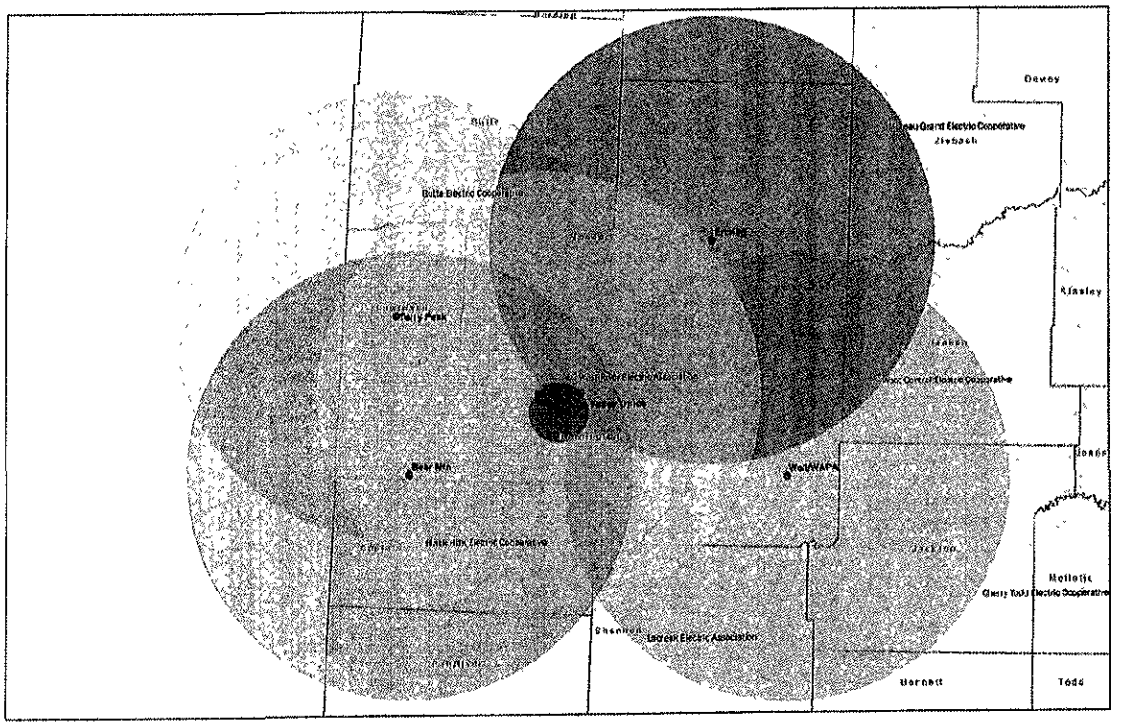


Eight distribution cooperatives, similar in size to West River, comprise the boundaries of the Rushmore Electric Power Cooperative service territory. This combined area encompasses much of western South Dakota. The West River Rapid Valley office project has been planned from the outset to include a possible future move of Rushmore's systems to the Rapid Valley location.

The single most important communications system operated by the cooperatives is conventional 2-Way land mobile radio. Throughout western South Dakota, there are approximately eighteen 150 MHz repeaters used to support this voice radio traffic. Repeaters at Cabot Hill, Enning and

Wall are directly controlled from the West River Rapid Valley location. With control of these three radio systems, West River staff can largely communicate throughout the entire service area.

Rushmore controls many of the other repeaters, either on a direct point to point radio link or via microwave radio where necessary. The Black Hills area repeaters and an approximation of their coverage areas are shown below.



The following is a summary of the radio and antenna systems proposed for use at Rapid Valley. Of the systems listed on the following page, applications 1 through 6 are point to point. Applications 7 through 9 are Omni-directional broadcast, to include backup VHF control, local area SCADA and future 900 MHz mobile data.

The frequencies used range from 150 MHz to 6G. Most of the point to point antennas need to be mounted at a substantial height in order to support the far end receivers to which they communicate.

ID	Description	Freq	Height	Azimuth	Ownership	Status
1	6 GHz Microwave to Rushmore Office	6000	85	275.9	REPC	Existing
2	6 GHz Microwave to Rapid City Sub	6000	85	295.0	REPC	Future
3	6 GHz Microwave to Cabot	6000	85	309.3	WREA	Future
4	Channel 3 VHF Control to Enning	150	90	39.8	WREA	Existing
5	Channel 2 VHF Control to Wall	150	90	104.1	WREA	Existing
6	Channel 1 VHF Control to Cabot Hill	150	90	309.3	WREA	Existing
7	Multichannel VHF Wide Area (Broadcast)	150	95	Omni	REPC	Future
8	IP Access Point (Broadcast)	900	95	Omni	WREA	Future
9	SCADA MAS DNP Protocol (Broadcast)	900	95	Omni	REPC	Future

ALTERNATIVES

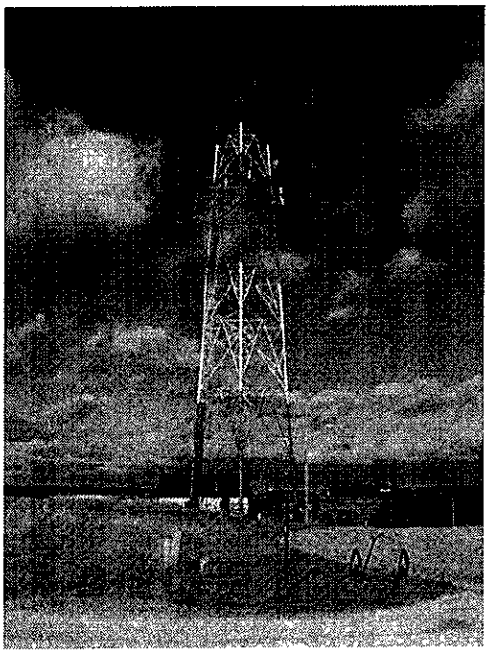
Several alternatives were considered for the Rapid Valley project:

- Guyed lattice tower
- Self supporting tower
- Monopole design with integral radome (flagpole)
- Monopole design with externally mounted antennas

A guyed structure was excluded from consideration at the outset by cooperative staff. Although this would be the least costly of the alternatives, significant space for guying would be required and the visual impact caused by this type of structure was expected to be controversial.

