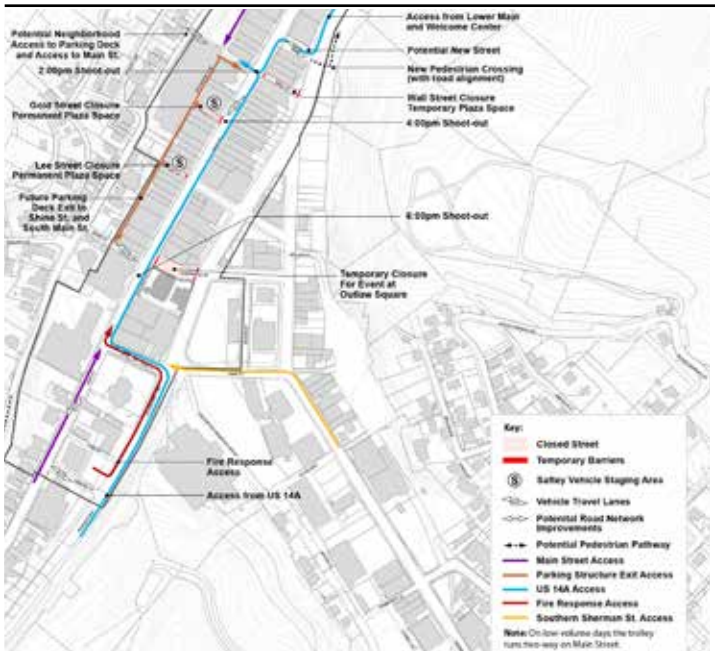


MAIN STREET MASTER PLAN

APPENDIX A: ENGINEERING REPORT

December 2021

Page left intentionally blank

Appendix A: Deadwood Main Street Master Plan Engineering Report

A. The Process of investigation

Ferber Engineering Company, Inc. (FEC), was tasked with performing legal document research and conducting field survey to reconstruct the property boundaries in the study area, with a focus on the Main Street corridor. Also included was surveying all public and private utility networks and performing detailed investigations of the sanitary sewer, water, and storm sewer systems. Following is a summary of the work completed.

a. Locating and mapping properties

Part of FEC's scope of work for the Deadwood Main Street Master Plan project was researching and reconstructing property boundaries in the project area. Because the master plan project is establishing the foundation for a future reconstruction of Main Street, the highest priority when considering property boundary reconstruction was given to the Main Street Right-of-Way. Every effort was made to thoroughly and accurately represent the entirety of each property located along the project area. However, establishing the Main Street Right-of-Way was paramount. The sole use of this data is for the purpose described herein and shall only be used as reference for any other function.

Legal property records research was performed by Dakota Title Company of Spearfish, South Dakota. Documents retrieved included plats, easements, and current deeds. The documents were reviewed and reconstructed based on record information.

Field surveying also commenced to find physical monumentation referenced in the recorded documents. Both conventional and GPS surveying methods were used with spatial locations relative to existing SDDOT control in South Dakota State Plane Coordinate System, NAD83(2011), North Zone, Feet.

Upon completion of the field work, the reconstructed records and field measurements were utilized to build the project legal base. This was a substantial task given the long and varied history of land records in Deadwood. The original division of land in Deadwood was via mineral surveys in the late 1870's. In 1891, P.L. Rogers produced a map of the town, which has been referenced and used in land transactions since. It however, lacked physical monumentation references and in some instances insufficient information for definitive reconstruction. As such, all the records that were recoverable, along with physical evidence in the field sometimes by way of building corners, party walls, etc., were used to construct this property

base. As stated above, the primary focus was on establishing the Main Street Right-of-Way. Figure 1 shows a map of the property as reconstructed.

b. Utility Investigation

The utility investigation performed for the Master Planning project consisted of a more focused approach than would ordinarily be deployed for a conventional topographic surveying effort. In lieu of putting in a blanket utility locating request and having all private utilities located concurrently, each utility company was contacted and FEC worked with their representatives directly to obtain accurate field locates.

Public utility background data was acquired by FEC staff from the City of Deadwood (City). As-built construction plans were digitally scanned from the City's Utility Maintenance Shop and City personnel provided FEC with internal Geographic Information Systems (GIS) utility databases. This information was used as a basis for field location and mapping of public utilities, and the sanitary sewer investigation.

