



November 3, 2011

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Ms. Pebbles Clark  
Reclamation Specialist  
Montana Department of Environmental Quality  
Abandoned Mine Lands Program  
P.O. Box 200901  
Helena, MT 59620-0901

Report of Subsidence Investigation – Phase 1  
501 Broadway Avenue South  
Red Lodge, Carbon County, MT

Dear Ms. Clark:

The following memorandum summarizes the investigation activities performed by DOWL HKM during August and September 2011 in regards to a complaint of subsidence at the above referenced property located in Red Lodge, Montana. This work was completed as outlined in Task Order No. 19, which was issued pursuant to DEQ Contract No. 407033 between DOWL HKM (Contractor) and the Montana Department of Environmental Quality (DEQ). The purpose of Task Order No. 19 is for review of existing background data in the area of the subject property related to the settlement complaint by Mr. Marvin Dukart performing a limited site survey and inspection.

If you have any questions regarding this project, please contact me at (406) 869-6372 or email to [cpeterson@dowlhkm.com](mailto:cpeterson@dowlhkm.com).

Sincerely,

DOWL HKM

A handwritten signature in black ink, appearing to read "Charles L. Peterson".

Charles L. Peterson, PG  
Project Manager

A handwritten signature in blue ink, appearing to read "Carla Van Sieten".

Carla Van Sieten, PG  
Geologist/GIS Specialist

Encl. Memorandum Report and CD

## MEMORANDUM

TO: Ms. Pebbles Clark, Reclamation Specialist  
Montana Department of Environmental Quality  
Abandoned Mine Lands Program

FROM: Charles L. Peterson, PG, Project Manager  
Carla Van Siclen, PG, Geologist/GIS Specialist

SUBJECT: Report of Subsidence Investigation – Phase 1  
501 Broadway Avenue South  
Red Lodge, Carbon County, MT

DATE: November 3, 2011  
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### PROJECT DESCRIPTION

On August 24, 2011, on behalf of Mr. Marvin Dukart, owner of the subject property, the mayor of Red Lodge, Brian Roat, contacted the Montana Department of Environmental Quality Abandoned Mine Lands Program (DEQ-AML) regarding potential settlement at 501 Broadway Avenue South. The location of the subject property is shown on Figure 1 in Appendix A. According to the Mayor there “is a rapid subsidence going on at this address—in front with the sidewalk and at the front of the house—front porch is pulling away from the house.” A request was made by the DEQ-AML to conduct an initial site visit to assess the reported settlement. Current and future assessment activities by the DEQ-AML and DOWL HKM are directed at determining if settlement at the subject is property is directly related to mine subsidence or other mining related activities.

On August 25<sup>th</sup>, 2011 DOWL HKM Professional Geologist, Carla Van Siclen, and Licensed Surveyor, Bob Rux, conducted a site inspection of the house and property and performed a limited spot elevation survey of the area of settlement at the front of the house. Photos were taken during the August 25<sup>th</sup> site visit (See Appendix B). On August 30<sup>th</sup> Charlie Peterson and Carla Van Siclen performed a second site inspection of the subject property to review the surveyed locations and observations made during the previous visit. The following sections provide the results of the survey and site inspection.

### BACKGROUND

#### Local Geologic Setting

Red Lodge, Montana is located on the northern edge of the Beartooth Mountain Range along the Rock Creek valley. Quaternary alluvial terraces and recent alluvium overlie the Tertiary Fort Union Formation in the area. Figure 2 in Appendix A is a geologic map of the Red Lodge area (Lopez, 2005). A thick Quaternary alluvial terrace deposit (Qat2) forms the west edge of the valley and is referred to as the West Bench. Thinner deposits of Quaternary alluvium (Qat3 and Qat4) overlie the

Fort Union which has been eroded to form the east edge (East Bench) of the valley. The town of Red Lodge is underlain by Quaternary terrace deposits and recent alluvium (Qat1 and Qal).

Based on a review of published material and well logs, the thickness of the alluvium appears to vary from a few feet to over 100 feet in the valley bottom. As part of a preliminary study of the potential for subsidence in the Red Lodge and Bearcreek Areas, Chen-Northern (1987) advanced a drill hole (DH-3) to 450.5 feet approximately two to three blocks north of the subject property (Figure 3 in Appendix A). The base of the alluvium was encountered at a depth of 108 feet. At least 85 feet of alluvium was encountered in drill hole DH-4 advanced as part of the Spectrum (1998) investigation and grouting project. However, during well log research of the Montana Bureau of Mines and Geology (MBMG) Groundwater Information Center (GWIC) website several well logs along the central and east sides of town noted encountering relatively shallow (less than 25 feet) bedrock (Figure 3 in Appendix A).

Some of the wells penetrated bedrock fifty feet or more and were installed by different drilling companies. Note that the Object ID listed near each well can be used as a cross reference with Table 1 in Appendix C. Table 1 presents additional well information obtained directly from the GWIC website, with the exception of the "Depth to Bedrock" information which was added by DOWL HKM after review of the well logs. There is some indication that the exploration holes referenced in Campbell (1906) also encountered bedrock at a shallow depth. Based on this information, relatively shallow bedrock may exist below the subject property.

The Fort Union Formation is readily exposed along the east bench and consists of mainly shale, siltstone, sandstone, and coal deposits. The bedrock in the Red Lodge area dips approximately 25 degrees to the south-southwest toward the Beartooth Mountains (Lopez, 2005). The coal deposits are part of the Red Lodge-Bearcreek Coal Field, formerly the Red Lodge Coal Field (Roberts, 1999 and Woodruff, 1909). The coal deposits are present on the east and west benches as well as below the town of Red Lodge.

### Groundwater

As previously mentioned; groundwater well information was retrieved from the MBMG GWIC database and reviewed. Well locations were plotted in ArcGIS using the latitude and longitude coordinates provided in the GWIC database and are shown on Figure 3 in Appendix A. Note that the accuracy of the coordinate locations provided by GWIC can vary substantially depending on the method used to locate the wells. According to the GWIC metadata, some wells were located using a more accurate Global Positioning System (GPS) and a site visit has been conducted. However, most of the wells were located by contract drillers and landowners using a township, range, section, and tract description and substantial errors in location are possible. Additional well information is provided in Table 1 in Appendix C.

The depth of groundwater below the surface near the subject property appears to be in the range of 5 to 18 feet. According to the MBMG GWIC website 15 long term monitoring stations exist in Carbon County. However, only one well (Object ID 32) is located in the valley bottom. This well is located approximately eight blocks north of the subject property and is completed at a depth of 38 feet in alluvium. Static water level readings have been collected at this site since 2002. Water level readings were relatively consistent from 2002 through 2010 and ranged from about 12 to 14 feet below ground surface. However, in 2011 the range in water level readings varied from about 9 feet

to 15.6 feet below the ground surface. Review of the United States Geological Survey (USGS) National Water Information System Mapper website, no long term groundwater monitoring sites maintained by the USGS are located in the town of Red Lodge. No additional water level information was reviewed for this study.

### Mining History

Coal was first discovered along the east side of the Rock Creek drainage in the mid-1860's (Spectrum, 1989 and Anderson, 1983). There was no accessible market at the time, but with the completion of the Laurel to Red Lodge railroad in 1889, commercial mining commenced (Spectrum, 1989 and Anderson, 1983). The Red Lodge mining district consisted of two mines, the Sunset and Red Lodge Mines, referred to on the Carbon County Historical Society website as the West Side or Sunset Mine and the East Side or Sunrise Mine, respectively.

Campbell (1906) identifies eleven coal beds in the Red Lodge area and notes that additional thin beds of coal occur lower down in the rock section. Roberts (1999) states that "in the Red Lodge district, at least seven coal beds, originally designated as coal beds 1 through 7, were identified in the coal-bearing interval of the Fort Union." Two additional beds were later discovered which are referred to as beds Number (No.) 1½ and 4½ (Roberts, 1999 and Woodruff, 1909). According to Combo (1949), eight beds of coal (No. 1, 1½, 2, 3, 4, 4½, 5, and 6) are known to have been worked in the vicinity of Red Lodge.

Hard copies of the historic mine maps and information related to a project conducted by MSU-B College of Technology which took the historical mine maps and converted them to a three dimensional electronic format was provided to DOWL HKM by DEQ-AML. The MSU-B information indicates that maps for coal beds No. 1½, 2, 3, 4, 5, and 6 were located and converted to a digital format. A preliminary summary memo for the MSU-B project indicates that they were not able to locate any records for beds No. 4½, 7, or 8. There is also no information on coal bed No. 1 in the data from the MSU-B project. Although they may exist, it appears that historic mine maps for these four beds have not been located. Also, based on review of the Chen-Northern (1987) report, another map showing mining of the No. 2 bed below the town of Red Lodge exists. Historical mine maps exist for six of the eight beds known to be worked in the vicinity of Red Lodge (No. 1½, 2, 3, 4, 5, and 6). It is the understanding of DOWL HKM that no maps have been located for beds No. 1 or 4½ or beds No. 7 or 8, which *may indicate* these beds were not mined extensively in the Red Lodge area.