A self supporting structure, similar to Rushmore's tower located at 1715 Cambell Street, had been the plan on through the fall of 2008. This type of structure is more costly than an equivalent guyed tower, but it does provide a better visual impact and it can provide good flexibility to accommodate future antenna systems if properly designed at the outset.

Self supporting towers can also be designed to accommodate the addition or removal of more sections, if needed at a later date. Such was the case at RC Fire Station 6, where several of the top sections were later removed.



RC Fire Station Six

In late 2008, West River expanded the list of tower options to include the use of a monopole design for the new Rapid Valley structure.

Monopoles typically are the highest cost option of the three basic structure types and it can be difficult to add extra antenna systems to these towers without good planning and considerable expense. Access is more problematic and use of an aerial lift may be required depending upon the work at hand.

In recent time, there have been a number of monopole structures erected in the Rapid City area by the local cellular providers. Some of these structures have included a top mounted radome assembly, flag and night lighting. The antenna systems mounted within the radomes of these towers have typically been of a sectored design, operating in the 800 MHz or 2G spectrum.

Use of a monopole design with an integral radome does not appear to be a feasible solution for West River Electric Association:

- There does not appear to be any known way to install microwave dish antennas within the radome of a flag-type structure.
- 150 MHz directional antennas, needed to control the repeaters at Cabot, Enning and Wall equally will not fit within the radome of a flag-type structure.
- Monopole towers with integral radomes largely preclude the use of Omni-directional antennas. For a cellular application designed with sector antennas, this is generally a

non-issue. But the cooperative's broadcast requirements, although few, anticipate the use of Omni-directional antennas. Omni-directional antennas typically require a separation of several feet from any adjacent metal supports and the effects of a placement immediately next to the center support of the radome assembly were unknown at this writing. Probably some arrangement could be made to harness together three or more 150 MHz antennas to create an Omni-directional pattern. But it would be cumbersome and costly proposition at best.

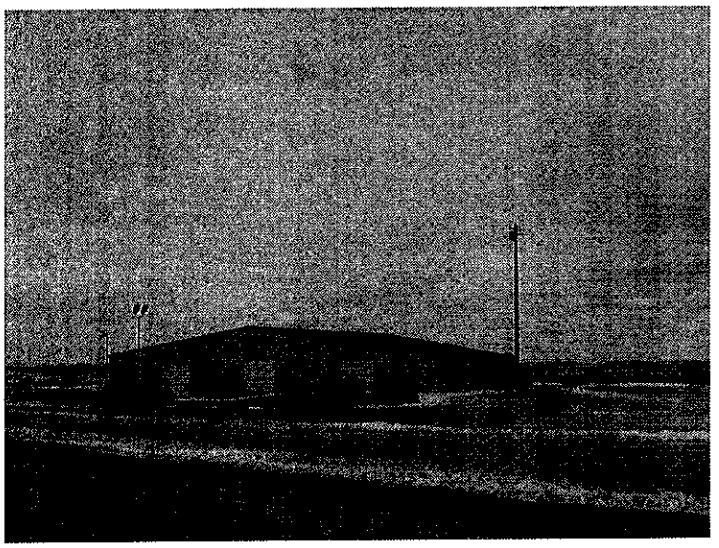
Several other issues have been identified as a problem for this application:

- Installation of a flag on a monopole with externally mounted directional VHF or microwave antennas will create a direct mechanical conflict with both the flag and any hoisting rope needed to attach the flag.

- The installation of flag lighting will focus a significant amount of light energy into the night sky. At a time when most utilities are being directed reduce the night sky effect from street lights; this proposed application would seem to be in direct conflict. With particular respect to the Rapid Valley location, placement of lights on the Rapid Valley structure could possibly conflict with the adjacent Elk Vale bypass – which lies approximately 20' above the base elevation of the proposed tower site.

- It is estimated that the yearly energy use of flag lighting could total approximately 8760 kWh per year. This energy use approaches the usage of a small sized house. While the cooperative can probably afford the energy cost, it will add to the costs of doing business via increased system loss.

- Several monopole structures are in use at cooperative locations throughout South Dakota. Indeed, West River has such a structure in service at its Wall office, located at I-90 Exit 109 – a photo of which follows below. There are no monopole structures with integral radomes in use on any of the South Dakota cooperative systems, for the reasons stated above. Even if the arrangement could be made to work, it would be a one-of-a-kind situation, and it could present significant maintenance and safety concerns for cooperative crews.