Using industry-standard surveying practices, each utility network was surveyed relative to South Dakota Department of Transportation (SDDOT) control in the South Dakota State Plane Coordinate System, NAD83(2011), North Zone, Feet. Upon completion of the field survey, data reduction was performed in the office resulting in a pipe network representation of each utility. Figures 2 - 11 attached to this report illustrate each utility. An interactive GIS webmap was also produced representing the survey and other supporting information assembled during the investigation. Login information was provided to City of Deadwood Staff and this information will be incorporated into the Deadwood GIS system as appropriate.

i. Sanitary Sewer Investigation

An in-depth sanitary sewer investigation was performed by FEC with assistance from Rapid Rooter of Rapid City, SD, and Trekk Design Group of Kansas City, MO. Rapid Rooter and FEC videoed the sanitary sewer system contributing to Main Street, from Armory Street to Highway 14A and assessed the condition of 35 manholes in the study area (Figure 2). There were approximately 5900 lineal feet of main and 3100 lineal feet of laterals videoed during this effort. The weekly work schedule was Tuesday through Thursday and spanned from May 26, 2020 to June 24, 2020.

From May 26, 2020 to May 29, 2020, Rapid Rooter videoed sanitary sewer mains (equipment used shown in Picture 1).

Picture 1 Sanitary Sewer Inspection Camera

During this effort FEC surveyed, using conventional survey methods, defects and sanitary sewer lateral taps for each section of main. Rapid Rooter's camera setup was equipped with utility locating capabilities which allowed for these locations to be surveyed.

From June 3, 2020 to June 24, 2020, Rapid Rooter videoed sanitary sewer laterals within the project area. During this effort, Rapid Rooter located the laterals as videoing took place and FEC surveyed the lateral locations using conventional methods. Defects, bends, and material changes within the Right-of-Way were surveyed. To access the laterals, FEC and Rapid Rooter coordinated with business managers, owners, maintenance supervisors, and other staff to locate access points for the laterals. These points of access consisted of cleanouts on the exterior and interior of the building, exterior roof vents, and removing and replacing toilets when all other options were exhausted.

Following the results of the video assessments, Trekk Design Group, LLC was subcontracted by FEC to conduct smoke testing of the sanitary sewer system on April 27th and 28th, 2021. Two FEC personnel and an individual from Trekk, along with available City personnel smoke tested the entirety of the sanitary sewer system described above. A manhole-mounted smoking unit was used to complete the work.

Picture 2 Smoke Testing Deployment

The smoking unit utilized liquid smoke canisters. Trekk personnel set up the smoke blower at every other or every third manhole based upon on the distance between manholes, the intensity of smoke needed, and the number of intersecting mains. FEC and City personnel were spotters that walked upstream and downstream of the smoke blower. FEC also deployed the use of a drone to supplement the on-the-ground observation capabilities. Once spotted, defects were then surveyed by Trekk personnel using a handheld GPS device.

ii. Water system investigation

The water system investigation consisted of reviewing as-constructed plans, talking with City staff, and reviewing existing GIS information. Infrastructure locations were field surveyed, but visual inspection of the water system was not completed as the only practical way to do this is by excavation and surface replacement.

iii. Storm sewer system investigation

The storm sewer system investigation consisted of reviewing as-constructed plans, talking with City staff, and reviewing existing GIS information. Visual inspections of the inlets and pipes were also performed in the field as the infrastructure locations were surveyed.

B. Findings of conditions investigations

The following section will summarize the findings identified during the investigations discussed above.

a. Property reconstruction findings

There were a few properties in the project area that were lacking enough documentation and field evidence to definitively reconstruct and should be considered graphical in nature. These areas are shown highlighted in Figure 1 and did not directly impact the reconstruction of the Main Street Right-of-Way. The Wells Fargo lot is highlighted, but is should be noted that the Main Street side of the bank lot was reconstructable. There was some ambiguity on the Highway 14A side of the lot. It should also be noted that interior lot lines, in many instances, are also graphical in nature.

b. Sanitary sewer findings

Overall, the sanitary sewer mains within the project area are in good working condition. Most of the issues encountered were due to grease buildups. Figure 2 illustrates the sanitary sewer system and the webmap referenced above contains links to all the videos and assessments performed.