Mine workings underlie the East and West Benches as well as portions of the town of Red Lodge. Preliminary review of the Chen-Northern (1987) report, historical maps, and the data developed by MSU-B show that the No. 4 and No. 5 beds were mined in the area below the subject property. The No. 2 bed was mined to within approximately ½ block south of the subject property. The No. 2 bed would have had workings closest to the surface in the area of the subject property. However, no underground mine map of the No. 2 bed in this area has been located by the DEQ-AML. As part of a preliminary study of the potential for subsidence in the Red Lodge and Bearcreek Areas, Chen-Northern (1987) borrowed mine maps from Meridian Minerals and developed three maps of the Red Lodge area showing depth of cover, cumulative mined thickness, and subsidence potential. Electronic versions of these maps, which were imported into ArcGIS and geo-referenced by DOWL HKM are presented in their modified form as Exhibits 1, 2, and 3 in Appendix A. The cumulative mined thickness map (Exhibit 2 in Appendix A) shows that anywhere from zero to 18 feet of

material has been mined from below the area of the subject property with what appears to be the area of greatest thickness (18 feet) located near the northeast corner of the lot. Chen-Northern (1987) also developed cross sections of mine limits (Exhibit 4 in Appendix A), the locations of which are shown on Exhibit 1. However, note that cross section A-A' and C-C' are mislabeled and should be reversed when comparing the cross sections to the maps.

Relatively shallow bedrock may exist below the subject property, however, based on Chen-Northern's interpretation (Exhibit 1 and Cross section B-B'), it appears that mining in the area of the subject property occurred about 500 feet below the ground surface and deeper. South of the subject property (about ½ block) it appears that the No. 2 bed was mined at a depth of between 300 and 350 feet. Note that the original mine maps and any maps interpreted from the original mine maps may have some level of inaccuracy associated with them. Reasons for these inaccuracies could range from original survey errors to assumptions made during conversion to an electronic format. The location of the pillars, voids, tunnels, and any below grade features should be considered approximate.

The coal production in 1889 was 6,000 tons and in 1920 production was over a million tons (Spectrum, 1989 and Anderson, 1983). In 1924, coal production began in Colstrip, Montana, forcing a cut back in production at Red Lodge (Spectrum, 1989 and Anderson, 1983). The West Side Mine closed July 31, 1924 and the East Side Mine closed June 30, 1932 (Zupan and Owen, 2000). According to the Mining Artifacts & History website, "The Great Depression forced more mines to close, and in 1943 an underground explosion killed 74 men at the Smith Mine in Bearcreek four miles east of Red Lodge, devastating the community and effectively ending coal mining in Carbon County."

Subsidence related to the mining activities has been documented east of Red Lodge and in the Bear Creek Area (Spectrum, 1989). Chen-Northern (1987) only identified two small areas of moderate subsidence potential on the east side of town, just south of the subject property (Exhibit 3, Appendix A). It has been approximately 70 to 80 years since mining ceased in the Red Lodge area. Although subsidence related to mining could have occurred in that time, based on the information reviewed by DOWL HKM, it appears that the Hymer Mine Shaft subsidence on Adams Avenue South is the only documented active subsidence within the town of Red Lodge.

### History of the Subject Property

DOWL HKM reviewed the Sanborn Fire Insurance maps of the property from 1891, 1896, 1901, 1907, 1912 and 1927 at the Carbon County Historical Society in Red Lodge, Montana. There is no Sanborn map coverage of the property in 1891, 1896, or 1901. The 1907 Sanborn map shows a small cabin located in the south-central portion of the lot. However, on the 1912 and 1927 Sanborn maps the cabin is gone and a structure/home is shown in the same general location as the current home. There is also a small structure in the northwest corner of the property. It appears that the main part of the house was constructed between 1907 and 1912. No detailed information regarding the settlement or the progression of settlement was obtained prior to the site inspection.

## FIELD INVESTIGATION

### Site Inspection

The site inspection included visual inspection of the property and the exterior of the house at 501 Broadway Ave. S. and taking photographs of pertinent features (See Figure 4 in Appendix A, and Appendix B). The general condition of the sidewalk and street (Broadway Ave. S.) were also noted. The residence at 501 Broadway Ave. S. is a two story wooden framed house built upon a mixed concrete/concrete block foundation. There is a set of concrete stairs leading up to the front entrance. There is a deck and entrance at the back of the house. The deck obscures the south half of the west foundation wall. There appears to be additions to the original structure at the front and back of the house. Most of the concrete portion of the foundation appears to be covered with a stucco facade. The entire foundation appeared to have been recently painted. The house is provided with city water and sanitary sewer service, underground natural gas and overhead electric service.

There is a concrete (city) sidewalk along the east side of the property. A concrete walkway was observed leading from the city sidewalk to the front steps. A low spot and significant crack in the city sidewalk was very apparent. DOWL HKM probed the crack in the city sidewalk and it appeared to be open to a depth of about 4 inches. An offset crack in the walkway just below the front steps was also observed. The settlement in the city sidewalk appears to have existed for a period of time as grass had grown into the low spot along the crack. However, fresh pieces of broken concrete in the city sidewalk and a fresh looking surface to the cracked concrete in the walkway possibly indicate recent movement.

The yard surrounding the house consists of a lawn and a few trees and ornamental bushes and no underground sprinkler system was observed. There is a detached garage/structure located along the west side of the lot. There was no obvious depressions in the yard with the exception of the area near the cracked concrete sidewalk east of the house. A crack was also noted in the asphalt pavement of Broadway Ave. S. that generally lines up with the cracks in the sidewalk and walkway but no obvious low spot was observed in the street.

Most of the house foundation is visible but somewhat obscured by paint and stucco. However, overall the foundation appeared to be in relatively good condition with the exception of the area near the northeast corner of the house. Two cracks were observed on either side of the concrete steps at the contact with the foundation (front addition) of the house. These cracks were open and the crack on the north side appeared to be offset slightly down to the east (indicating some recent settlement of the concrete stairs). Another open crack was observed near the northeast corner of the house where the front addition and the main foundation of the house meet. The crack was observed in the stucco façade and may not penetrate the entire foundation wall. This open crack may indicate possible settlement of a portion of the foundation, although it may just be the stucco façade cracking in response to the settlement of the front stairs. Other hairline cracks were observed in the foundation (Figure 4 in Appendix A).

### Spot Elevation Survey

Spot elevation measurements of the ground surface were collected of the city sidewalk and concrete walkway on August 25<sup>th</sup>, 2011. Survey locations are shown on Figure 4 in Appendix A. The vertical elevations and horizontal positions for these points were measured using a Trimble R-6 dual

frequency survey grade GPS receiver in RTK mode. The high level of horizontal accuracy that the survey grade GPS receiver provided will enable the same spot elevation locations to be re-established in the future. The vertical datum for this survey is North American Vertical Datum (NAVD) 88. The horizontal datum is North American Datum (NAD) 83. Horizontal coordinates are Montana Zone 2500 State Plane. Horizontal units are International Feet and vertical units are U.S. Survey Feet.

As was observed during the site visit, the survey shows that the low spots occur along the crack in the city sidewalk and concrete walkway (Figure 4a in Appendix A).

## CONCLUSIONS

- It appears that recent settlement of the city sidewalk, concrete walkway and front stairs at the subject property has occurred relatively recently. There is also an open crack near the northeast corner of the foundation that may indicate possible settlement of a portion of the foundation, although it may just be the stucco façade cracking in response to the settlement of the front stairs.
- The settlement appears to be limited to the northeast corner of the lot and city sidewalk.
- Based on well log review, relatively shallow (less than 25 feet) bedrock may exist below the subject property. However, mining activities appear to have occurred at depths of between 300 and 350 feet and deeper about ½ block south of the subject property and 500 feet and deeper in the area of the subject property.
- There are many reasons for the settlement of flatwork (sidewalk and walkways) and foundations that are unrelated to mine subsidence. The age of the flatwork and foundation, type of construction, foundation depth, soil and rock type present below the foundation, depth to groundwater or groundwater fluctuations, utility related issues, extreme weather conditions, and tree roots can contribute factors to the current condition of the flatwork and foundations. The location and orientation of the settlement observed in the flatwork and foundation indicate that there may be a utility related issue occurring such as a leak in a water supply line that services the house.
- Preliminary review of the Chen-Northern (1987) report, historical maps, and the data developed by MSU-B show that the No. 4 and No. 5 beds were mined in the area below the subject property. A cumulative mined thickness map developed by Chen-Northern (1987) shows that anywhere from zero to 18 feet of material has been mined from below the area of the subject property. Chen-Northern (1987) also shows the No. 2 bed was mined to within approximately ½ block south of the subject property. The No. 2 bed would have had workings closest to the surface in the area of the subject property. However, no underground mine map of the No. 2 bed in this area has been located by the DEQ-AML. Note that the original mine maps and any maps interpreted from the original mine maps may have some level of inaccuracy associated with them and the location of the pillars, voids, tunnels, and any below grade features should be considered approximate.

## RECOMMENDATIONS

Based upon review of the information supplied by DEQ-AML, published information, the site inspection, and survey results, to determine if the observed settlement is directly related to mine subsidence or other mining related activities, the following recommendations are made:

- Leaking water lines can cause soil settlement or migration of fine-grained soil along the utility trench and subsequent settlement. DOWL HKM recommends the water supply line servicing the house be located and tested for leaks and all utility line locations be documented. DOWL HKM has requested a utility locate in order to confirm the utility locations including the water line that services the house. On September 14, 2011, DOWL HKM submitted a utility locate request to the one-call utility locate service to have the utilities marked for this property. However, no utilities had been marked as of September 17, 2011. A follow-up field check should be conducted to make sure utilities have been marked.
- It is recommended that periodic site inspections and surveys be completed to monitor and document any potential settlement. The survey should include repeating the initial survey to document the location, rates, and magnitude of any subsidence. It is recommended that a survey be conducted before winter (November) and again in the spring after the snow melts.
- DEQ-AML should keep in touch with the land owner on regular basis to monitor the situation.
- DOWL HKM recommends that an interview be conducted with the landowner using a standardized questionnaire format to develop a historical perspective of the settlement observed.
- Instrumentation could potentially be installed, such as crack monitors, to gauge whether there is any additional movement in the house foundation.
- The house is built upon a mixed concrete/concrete block foundation. Most of the house foundation is visible but somewhat obscured by paint and stucco. However, overall the foundation appeared to be in relatively good condition with the exception of the area near the northeast corner of the house. As previously mentioned, there are many reasons for the settlement of flatwork (sidewalk and walkways) and foundations. Differences in foundation construction techniques within one house foundation can sometimes magnify even minor settlement of the surface soil. If the water/utility lines are found to be in sound condition, DOWL HKM recommends a shallow foundation investigation near the northeast corner of the house to document the soil types present below the footings as well as footing types and depths.
- An attempt should be made to locate any additional mine maps or mine related information, particularly the map of the No. 2 bed or any information referenced in the Chen-Northern (1987) report specific to the Red Lodge area mining.