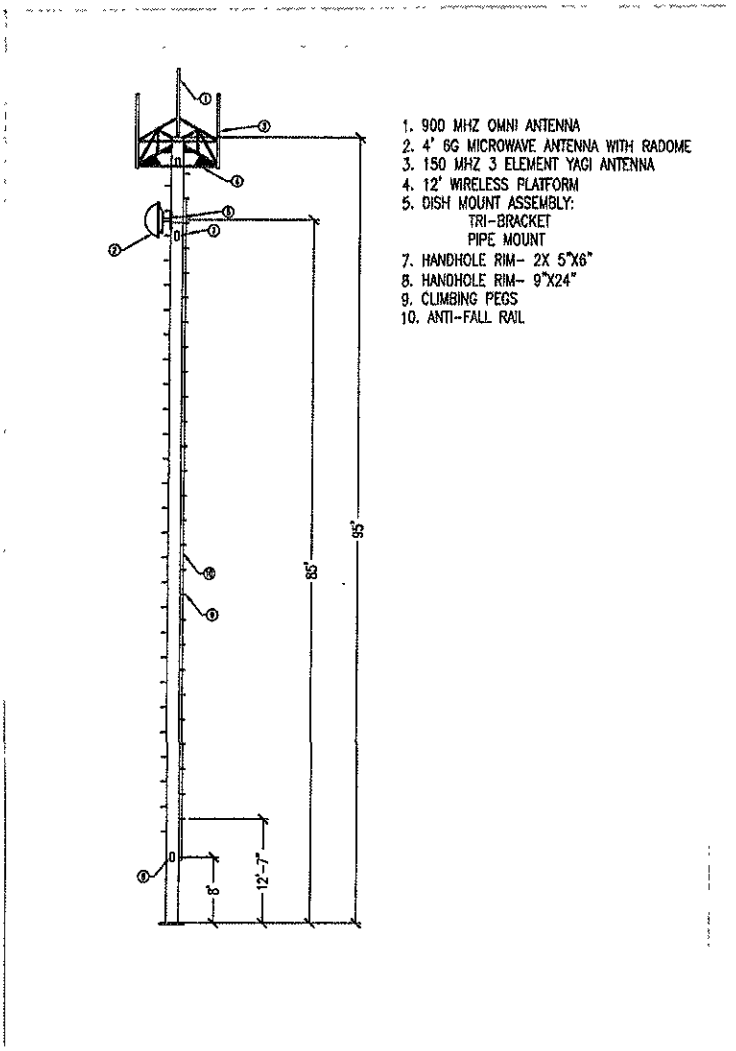
WREA Wall Office

PROPOSED SOLUTION

Use of a guyed tower was excluded from the outset. Plans for a self-supporting tower were later excluded at the direction of Growth Management staff. Possible incorporation of a radome assembly into a monopole design is viewed to be technically infeasible for the cooperative application.

West River proposes to construct a 95' monopole tower at the location of the new Rapid Valley office at 3250 East Highway 44. The structure would include a top mounted platform to support externally mounted Omni-directional and point to point 150 MHz control antennas. The structure would look similar to the facility located at the downtown office of Montana Dakota Utilities, but with different antennas and the addition of a six foot microwave dish to be located at the 85' centerline.

A copy of the plan view and elevation can be found in the Appendix of this report. West River believes that this design will most closely meet the desires of Rapid City Planning and Zoning, but yet preserve the communications needs now and for the future for West River and Rushmore.