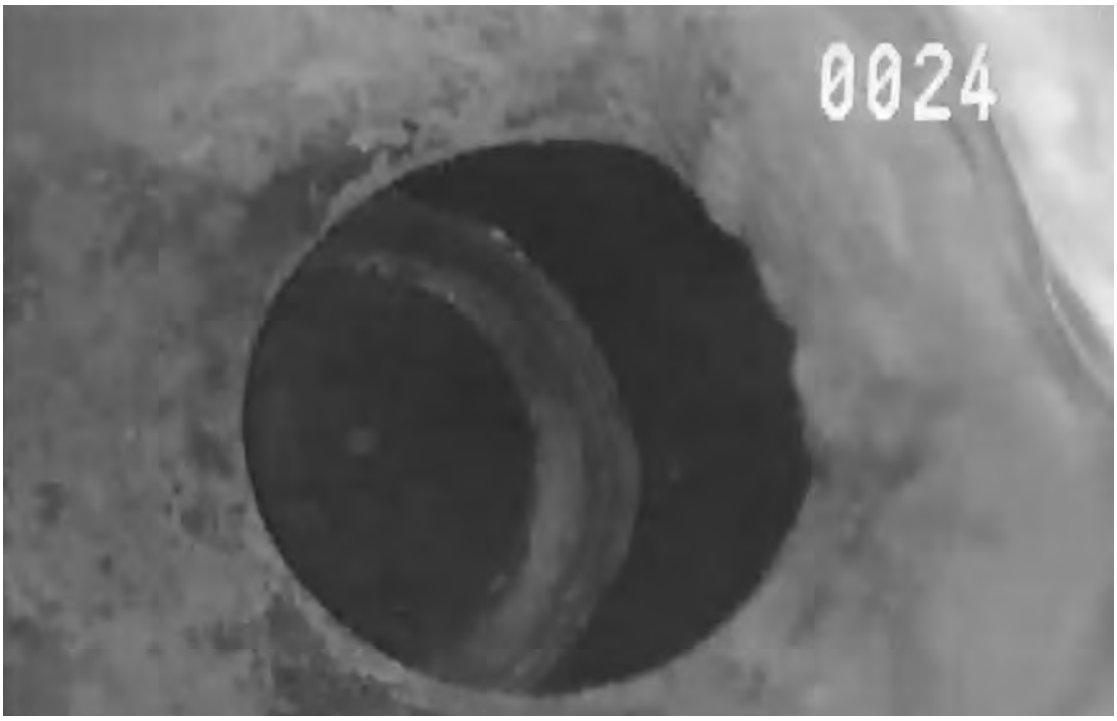
Defects observed during the sewer investigation included minor sags, grease buildup, and sediment deposits in the mains. Where there were buildups and deposits, Rapid Rooter had to jet and clean prior to videoing. Mains that required jetting and cleaning were between manholes 422 and 467 (under the parking garage), 73 and 494 (in front of the Mineral Palace), 58 and 59 (in Main Street) and 57 and 55 in Wall Street. The City was called to jet the main between manholes 62 and 454 in US Highway 14A due to a blockage. The camera was generally able to pass through the minor sags. However, sags can end up creating a long-term maintenance issue when sediment and other debris settles in the main, eventually creating a blockage. Picture 3 shows an example of a sag in a sanitary sewer main.

Picture 3 Example of sag in sewer main

The main between manhole 62 and 80 was not videoed due to a blockage. After discussing this section of main with City crews, it was determined that the main has not been in service for the last 20 plus years.