- A sub-surface exploration program may be considered after the above mentioned recommended tasks are completed.
- The objectives of any sub-surface exploration program are recommended to determine basic geologic conditions including documenting depth to groundwater, soil types and thicknesses, and depth to bedrock. The exploration program may be designed to establish the depth, thickness, and current condition of the existing coal beds. A thorough and well designed exploration program can most likely determine whether collapse of the mined coal seams has occurred locally. However, documenting active subsidence is a separate issue and a much more difficult task. There are numerous types of drill rigs and drilling contractors that can penetrate the coarse alluvium and bedrock to the depths required by any drilling program.

### LIMITATIONS AND CONCERNS

- Very little sub-surface information exists near the subject property and no subsurface evaluation was conducted of the subject property for this study.

### REFERENCES

Anderson, Paul, 1983, Cultural Resources Inventory and Evaluation, Red Lodge East Bench-Washoe-Highway-Burns-Smith Mines; pg 8-10, Cultural Resource Division, GCM Services, Inc., Butte, Montana (presented in Spectrum, 1989).

Campbell, R. M., 1906 Contributions to Economic Geology Part II – Coal, Lignite, and Peat, U. S. Geological Survey Bulletin 316, Pgs 174-193.

Carbon County Historical Society Website, Website last accessed on September 15, 2011  
<http://www.carboncountyhistory.com/content.asp?navID=exhibits&mainNav=Exhibits&subNav=Mining&content=mining>

Carbon County Historical Society Mine Maps, various dates, provided to DOWL HKM in hard copy by Montana Department of Environmental Quality, Abandoned Mine Lands Program.

Carbon County Historical Society Mine Maps, 1904, in-house paper copies of archived information regarding Hymer Mine Shaft, located at Carbon County Historical Society building, 224 North Broadway, Red Lodge, Montana, 59068

Chen-Northern, Inc. (Northern Engineering and Testing, Inc.), 1987, Report of Investigation Red Lodge/Bear Creek Subsidence Potential Study, prepared for the Montana Department of State Lands, Abandoned Mine Reclamation Bureau.

Combo, J.X, Brown, D. M., Pulver, H.F., and Taylor, D. A., 1949, Coal Resources of Montana, U. S. Geological Survey Circular 53.

Colorado-West Website: reprint of article on Hebgen Lake Quake, 1959, Billings Gazette, Website last accessed on September 12, 2011; [www.colorado-west.com/cooke/hebgen.html](http://www.colorado-west.com/cooke/hebgen.html)

Roberts, S.B., and Rossi, G.S., 1999, A summary of Coal in the Fort Union Formation (Tertiary), Bighorn Basin, Wyoming and Montana, U. S. Geological Survey Professional Paper 1625-A.

Department of Natural Resources and Conservation Montana Board of Oil and Gas. Online Oil and Gas Information System. Website last accessed September 14, 2011. <http://bogc.dnrc.mt.gov/>.

Gradient Geophysics, 1999, Final Report for McCully Subsidence Project, prepared for Spectrum Engineering (Contractor for the Montana Department of State Lands, Abandoned Mine Reclamation Bureau).

Lopez, D. A., 2005, Geologic Map of the Red Lodge Area, Carbon County, Montana, Montana Bureau of Mines and Geology Open File 524.

Mining Artifacts & History website; Montana Mines Article, Website last accessed on September 15, 2011. <http://miningartifacts.homestead.com/MontanaMines.html>

Montana Bureau of Mines and Geology Ground-Water Information Center, 2011. Groundwater well information accessed from database. Website last accessed on September 15, 2011. <http://www.mbmgs.mtech.edu/>

Montana State University Billings, 2011, Coal Project, Red Lodge, Montana, Project files provided to DOWL HKM in electronic format by Montana Department of Environmental Quality, Abandoned Mine Lands Program.

MSE-HKM, Inc., 1995, Jarvi Residence Subsidence Backfill, DEQ-AMR 94-006, prepared for the Montana Department of Environmental Quality, Abandoned Mine Reclamation Bureau.

Sanborn Fire Insurance Maps, LLC. 1891, 1896, 1901, 1907, 1912, and 1927. Reviewed at the Carbon County Historical Society Museum located at 224 North Broadway, Red Lodge, Montana, 59068.

Spectrum Engineering, 1989, Final Report Carbon County AML Statewide Maintenance Palmer Project Carbon County, Montana, prepared for the Montana Department of State Lands, Abandoned Mine Reclamation Bureau.

Spectrum Engineering, 1998, Final Report Red Lodge Shaft Subsidence OSM Emergency Project, Contract DEQ No. 470029 to 05, prepared for the Montana Department of Environmental Quality, Mine Waste Cleanup Bureau.

Stout, T., Montana, Its Story and Biography, 1921, Volume 2, American Historical Society, Chicago and New York.

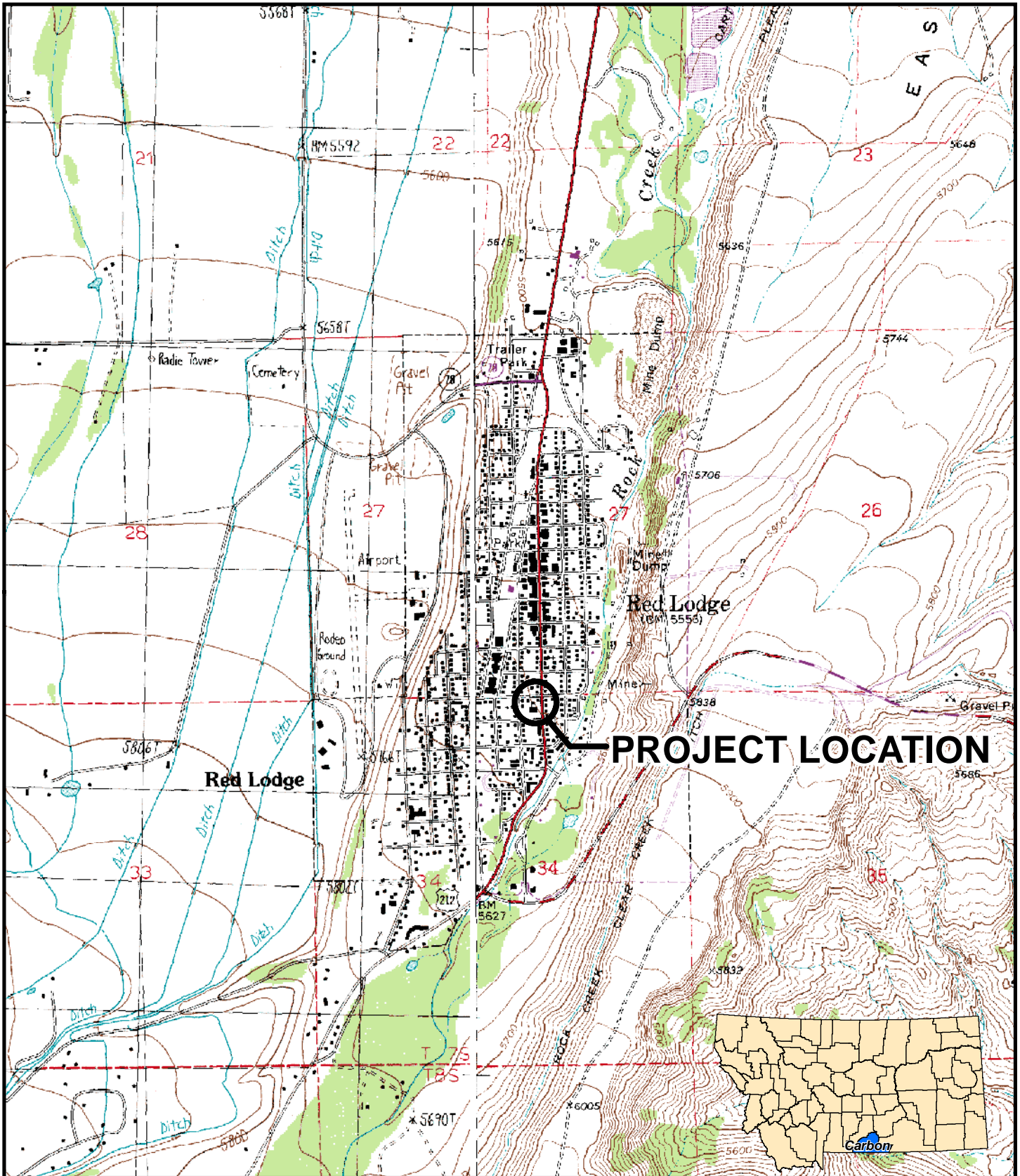
United States Geological Survey National Water Information System:Mapper website, Website last accessed on September 27, 2011. <http://wdr.water.usgs.gov/nwisgmap/?state=mt>

Woodruff, E.G., 1909, The Red Lodge coalfield, Montana, U.S. Geological Survey Bulletin 341  
pg. 92-107.