MJB 25Mar09

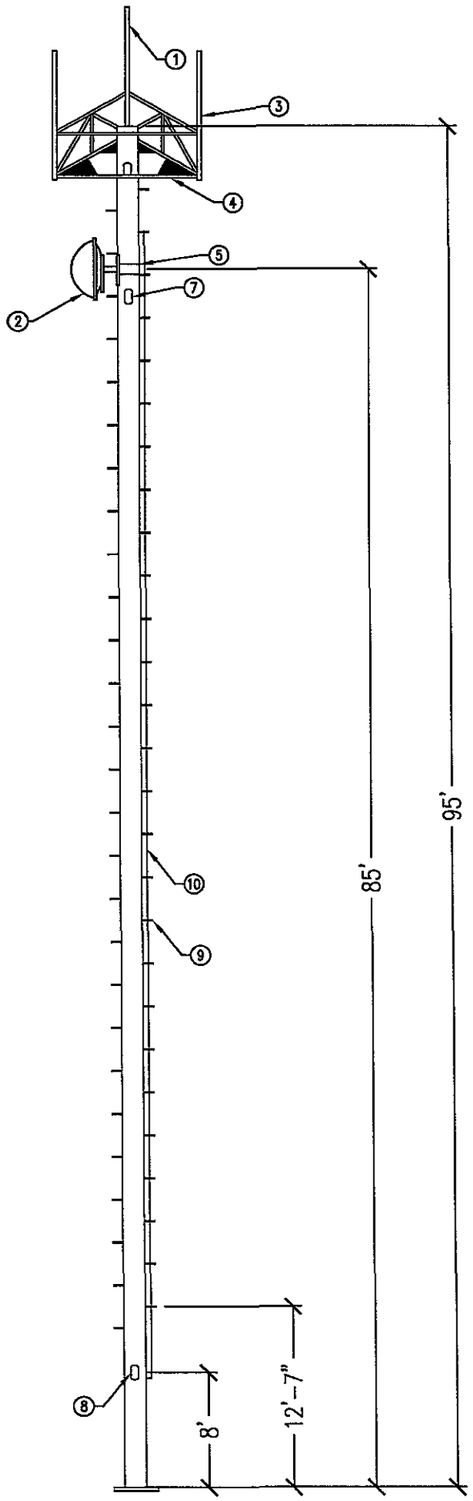
APPENDIX

Sheet 1 – Elevation & Sections

Sheet 2 – Sections

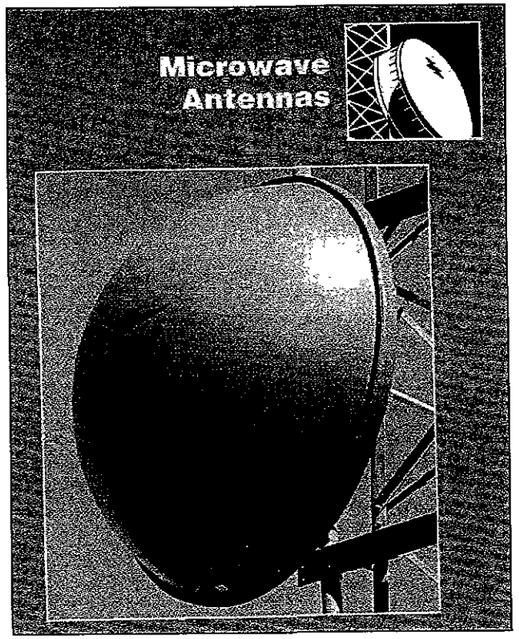
Sheet 5 – Path Profiles at 90' AGL

Sheet 6 – Sample Foundation Plan

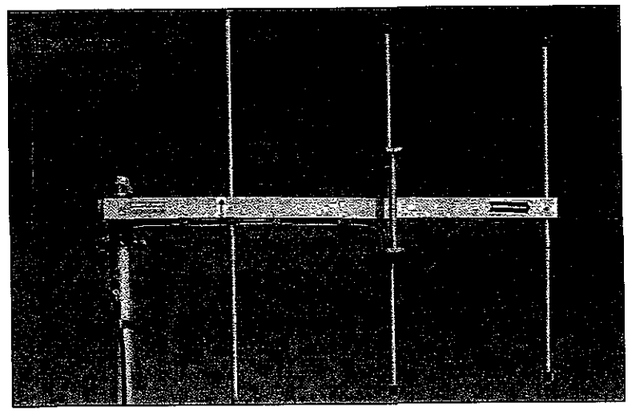


1. 900 MHZ OMNI ANTENNA
2. ~~6~~ 6G MICROWAVE ANTENNA WITH RADOME 6'
3. 150 MHZ 3 ELEMENT YAGI ANTENNA MJB 3/25
4. 12' WIRELESS PLATFORM
5. DISH MOUNT ASSEMBLY:
   TRI–BRACKET
   PIPE MOUNT
7. HANDHOLE RIM– 2X 5"X6"
8. HANDHOLE RIM– 9"X24"
9. CLIMBING PEGS
10. ANTI–FALL RAIL

OMNI ANTENNA



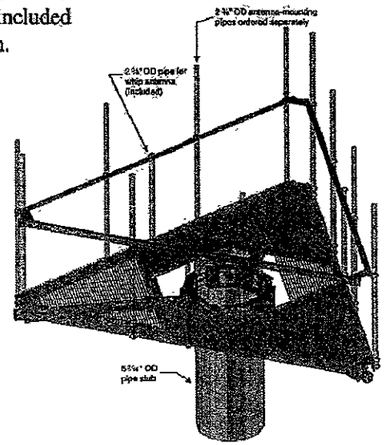
6' ~~6~~ 6G MW ANTENNA MJB 3/25



150 MH2 3 ELEMENT
TAGI ANTENNA

WIRELESS PLATFORM
FOR POLYGON & ROUND POLE STRUCTURES

Three-Sided Wireless Platforms, for round and polygon poles with 12 or more sides, are designed to support up to five Panel Antennas on each Platform face. The Platform mounts to the pole using a separately ordered Tri-Bracket (page 10.1). Wireless Panel Antennas mount to the Platform on separately ordered 2⅜" OD Antenna Mounting Pipes. U-bolts for twelve Antenna Mounting Pipes are included with every Platform.



Platforms with Hatches and Handrail Kits

Product Number	Min. Dia	Max. Dia	Outside Antenna Separation	List Price
B2044	1'	2'	8'-7"	$2,800.00
B1833	1'	2'-½"	12'	$2,850.00
B1894	2'-½"	3'-8"	12'-10"	$2,950.00
B1895	3'-8"	4'-6"	12'-10"	$3,050.00

WEST RIVER ELECTRIC COOPERATIVE
RUSHMORE ELECTRIC POWER COOPERATIVE

RAPID VALLEY TOWER

ELEVATION 95'

DRAWN/CHECK BY: AK/MB		SHEET:
02/23/09	SCALE: 3/32"=1'–0"	1

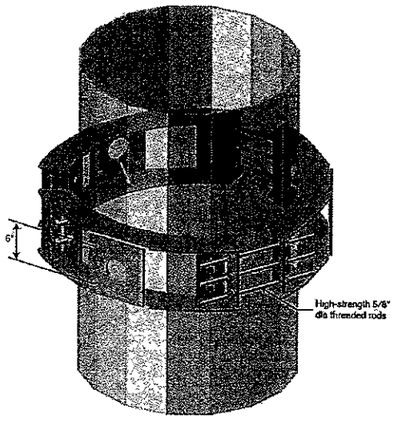
I:\Towers\Rapid Valley Office\Drawings\Rapid Valley Monopole

Universal Tri-Bracket

Universal Tri-Bracket fits round poles and polygonal poles with 12 or more sides. The innovative design provides at least 18 points of contact with the pole to prevent rotation and can be installed at any azimuth on the pole for precise antenna alignment.

Provides 3 mounting arm locations 120 degrees apart.

Galvanized.



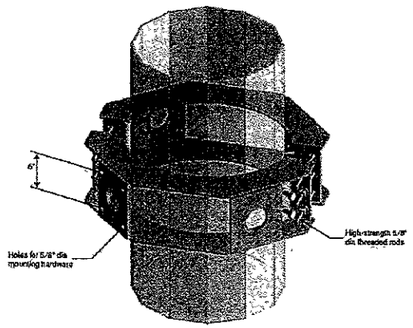
Product Number	Description	List Price
B2592	Fits 10' to 2'-1" Pole Diameter	$690.00
B2593	Fits 1'-10" to 3'-2" Pole Diameter	$750.00
B2594	Fits 3' to 4'-2" Pole Diameter	$1,090.00
B2606	Fits 4' to 5' Pole Diameter	$1,190.00

Universal Quad-Bracket

Universal Quad-Bracket fits round poles and polygonal poles with 12 or more sides. The innovative design provides at least 24 points of contact with the pole to prevent rotation and can be installed at any azimuth for precise antenna alignment.

Provides 4 mounting arm locations 90 degrees apart.

Galvanized.