There were some properties where the laterals were unable to be videoed due to not being able to gain access, defects within the building, and properties that were on injector pump systems. Addresses where laterals were not videoed include:

- **8 Shine Street** – Unable to find cleanout, attempted to pull the interior toilet but were still unsuccessful in videoing due to multiple interior bends.
- **415 Williams Street** – Were not able to contact the owner and gain access to the residence.
- **405 Williams Street** – Were not able to access the service through an internal or external location.
- **37 Lee Street** – Service was drawn in based on discussion with the owner. Tried to access the service through a roof vent without success.
- **667 Main Street** – Could not gain access to the building.
- **668 Main Street** – Gold Dust C-Store – There was a separation in the lateral 25' from the bathroom under the building. The separation was severe enough it appeared to be discharging below the building. (Picture 4)



Picture 4 Example of Sewer Service Joint Separation

- **652 Main Street** – Lateral is on an injector pump for 650 Main Street.
- **624 Main Street** – Original Saloon 10 – Could not gain access to the service from the interior of the building.
- **618 Main Street** – Sickies Garage – Could not gain access to the service in the crawl space or through an internal toilet.

Two properties had service lines which connected to and\or ran through a neighboring property.

- The sanitary sewer lateral for 435 Williams Street (Deadwood Library) exits the building on the south side and heads northeast through the property of 9 Shine Street. There are 2 cleanouts located on the property of 9 Shine Street that were accessed to video/locate this lateral to the Library and Shine Street.

- Initially, locating the lateral for 637 Main Street from the interior of the building to Main Street or Lee Street was unsuccessful. While videoing the 6" PVC lateral for the Gold Dust Hotel, it was observed that a connection approximately 10' from the exterior wall of the Gold Dust existed. The toilet for 637 Main Street was flushed to check this connection and flow was observed into this lateral. It was then determined that the sanitary sewer lateral for 637 Main Street connects to the 6" PVC lateral of the Gold Dust Hotel and heads toward Lee Street.

The most notable defect found during smoke testing was a missing cleanout cap on the 6" service outside the residence at 415 Williams Street. The cleanout is located behind the

house, on the east side of the property. Another damaged cleanout was observed at 699 Main Street near Highway 14A between the Silverado and Outlaw Square. Additionally, two power cabinets along the Highway 14A side of Main Street properties, between Lee Street and Wall Street, exhibited significant smoke defects. One other power cabinet related defect was detected on the north side of the parking garage on Broadway Ave as well. There were also four vented manhole covers discovered, one service lateral connection issue at 745 Main Street and one potential downspout connection detected at 555 Main Street.

Five buildings also detected smoke inside during testing, all of which are located along Main Street, between Shine Street and Gold Street. The most significant of these was located at 668 Main Street, which was shown to have lateral separation during the video portion of the sanitary sewer investigation. Other addresses that detected smoke in the building were:

- **651 ½ Main Street** – Unknown source.
- **660 Main Street** – Dry toilets.
- **685 Main Street** – Floor drain.
- **688 Main Street** – Unknown source.

c. Water system findings

As mentioned previously, no detailed investigation into the water system (Figure 3) was performed, however, based off recently completed FEC work in downtown Deadwood and discussions with Public Works Staff, several potential water service-related issues have been identified. Primary among these concerns is premature corrosion of various water system components. The water system was constructed in the early 1990's and is comprised of a combination of PVC (plastic) pipe and ductile iron (metallic) fittings. Public Works Staff have specifically identified that the bolts on a number of valves have experienced significant corrosion. Corrosion was also evident on metallic components of the water system in Deadwood Street, which was recently reconstructed as part of the Outlaw Square Project as shown below in Pictures 5 and 6.

Picture 5 Metallic Component Corrosion

Picture 6 Valve Corrosion

Other issues brought to light in discussions with City staff include a handful of situations in which there are shared water services and\or multiple meters in one building. This is currently known to occur at 628 Main Street, 652 Main Street and 675 Main Street. This is also occurring at the Mineral Palace (601-607 Main Street) where there are four meters coming off a single service inside the building. At 651 and 651 ½ Main Street there is currently a single service and meter supplying two separate business. Similarly at 622 Main Street, there is currently one owner with two tenants being served by a single service and meter.

d. Storm system findings

From the surface, visual inspection of the storm drain system indicates it is in relatively good shape. Gold Street and a small section of Broadway Avenue, near the parking garage, have known issues of disjointed and\or plugged pipes which will warrant some pipe replacement (Figure 4). The Hampton Inn at Tin Lizzie's is another area of potential drainage concern. The finished floor elevation of the hotel is low in relation to the adjacent street. Public Works Staff stated that during significant precipitation events water leaves the street and ponds in the hotel entryway.