Zupan, S. and Owens, H.J., (editors), 2000, Red Lodge Saga of a Western Area (copy write 1979  
Carbon County Historical Society), Library of Congress Catalog # 79-90759, Frontier Press, Inc,  
Billings, Montana.

**APPENDIX A**

**FIGURES AND EXHIBITS**



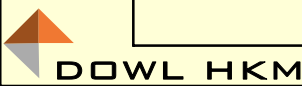
**Figure 1 - Vicinity Map**  
**501 Broadway Avenue South**  
**Block 36, Lot 1, Red Lodge First Addition**  
**Red Lodge, Montana**

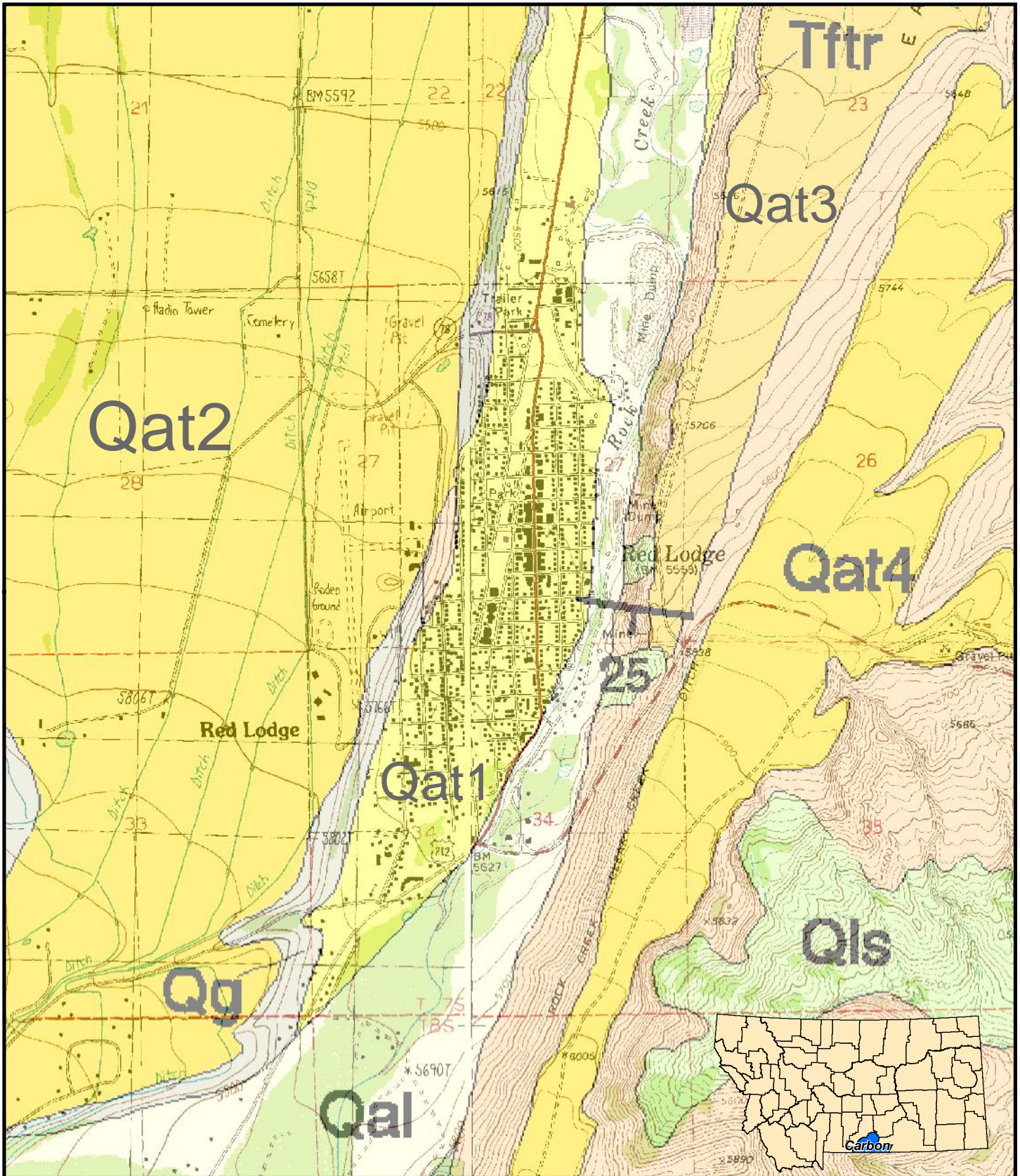
Map Source: USGS 7.5 Minute Topographic Map Series  
 Red Lodge East and Red Lodge West Quadrangles



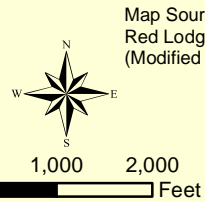
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Job #: 4031.20281





**Figure 2 - Geologic Map  
Red Lodge, Carbon County Montana**

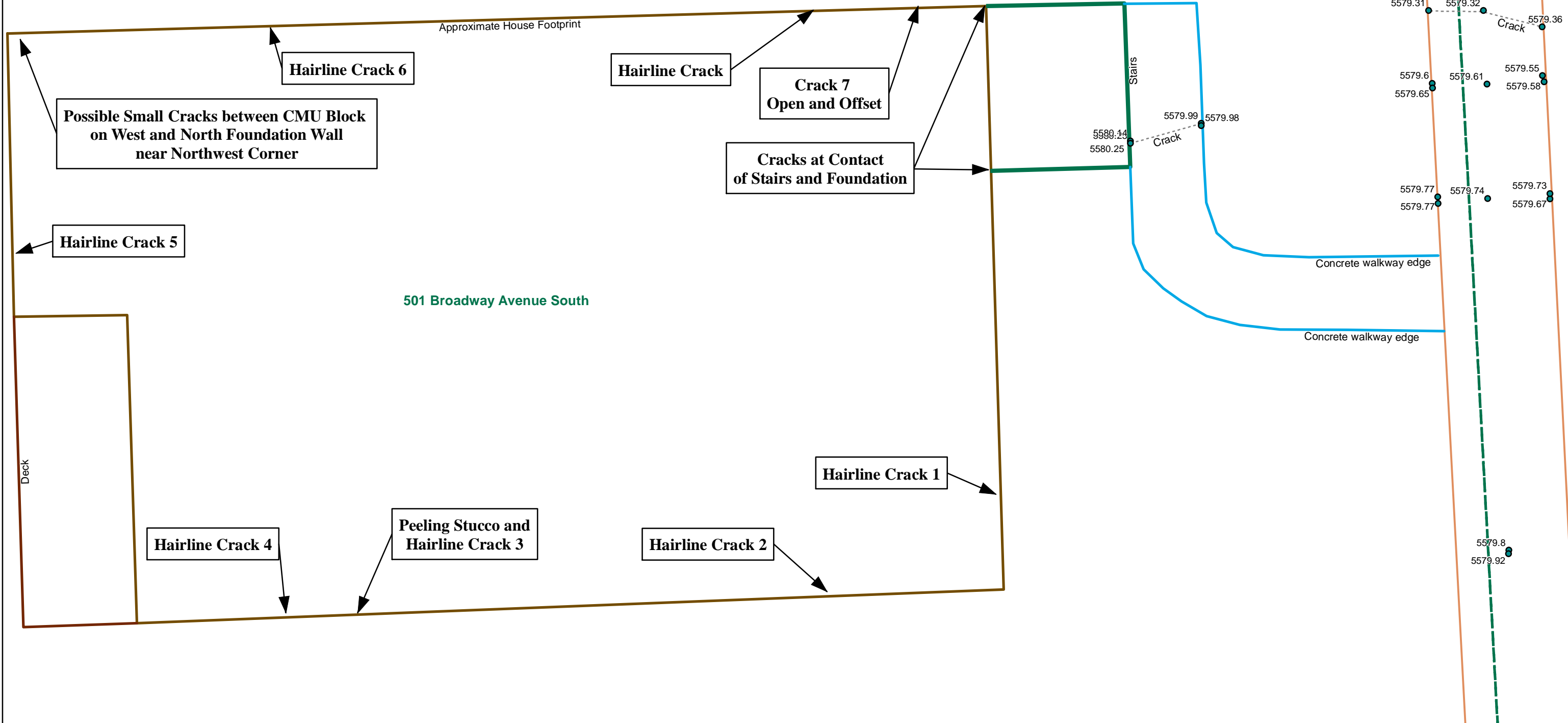
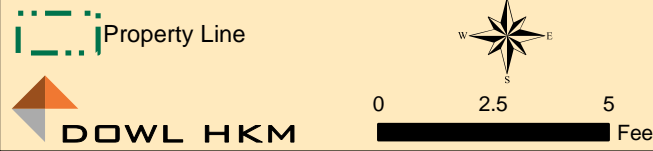


Map Source: Lopez, 2005, Geology of the Red Lodge Area Carbon County, Montana (Modified by DOWL HKM)