Product Number	Fits Pole Diameter	List Price
B2723	Fits 1' - 1'-6" Pole Diameter	$560.00
B2724	Fits 1'-6" - 2' Pole Diameter	$590.00
B2725*	Fits 2' - 2'-6" Pole Diameter	$660.00
B2726*	Fits 2'-6" - 3' Pole Diameter	$780.00
B2727*	Fits 3' - 3'-6" Pole Diameter	$895.00
B2769*	Fits 3'-6" - 4' Pole Diameter	$995.00

*Parts can be used to support a four-sided platform (B2740)

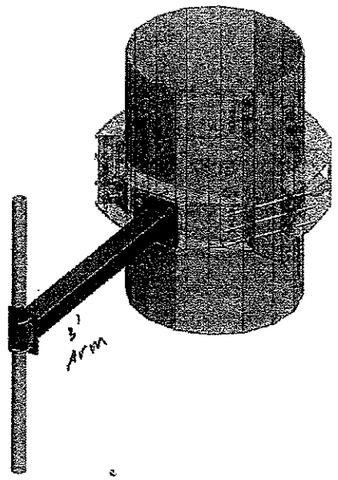
Standoff Mount

For Single Wireless Antenna

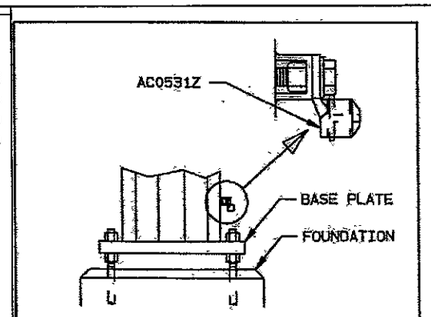
This Standoff Mount provides support for a single wireless sector antenna from the Tri-Bracket. The Standoff Mount bolts to the separately ordered Tri-Bracket (page 10.1) with included ⅝" diameter hardware.

The wireless panel antenna mounts on a separately ordered 2⅜" OD Antenna-Mounting Pipe (page 8.1).

Galvanized.

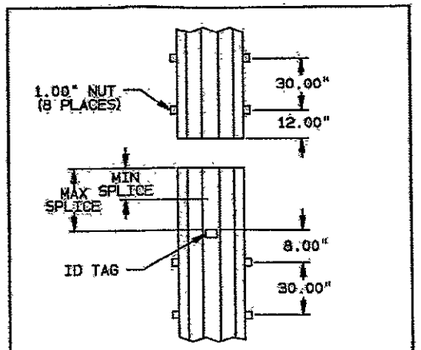


Product Number	Description	List Price
B1826	4' Standoff Mount for single antenna	$180.00
B2434	1'-6" Standoff Mount for single antenna	$125.00
B2758	2' Standoff Mount for single antenna	$130.00
B2759	3' Standoff Mount for single antenna	$140.00



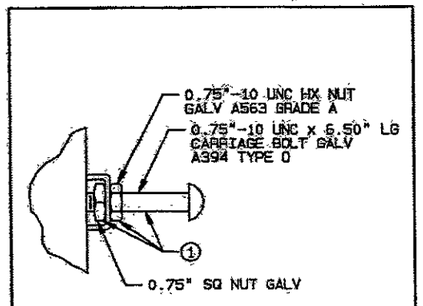
SEE CC10258 FOR CAGE INFORMATION.
A MINIMUM OF TWO FULL THREADS IS REQUIRED ABOVE TOP NUTS.

BASE PLATE CONNECTION



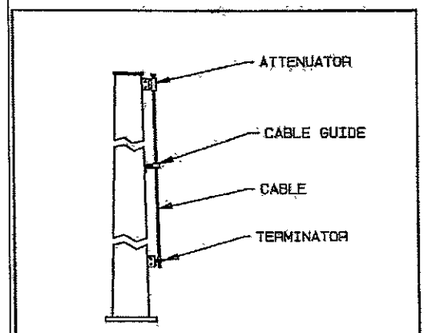
REFER TO ELEVATION VIEW FOR MINIMUM AND MAXIMUM SPLICE VALUES.

SPLICE CONNECTION

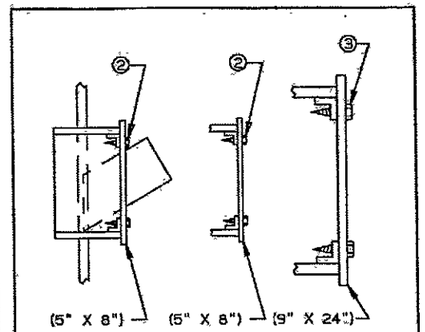


TURN STEP BOLTS UNTIL FRONT EDGE TOUCHES POLE SHAFT

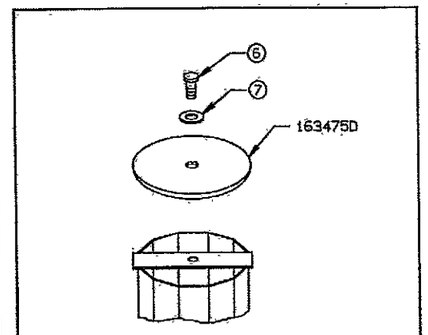
POLE STEP KIT



SAFETY CLIMBING ASSEMBLY



HANDHOLE COVERS



POLE CAP CONNECTION

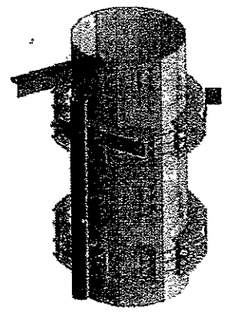
Pipe Mount

For Dish Antenna

The Pipe Mount provides support for a dish antenna and for the antenna's strut(s). The Mount includes a 4½" OD x 5' long pipe and both long and short side-strut brackets that accommodate a wide range of antenna sizes and pole diameters.