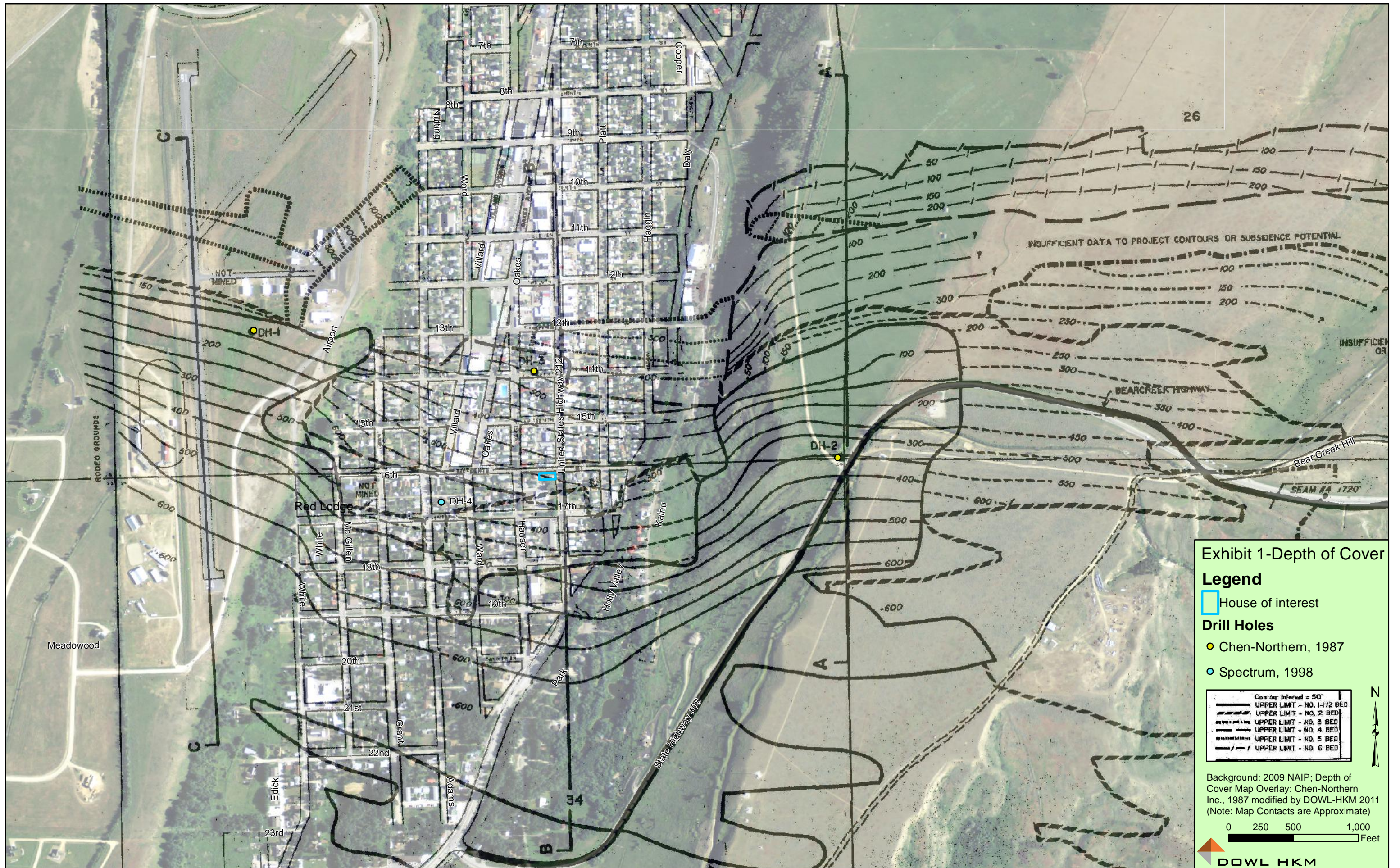


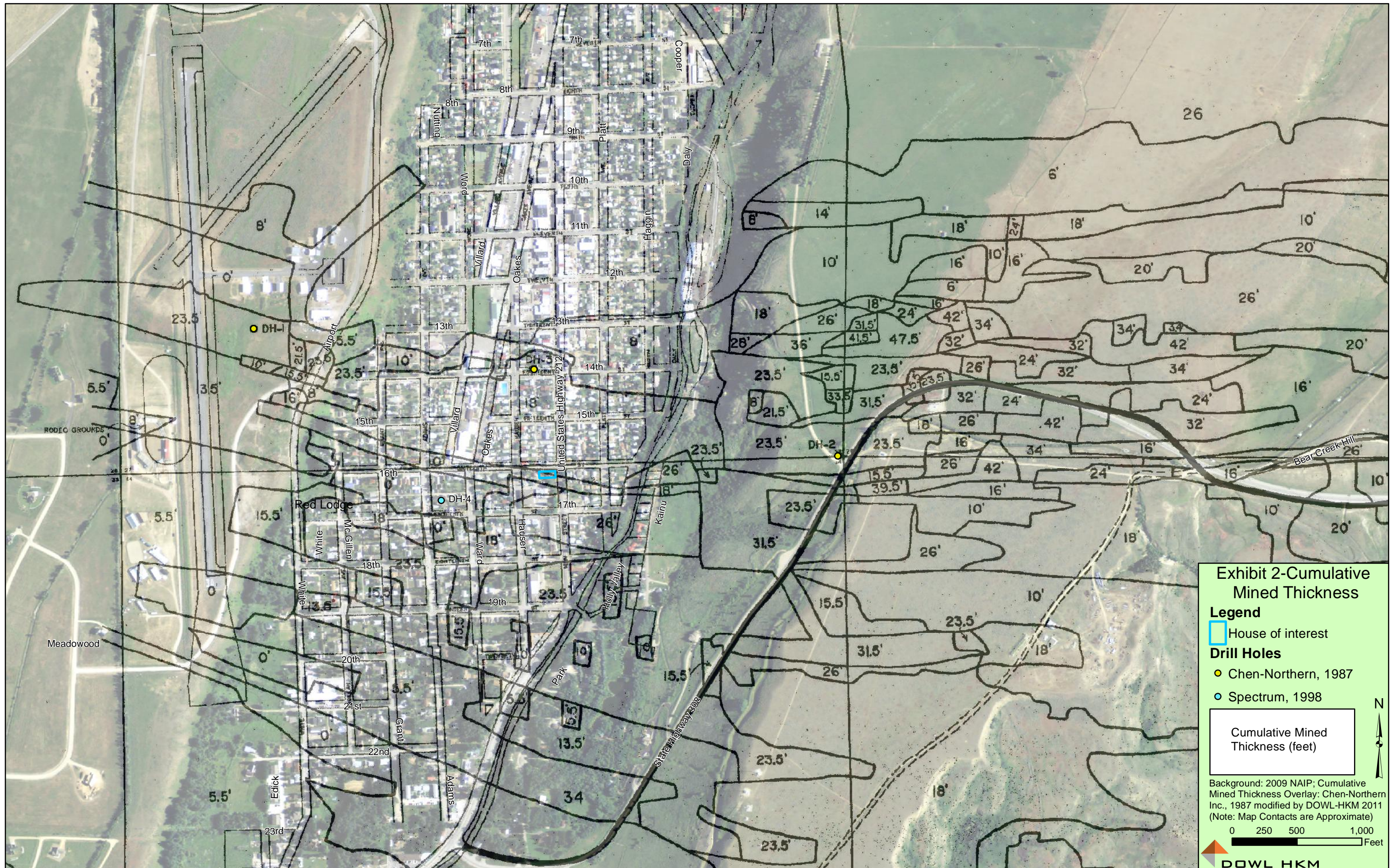
**Figure 4 - August 2011 Site Survey**

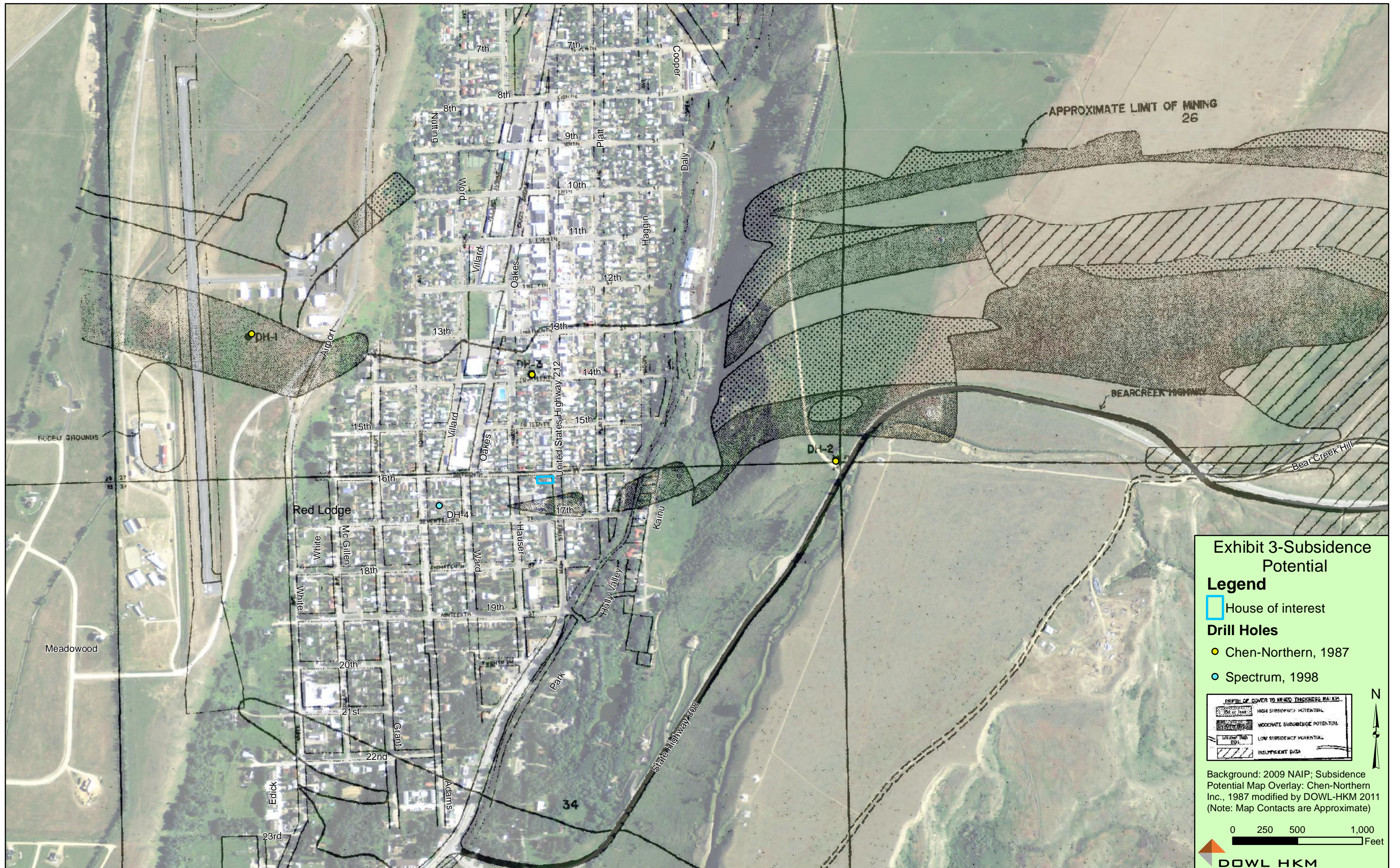
Survey by DOWL HKM; Horizontal Datum: Montana State Plane NAD83 International Feet; Vertical Datum: NAVD 88 US Feet  
 Property Boundary: State Cadastral Data (2011)  
 (Note: Structures, Property Boundaries, and Crack Locations Approximate)











**Exhibit 3-Subsidence Potential Legend**

**House of interest**

**Drill Holes**

- Chen-Northern, 1987
- Spectrum, 1998

DEPTH OF COVER TO MINED THICKNESS RATIO	
[Diagonal Hatching]	HIGH SUBSIDENCE POTENTIAL
[Cross-hatch]	MODERATE SUBSIDENCE POTENTIAL
[Dotted]	LOW SUBSIDENCE POTENTIAL
[Horizontal Hatching]	INSUFFICIENT DATA

Background: 2009 NAIP; Subsidence Potential Map Overlay: Chen-Northern Inc., 1987 modified by DOWL-HKM 2011 (Note: Map Contacts are Approximate)

0 250 500 1,000 Feet

**DOWL HKM**

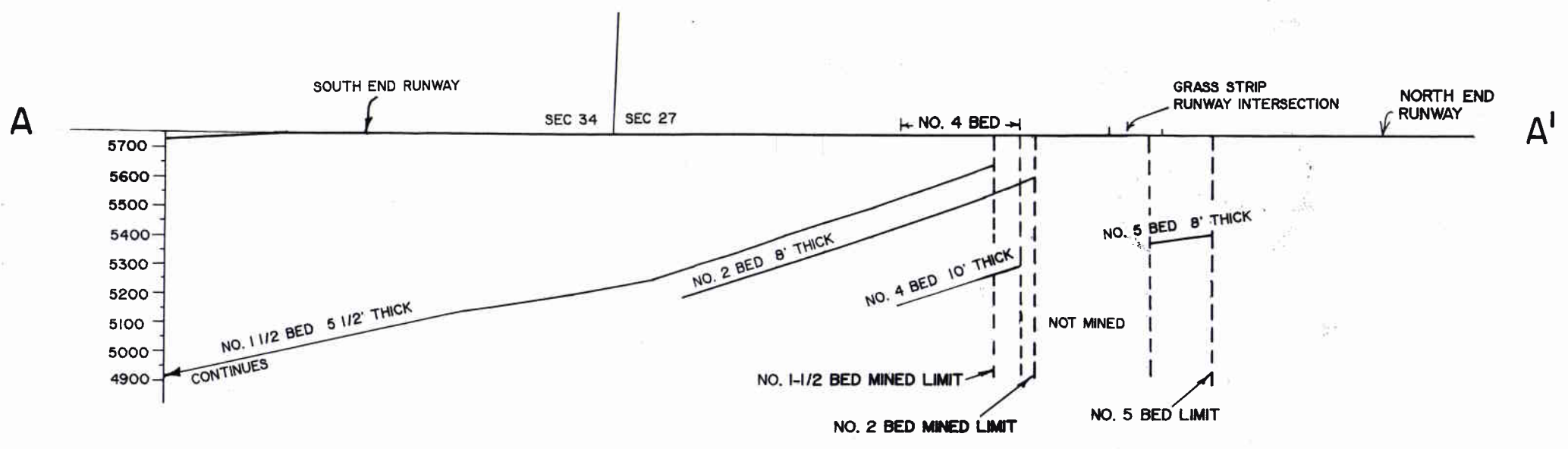
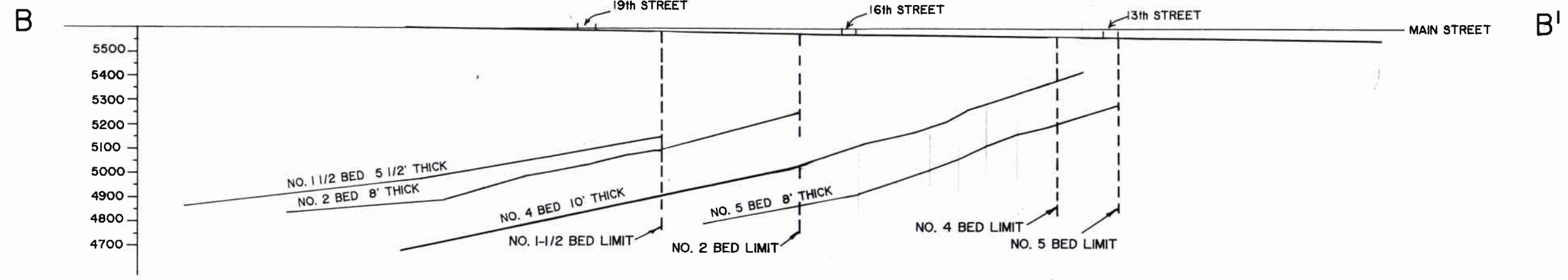
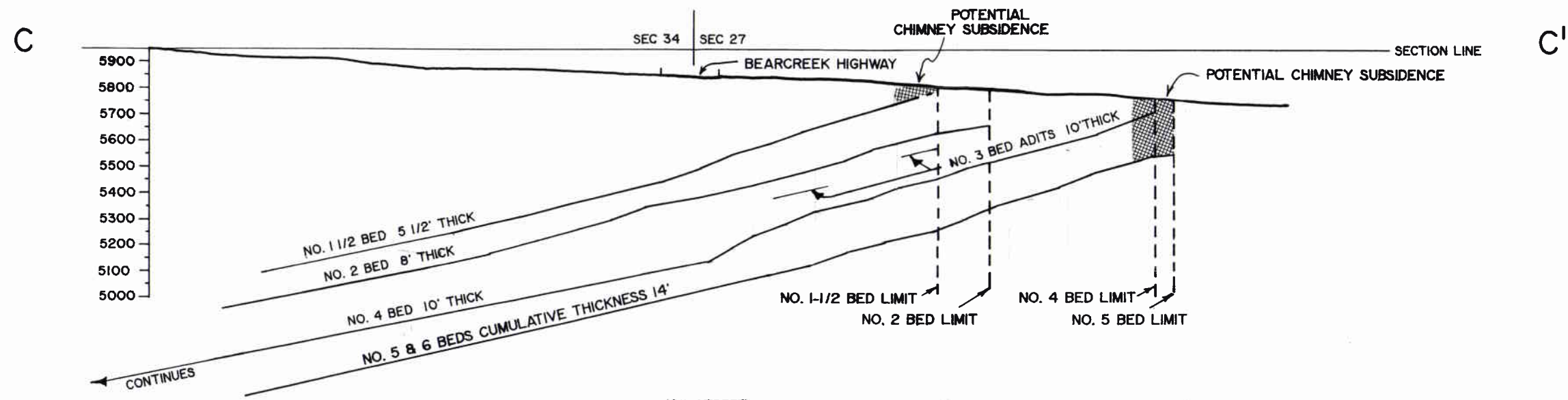



Exhibit - 4 Cross Sections

STATE OF MONTANA DEPARTMENT OF STATE LANDS HELENA, MONTANA BEARCREEK/RED LODGE SUBSIDENCE STUDY CROSS SECTIONS OF MINE LIMITS	
 <b>Northern</b> Engineering and Testing, Inc.	Drawn: LNR Checked: JMP Scale: 1" = 500' Date: 10/29/87
	DRAWING NO. 87-3001D-7

**APPENDIX B**

**PHOTOGRAPHS**



8/25/2011 12:30:19 PM  
View South of Sidewalk  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-30-19 - 0089.JPG



8/25/2011 12:30:32 PM  
View South of Sidewalk - Crack is Open to a Depth of 4 Inches  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-30-32 - 0090.JPG



8/25/2011 12:30:49 PM  
View South of Sidewalk  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-30-49 - 0091.JPG



8/25/2011 12:30:55 PM  
View South of Sidewalk  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-30-55 - 0092.JPG



8/25/2011 12:31:03 PM  
View South of Sidewalk  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-31-03 - 0093.JPG



8/25/2011 12:31:35 PM  
View South of Front Stairs - Note Open Crack Between the Stairs and Foundation  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-31-35 - 0094.JPG



8/25/2011 12:32:00 PM  
View West of Front of House  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-32-00 - 0095.JPG



8/25/2011 12:32:24 PM  
View Northwest of South Side of Front Stairs - Note Open Crack Between the Stairs and Foundation  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-32-24 - 0096.JPG



8/25/2011 12:33:32 PM

View Southeast of North Foundation and Open Crack 7 in Stucco Where the Front Addition and Main House Foundation Meet  
501 Broadway Avenue South, Red Lodge, MT