The Pipe Mount installs on two separately ordered Tri-Brackets (page 10.1) with included ⅝" diameter hardware.

Galvanized.



Product Number	Description	List Price
B1832	Pipe Mount for dish antenna	$170.00

WEST RIVER ELECTRIC COOPERATIVE
RUSHMORE ELECTRIC POWER COOPERATIVE

RAPID VALLEY TOWER

SECTIONS

DRAWN/CHECK BY: AK/MB		SHEET:
02/23/09	SCALE: NTS	2

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09PD007

Rushmore Electric Power Cooperative, Inc.
Frequency: 900MHz; ERP: 500W

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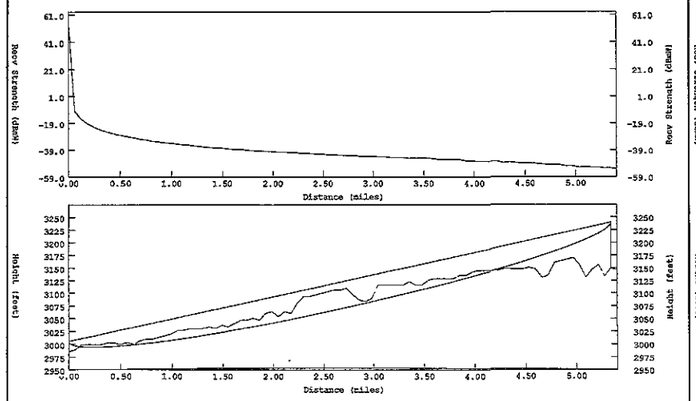
February 27, 2009

Study: Airport Sub to RV Office Tower (Survey Site-90')
TX Site: Airport Sub (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 5.34 mi, 303.5 degrees

TX Latitude: N44-01-23.96
TX Longitude: W103-04-14.18
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 150MHz; ERP: 500W

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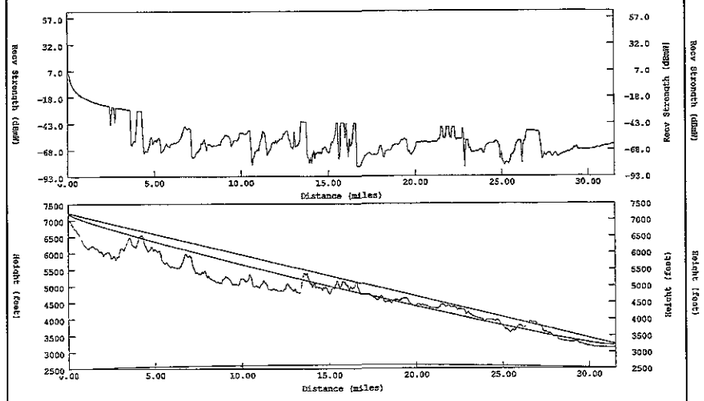
February 27, 2009

Study: Bear Mtn to RV Office Tower (Survey Site-90')
TX Site: Bear Mtn (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 31.50 mi, 64.9 degrees

TX Latitude: N43-52-26.80
TX Longitude: W103-44-05.70
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 150MHz; ERP: 500W

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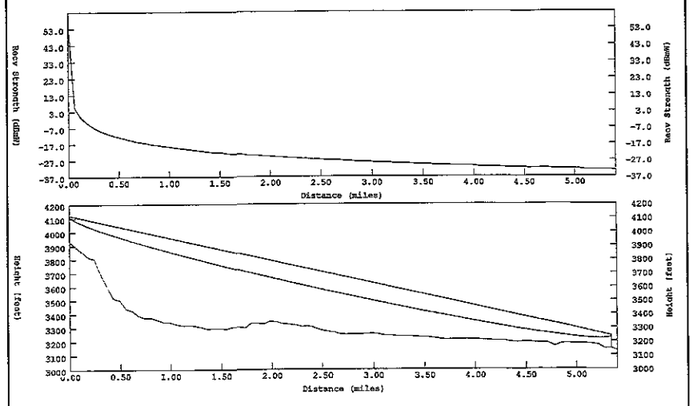
February 27, 2009

Study: Cabot to RV Office Tower (Survey Site-90')
TX Site: Cabot Hill (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 5.35 mi, 129.2 degrees

TX Latitude: N44-05-54.00
TX Longitude: W103-14-38.00
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc
Frequency: 6GHz; ERP: 500W

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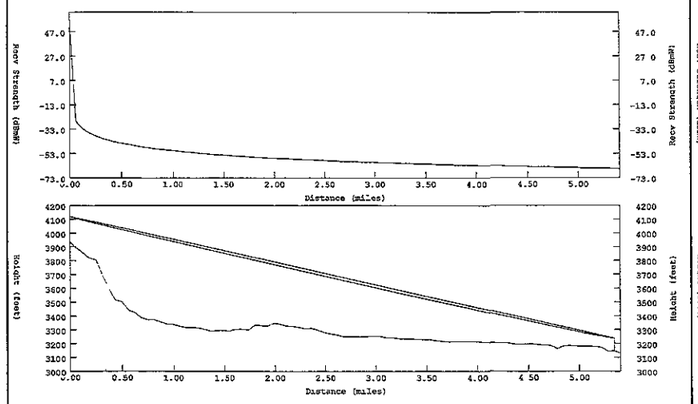
February 27, 2009

Study: Cabot to RV Office Tower (Survey Site-90')-6GHz
TX Site: Cabot Hill (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 5.35 mi, 129.2 degrees

TX Latitude: N44-06-54.00
TX Longitude: W103-14-38.00
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 150MHz; ERP: 500W