8/25/2011 12:33:47 PM

View South of Front Stairs - Note Open Crack Between the Stairs and Foundation  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-33-47 - 0098.JPG



8/25/2011 12:57:16 PM

View South of Front Stairs and Crack in Walkway  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-57-16 - 0099.JPG



8/25/2011 12:57:55 PM

View West of East Foundation and Hairline Crack 1 near Southeast Corner of House  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-57-55 - 0100.JPG





8/25/2011 12:58:39 PM

View West of East Foundation and Hairline Crack 1 near Southeast Corner of House  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-58-39 - 0101.JPG



8/25/2011 12:59:16 PM

View North of South Foundation and Hairline Crack 2 at Front Addition  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 12-59-16 - 0102.JPG



8/25/2011 1:00:21 PM

View North of South Foundation and Buckled Stucco and Hairline Crack 3  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-00-21 - 0103.JPG



8/25/2011 1:00:30 PM

View North of South Foundation and Hairline Crack 4 at Back Addition  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-00-30 - 0104.JPG



8/25/2011 1:01:16 PM  
View East of West Foundation and Crack 5 in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-01-16 - 0105.JPG



8/25/2011 1:01:41 PM  
View East of West Foundation and Paint Peeling or Possible Cracking in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-01-41 - 0106.JPG



8/25/2011 1:02:54 PM  
View South of North Foundation and Paint Peeling or Possible Cracking in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-02-54 - 0107.JPG



8/25/2011 1:03:05 PM  
View South of North Foundation and Hairline Crack 6 at Back Addition  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-03-05 - 0108.JPG

## **APPENDIX C**

### **TABLE 1 – WELL INFORMATION**



Table 1 - Well Information

67	161385	45.17932	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAC	WELL	0	WISE JEFF	0	40	25	32	35	15	PUMP	1				B & H	8/21/1996	DOMESTIC	44
68	173022	45.18122	-109.246011	TRS-SEC	NAD83	7S	20E	34	ABA	WELL	0	BROWN VERNETTA	0	25	7	25	0	60	AIR	0		7	0.2	AAQUA DRILLING INC	8/6/1996	IRRIGATION	>25
69	239572	45.18122	-109.246011	TRS-SEC	NAD83	7S	20E	34	ABA	WELL	0	COLT COMMUNICATIONS L.L.P.	0	40	6	39	0	75	AIR	1	39	6	0.08	AAQUA DRILLING INC	8/8/2007	DOMESTIC	>40
70	247582	45.19592	-109.243573	TRS-SEC	NAD83	7S	20E	27	AAB	WELL	0	CITY OF RED LODGE	0	49	21	49	0	80	AIR	1	50	21	5	AAQUA DRILLING INC	7/14/2008	PUBLIC WATER SUPPLY	>49
75	189953	45.1884	-109.249036	TRS-SEC	NAD83	7S	20E	27	DBB	WELL	0	RAY JUDD FORD INC	0	20	15	10	0	0	OTHER	0				B & H	4/26/2001	MONITORING	>20
76	126442	45.17743	-109.248766	TRS-SEC	NAD83	7S	20E	34	ACB	WELL	0	WHITTEN R.P.	0	28	11	28	28	20	AIR	1	11	0.1	ROCK CREEK DRILLING INC	10/4/1991	DOMESTIC	>28	
78	919820	45.18652	-109.243573	TRS-SEC	NAD83	7S	20E	27	DAC	PETWELL	0	DIAMOND DRILL -2	0	0	0	0	0	0		0							Unk
79	243803	45.19122	-109.24767	TRS-SEC	NAD83	7S	20E	27	AC	WELL	0	O'NIEL GREG	0	60	30	22	0	10	AIR	1	60	30	0.07	DOUGLAS DRILLING	12/5/2007	UNKNOWN	50
80	183507	45.18122	-109.246011	TRS-SEC	NAD83	7S	20E	34	ABA	WELL	0	MOUNTAIN LOG Y SEDOR	0	50	14.5	38	0	11	AIR	1	50		0.17	AAQUA DRILLING INC	5/27/2000	DOMESTIC	14
81	192991	45.17932	-109.251521	TRS-SEC	NAD83	7S	20E	34	BAD	WELL	0	EDWARDS KEITH	0	38	14	38	0	100	AIR	2	34	14	0.25	B AND H	6/15/2001	IRRIGATION	>40
83	214190	45.17648	-109.252899	TRS-SEC	NAD83	7S	20E	34	BD	WELL	0	DOWNING GALE	0	40	6	40	0	60	AIR	1.5	40	6	0.03	DOUGLAS DRILLING	7/23/2002	IRRIGATION	>40
85	243804	45.17648	-109.252899	TRS-SEC	NAD83	7S	20E	34	BD	WELL	0	KYNER JAMES	0	40	8	40	0	20	AIR	1	40	8	0.05	DOUGLAS DRILLING	8/25/2006	IRRIGATION	>40
87	155408	45.18122	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAB	WELL	0	HUDAK EXCAVATION & CONSTRUCTION	0	180	57	80	175	8	AIR	1.5	57	1	1	B & H	4/1/1996	DOMESTIC	53
88	157948	45.18934	-109.250401	TRS-SEC	NAD83	7S	20E	27		WELL	0	RED LODGE SCHOOL DISTRICT NO 1	0	60	0	0	0	0	OTHER	0				AMERICAN DRILLING & SUPPLY	8/14/1996		>60
89	219745	45.18027	-109.247389	TRS-SEC	NAD83	7S	20E	34	AB	WELL	0	CLARKS BUS SERVICE *WELL 2	0	8	5	0	0	0	OTHER	0				DOUGLAS DRILLING	6/2/2005	MONITORING	>8
90	104764	45.1837	-109.24767	TRS-SEC	NAD83	7S	20E	27	DC	WELL	0	RED LODGE SCHOOL DISTRICT NO 1	0	60	22	59	40	90	PUMP	8				B & H	1/1/1983	IRRIGATION	>60
92	164285	45.18122	-109.251521	TRS-SEC	NAD83	7S	20E	34	BAA	WELL	0	TIMONEN SIGRID S.	0	24	6	24	0	40	AIR	1	6	0.16	AAQUA DRILLING INC	8/5/1997	IRRIGATION	>24	
94	223129	45.18746	-109.24767	TRS-SEC	NAD83	7S	20E	27	DB	WELL	0	SALLADE CHARLES	0	40	26	40	0	30	AIR	2	40	26	0.1	DOUGLAS DRILLING	11/22/2005	IRRIGATION	>40
95	201857	45.1837	-109.24767	TRS-SEC	NAD83	7S	20E	27	DC	WELL	0	RONNING TRACY	0	40	6	20	0	40	AIR	1.5	39	6	0.02	DOUGLAS DRILLING	12/6/2002	IRRIGATION	35
98	128247	45.18122	-109.248766	TRS-SEC	NAD83	7S	20E	34	ABB	WELL	0	SLANTZ RUSSELL	0	28.5	11	28	28	30	AIR	1	11.5	0.1	ROCK CREEK DRILLING INC	10/7/1991	DOMESTIC	>28.5	
100	219742	45.17459	-109.250144	TRS-SEC	NAD83	7S	20E	34		WELL	0	LEFEBVRE JOE	0	40	0	40	0	60	AIR	1.5	40	2	2	DOUGLAS DRILLING	6/2/2005	IRRIGATION	>40
101	158424	45.18464	-109.251767	TRS-SEC	NAD83	7S	20E	27	CDA	WELL	0	RED LODGE SCHOOL DISTRICT	0	58	20	0	55	50	AIR	2	20	0.5	B & H	8/23/1996	IRRIGATION	>60	
102	243777	45.1837	-109.24767	TRS-SEC	NAD83	7S	20E	27	DC	WELL	0	JORDEN LINDA	0	37	10	20	0	30	AIR	1	37	10	0.03	DOUGLAS DRILLING	3/31/2008	IRRIGATION	35
104	187291	45.17932	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAC	WELL	0	MARCELLO GUIDO/ MARY	0	33	14	33	33	30	AIR	0	12	0.03	DOUGLAS DRILLING	8/11/1999	IRRIGATION	>33	
106	161390	45.18122	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAB	WELL	0	PILATI MICHAEL	0	38	17	38	35	40	AIR	1	17	0.5	B & H	10/1/1996	IRRIGATION	>40	
107	211966	45.18746	-109.24767	TRS-SEC	NAD83	7S	20E	27	DB	WELL	0	BERTRAM KELLY	0	40	22	0	0	60	OTHER	1	40	22	0.2	DOUGLAS DRILLING	5/3/2004	DOMESTIC	>40
108	243779	45.1837	-109.24767	TRS-SEC	NAD83	7S	20E	27	DC	WELL	0	JORDAN LINDA	0	40	15	20	0	20	AIR	1	40	15	0.03	DOUGLAS DRILLING	3/31/2008	IRRIGATION	15
111	212138	45.17932	-109.251521	TRS-SEC	NAD83	7S	20E	34	BAD	WELL	0	JAQUITH PHILLIP	0	40	20	0	0	50	AIR	1	36	20	0.25	B AND H	5/14/2004	IRRIGATION	>40
112	201873	45.17648	-109.252899	TRS-SEC	NAD83	7S	20E	34	BD	WELL	0	NEARPASS BAYARD	0	40	6	40	0	40	AIR	1.5	39	6	0.03	DOUGLAS DRILLING	7/9/2002	IRRIGATION	>40
113	219749	45.18027	-109.247389	TRS-SEC	NAD83	7S	20E	34	AB	WELL	0	FINSTAD ERIC *PILATI MIKE	0	40	0	40	0	38	AIR	1.5	36			DOUGLAS DRILLING	6/5/2005	IRRIGATION	>40