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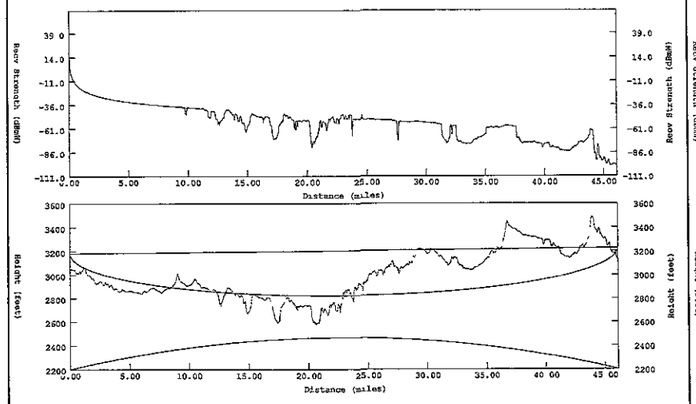
February 27, 2009

Study: Enning to RV Office Tower (Survey Site-90')
TX Site: WREA-Enning (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 46.08 mi, 220.2 degrees

TX Latitude: N44-34-38.00
TX Longitude: W102-33-38.00
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 6GHz; ERP: 500W

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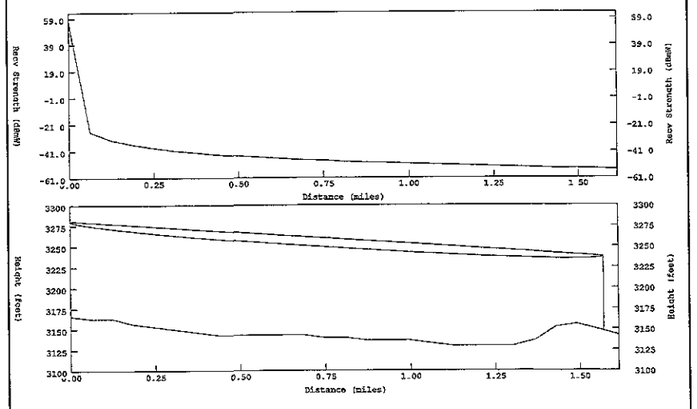
February 27, 2009

Study: REPC to RV Office Tower (Survey Site-90')-6GHz
TX Site: REPC (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 1.57 mi, 95.9 degrees

TX Latitude: N44-04-06.00
TX Longitude: W103-11-30.60
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 900MHz; ERP: 500W

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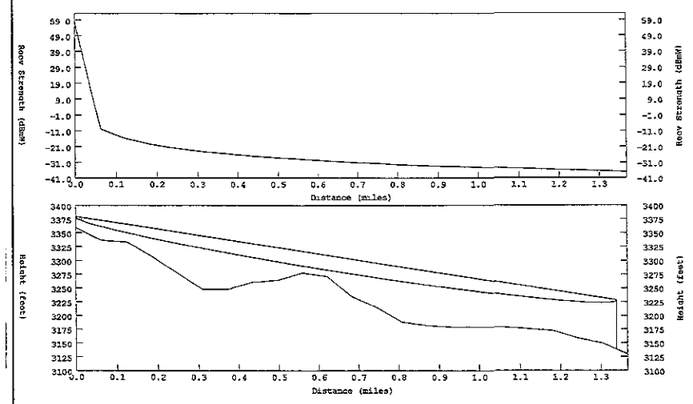
February 27, 2009

Study: St Pat Sub to RV Office Tower (Survey Site-90')
TX Site: St. Pat Sub-NE (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 1.34 mi, 207.2 degrees

TX Latitude: N44-04-59.85
TX Longitude: W103-08-52.89
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc.
Frequency: 150MHz; ERP: 500W

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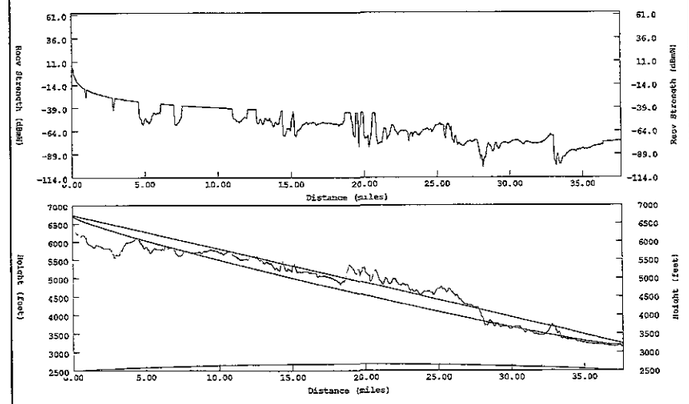
February 27, 2009

Study: Terry Peak to RV Office Tower (Survey Site-90')
TX Site: Terry Peak (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 37.65 mi, 118.4 degrees

TX Latitude: N44-19-36.90
TX Longitude: W103-49-39.70
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



Rushmore Electric Power Cooperative, Inc
Frequency: 150MHz; ERP: 500W

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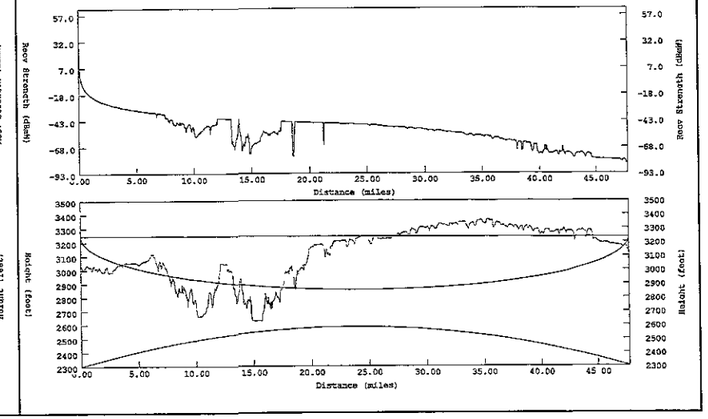
February 27, 2009