Table 1 - Well Information

114	251942	45.1837	-109.24767	TRS-SEC	NAD83	7S	20E	27	DC	WELL	0	SCHUBERT DIANA	0	40	12	20	0	25	AIR	1	40	12	0.03	DOUGLAS DRILLING	4/8/2008	IRRIGATION	38?
116	222195	45.17743	-109.251521	TRS-SEC	NAD83	7S	20E	34	BDA	WELL	0	MEIER RYAN AND JONI	0	77	41	57	0	20	AIR	1	77	41	0.08	AAQUA DRILLING INC	8/8/2005	DOMESTIC	62?
117	258470	45.17648	-109.252898	TRS-SEC	NAD83	7S	20E	34	BD	WELL	0	BRYNGELSON MARY	0	40	6	40	0	40	AIR	1.5	40	6	0.03	DOUGLAS DRILLING	7/29/2009	IRRIGATION	>40
118	124993	45.17743	-109.251521	TRS-SEC	NAD83	7S	20E	34	BDA	WELL	0	FORMANACK ROBERT W.	0	39	12	39	38	50	AIR	1				B & H	1/20/1983	DOMESTIC	>39
124	158425	45.17932	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAC	WELL	0	JURKOVICK RAY	0	38	27	38	30	18	AIR	1				B & H	9/23/1996	DOMESTIC	40
125	158426	45.17932	-109.251521	TRS-SEC	NAD83	7S	20E	34	BAD	WELL	0	THOKE WILLIAM P.	0	38	16	38	35	40	AIR	1		16	0.5	B & H	10/1/1996	IRRIGATION	>40
129	253522	45.18212	-109.24908	NAV-GPS	NAD83	7S	20E	27	DCC	WELL	0	GREER RICK	0	40	18	0	0	50	AIR	1	39	18	0.08	AAQUA DRILLING INC	10/20/2009	GEOTECH	>39
130	122490	45.18746	-109.24767	TRS-SEC	NAD83	7S	20E	27	DB	WELL	0	KANE JAMES	0	35	20	35	0	25	AIR	1				ROCK CREEK DRILLING INC	5/27/1977	DOMESTIC	>35
132	132672	45.18122	-109.254276	TRS-SEC	NAD83	7S	20E	34	BAB	WELL	0	NOGLICH MIKE VIRGINIA K. & PATRICK	0	39	18	39	39	35	AIR	1		18	0.1	ROCK CREEK DRILLING INC	9/1/1992	IRRIGATION	>39
133	144140	45.19122	-109.242207	TRS-SEC	NAD83	7S	20E	27	AD	WELL	0	THAYER BETTY	0	30	14	28	25	40	AIR	1		14	1	B & H	8/3/1991	IRRIGATION	>30
137	211991	45.17648	-109.252899	TRS-SEC	NAD83	7S	20E	34	BD	WELL	0	GRIBBLE KANDACE	0	40	23	0	0	45	AIR	1.5	40	23	0.2	DOUGLAS DRILLING	4/7/2004	IRRIGATION	>40
138	216524	45.18027	-109.247389	TRS-SEC	NAD83	7S	20E	34	AB	WELL	0	SOMMERFELD ANTHONY	0	60	10	20	0	20	AIR	1.5	60	10	0.03	DOUGLAS DRILLING	11/2/2004	DOMESTIC	15
139	226280	45.18276	-109.246304	TRS-SEC	NAD83	7S	20E	27	DCD	WELL	0	MICHEAL JEFF	0	19	9	18	0	30	AIR	1	18	9	0.08	AAQUA DRILLING INC	5/11/2006	DOMESTIC	18?
140	192990	45.1786	-109.2514	NAV-GPS	NAD27	7S	20E	34	BAD	WELL	0	WESTER MIKE AND NANCY	0	38	12	38	0	100	AIR	2	36	14	0.25	B AND H	6/15/2001	IRRIGATION	>40
141	207153	45.1802	-109.2534	NAV-GPS	NAD27	7S	20E	34	BAB	WELL	0	WISE JEFF	0	48	29	48	0	36	AIR	2	44	29	0.5	B AND H	9/5/2003	DOMESTIC	46
142	212293	45.1941	-109.2443	NAV-GPS	NAD27	7S	20E	27	ABD	WELL	0	BEAM CRAIG	0	32	10	32	0	35	AIR	2	30	10	0.25	B AND H	3/31/2004	IRRIGATION	>32
143	212299	45.176	-109.2492	NAV-GPS	NAD27	7S	20E	34	BDD	WELL	0	DOUTHIT BERT	0	40	12	38	0	60	AIR	2	35	12	0.25	B AND H	4/26/2004	IRRIGATION	>40
144	132671	45.18	-109.2513	MAP	NAD27	7S	20E	34	BAACC	WELL	0	CITY OF RED LODGE - WELL 1 SOURCE 2	0	74	20	0	0	900	OTHER	0					9/17/1961	PUBLIC WATER SUPPLY	Unk
145	173024	45.1783	-109.2481	NAV-GPS	NAD27	7S	20E	34	BDA	WELL	0	PARK BRETTNER	0	38	9	38	0	70	AIR	0		9	0.25	B & H	9/23/1998	DOMESTIC	>40
146	187237	45.1796	-109.2517	NAV-GPS	NAD27	7S	20E	34	BAC	WELL	0	ENGLER ED	0	58	18	58	0	75	AIR	1	56	18	0.25	B & H	12/6/2000	IRRIGATION	>60
147	247616	45.18328	-109.2441	SUR-GPS	NAD27	7S	20E	27	DDC	WELL	0	SWENSON RANDY	0	22	7	10	0	25	AIR	1	22	7	0.08	AAQUA DRILLING INC	7/10/2008	DOMESTIC	13
148	189172	45.1792	-109.2531	NAV-GPS	NAD27	7S	20E	34	BAC	WELL	0	MCBRIDE BARBRA	0	40	22	39	0	0	AIR	1	36	22	1	B & H	4/25/2001	IRRIGATION	>40
150	244817	45.18598	-109.24775	NAV-GPS	WGS84	7S	20E	27	DBC	WELL	0	PORTH ARCHITECTS	0	40	20	39	0	60	AIR	1	39	20	0.08	AAQUA DRILLING INC	5/28/2008	DOMESTIC	>40
151	244816	45.186	-109.247867	NAV-GPS	WGS84	7S	20E	27	DBD	WELL	0	PORTH ARCHITECTS	0	40	20	39	0	60	AIR	1	39	20	0.08	AAAA WATER WELL DRILLING INC	5/28/2008	DOMESTIC	>40
152	247579	45.18347	-109.249333	NAV-GPS	WGS84	7S	20E	27	CDD	WELL	0	RED LODGE PUBLIC SCHOOL	0	44	22	43	0	50	AIR	1	43	22	0.08	AAQUA DRILLING INC	8/4/2008	PUBLIC WATER SUPPLY	>44
153	252187	45.18257	-109.251833	NAV-GPS	WGS84	7S	20E	27	DDC	WELL	0	RUTHERFORD CHARLES AND LINDA	0	43	23	43	0	50	AIR	1	43	23	0.08	AAQUA DRILLING INC	5/27/2009	DOMESTIC	>43
155	241643	45.17648	-109.247389	TRS-SEC	NAD83	7S	20E	34	AC	WELL	0	DOEDEN KATHY	0	40	10	40	0	30	AIR	1	40	10	0.03	DOUGLAS DRILLING	1/2/2008	IRRIGATION	>40
156	104811	45.17648	-109.247389	TRS-SEC	NAD83	7S	20E	34	AC	WELL	0	KARAS BENJAMIN K.	0	110TRRC	30	8	30	0	200	OTHER	0			β	8/1/1959	DOMESTIC	>30
157	231468	45.17743	-109.246011	TRS-SEC	NAD83	7S	20E	34	ACA	WELL	0	COLT COMMUNICATIONS LLC MPPP	0	25	6	25	0	60	AIR	1	25	6	0.08	AAQUA DRILLING INC	9/11/2006	DOMESTIC	>25
158	173023	45.1794	-109.2439	NAV-GPS	NAD27	7S	20E	34	ABD	WELL	0	MARTIN DON	0	100	14	60	0	18	AIR	0		14	0.5	B & H	7/16/1998	DOMESTIC	16
162	124990	45.18746	-109.242207	TRS-SEC	NAD83	7S	20E	27	DA	WELL	0	JARVI TAIMI	0	30	11	0	25	40	AIR	1		11	1	B & H	8/12/1991	IRRIGATION	>30
163	251765	45.18746	-109.242207	TRS-SEC	NAD83	7S	20E	27	DA	WELL	0	DANE, ELIZABETH	0	40	9	40	0	30	AIR	1.5	40	9	0.03	DOUGLAS DRILLING	1/8/2009	IRRIGATION	>40
164	247545	45.19462	-109.24093	SUR-GPS	NAD27	7S	20E	27	AAD	WELL	0	RED LODGE PUBLIC SCHOOL	0	65	25	64	0	300	AIR	1	64	25	0.08	AAQUA DRILLING INC	7/12/2008	DOMESTIC	64
165	231524	45.19592	-109.240841	TRS-SEC	NAD83	7S	20E	27	AAA	WELL	0	BEARTOOTH NATURE CENTER	0	88	33	87	0	125	AIR	1	88	33	0.08	AAQUA DRILLING INC	9/14/2006	DOMESTIC	>88

**APPENDIX D**

**ELECTRONIC FILES  
(REPORT, FIGURES AND EXHIBITS, GIS  
FILES FOR SURVEY DATA)**