Study: Wall to RV Office Tower (Survey Site-90')
TX Site: WREA-Wall (Tower)
RX Site: WREA-RV Office (Tower-GPS)
TX --> RX: 47.74 mi, 284.8 degrees

TX Latitude: N43-53-38.00
TX Longitude: W102-13-51.00
RX Latitude: N44-03-57.63
RX Longitude: W103-09-37.35



WEST RIVER ELECTRIC COOPERATIVE
RUSHMORE ELECTRIC POWER COOPERATIVE

RAPID VALLEY TOWER – (90' AGL)

PATH PROFILES

DRAWN/CHECK BY: ESN/MB		SHEET:
02/27/09	SCALE: NTS	5

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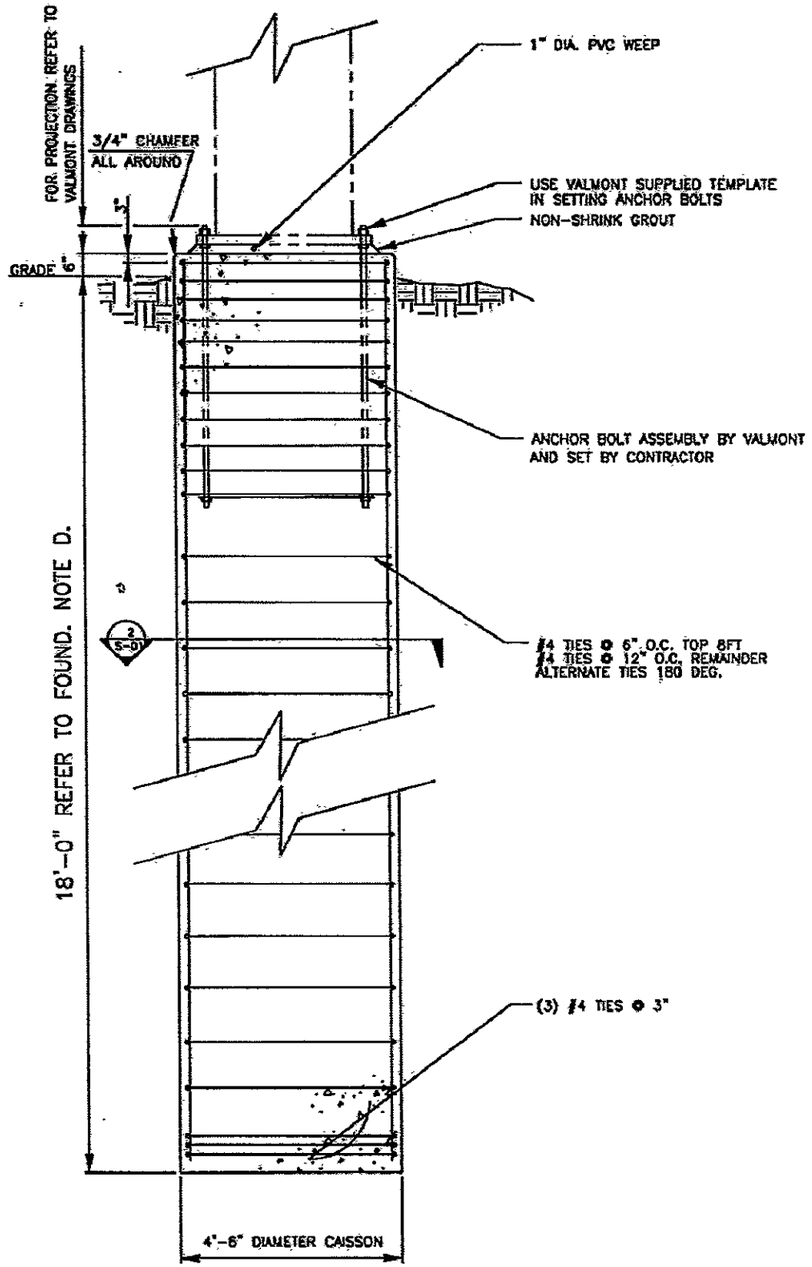
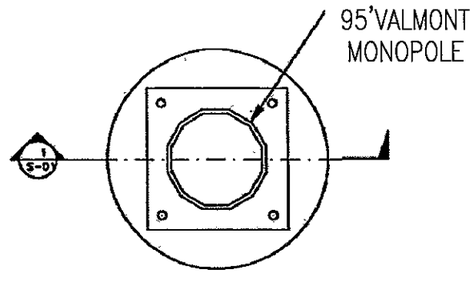
09PD007

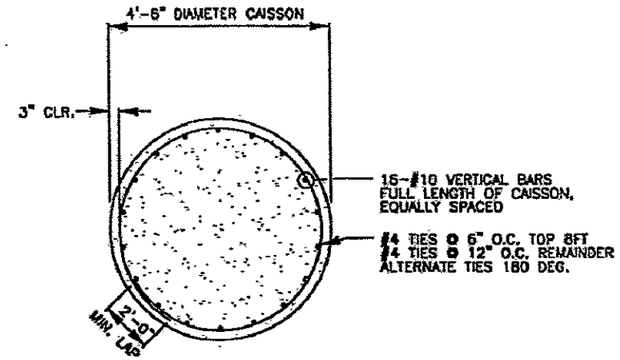


1 S-01 SECTION
SCALE: NONE



FOUNDATION PLAN

PLAN NOTES:
1. VERIFY ANCHOR BOLT LAYOUT PRIOR TO CONSTRUCTION.



2 S-01 SECTION

WEST RIVER ELECTRIC COOPERATIVE RUSHMORE ELECTRIC POWER COOPERATIVE		
RAPID VALLEY TOWER		
SAMPLE FOUNDATION PLAN		
DRAWN/CHECK BY: AK/MB		SHEET:
02/23/09	SCALE: NTS	6
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