C. Recommendations for action

The following section will summarize recommendations for addressing the deficiencies identified in the investigation and findings sections above.

a. Sanitary Sewer System

The sanitary sewer system would be best served by spot fixing the issues highlighted above, especially with regards to servicing. Overall, the mains and manholes appeared to be in good shape. To keep the mains in optimal condition, periodic jetting is recommended to clear obstructions. Any manhole cover and rim with perforations should be replaced with ones that have none to reduce inflow potential. FEC also recommends the installation of chimney seals in the upper areas of cone sections to prevent infiltration during wet periods.

b. Water System

Prior to or most likely in conjunction with an overall street reconstruction, there is a need to inspect every fitting. At that time, FEC recommends that every valve and metallic fitting be exposed, inspected, and a decision then be made to either wholesale replace the valves and other fittings, replace bolts, and\or connect an anode for further protection. Also, the installation of tracer wire access boxes and the relocation of existing faulty tracer wire from inside the valve to a separate access box will greatly increase the probability of proper system maintenance.

The City Public Works Division would like to see uniformity across the water service system, with one meter per service. In the situations where two businesses are currently sharing a single service and meter, Public Works would prefer to remedy the situation by providing a second service connection and meter during an overall reconstruct to alleviate any potential financial burden on the owners. For 651 and 651 ½ Main Street, there are currently unused existing stub-outs in the street that could be tied directly into the building via directional drilling or some other appropriate method. For 622 Main Street, a new tap, service and meter would need to be installed.

At the time of the master plan project's inception, Public Works staff raised concerns about future waterline replacements in conjunction with the Deadwood box project under Highway 14A. The exposed water mains should include some form of protection, either in the form of heated ductile iron, heat tape, or some other sufficient freeze protection.

c. Storm Sewer System

Pipe replacement near the parking garage in Gold Street and Broadway Avenue should be considered. On Main Street, the final design of the typical section will ultimately dictate whether the location of the existing storm sewer inlets in this area can stay or go. Curb changes and inlet location will be the determining factor in whether the existing mains are in an adequate location to convey storm water in the future typical section. If the final design dictates relocation of the inlets, an evaluation of what portions of the existing storm drainage system can remain needs to take place.

As stated previously, it has been indicated that there is a drainage concern (ponding during significant rain events) at the Hampton Inn - Tin Lizzie's. Adjustments to the street and curb profiles along with the potential addition of storm inlets should be considered to resolve this issue.

d. Sidewalk and pedestrian considerations

Albertson Engineering performed an analysis of sidewalk vaults for this project and determined that they will likely stay in place, with some amount of reconstruction necessary for enhanced structural integrity. The accesses currently being utilized by the public and private businesses as points of entry and delivery will need to remain in place and available for continued use.

Reconstruction of sidewalks will directly impact reconstruction of the sidewalk vaults, which in turn impacts the available cross-slope on the sidewalk above them. Maintaining reasonable headroom in the vaults, in relation to the store front, and in conjunction with the ties into the curb, all play into the design of an ADA compliant

pedestrian system. From a design standpoint, historic preservation may dictate that the significance of the sidewalk vaults and the location of the curbline require their conservation. This would necessitate a variable cross-slope design that does not strictly comply with ADA.

Considering there is a desire to not replace the sidewalk in a piecemeal approach, patching as improvements are being made, along with the need to preserve the historical nature of both the curbline location and the sidewalk vaults, the most impactful change to the current pedestrian access may be to focus on ADA compliance at intersection crossings. Making the crossings accessible by widening the ramps and shallowing the slopes could provide smoother transition back to the existing sidewalk grades.

e. Private utility coordination

Following the completion of utility investigation and mapping, detailed exhibits (Figures 6-11) were sent to representatives of each private utility inquiring about the accuracy of our survey and posing the following question to each:

"***If the Main Street Corridor in Deadwood was significantly reconstructed (surfacing replaced), what modifications\upgrades\etc. would your utility make in conjunction with the reconstruction?"***

The responses were varied. Black Hills Energy replied that they would pursue putting their utilities underground in Broadway Avenue. SDN Communications indicated there would be no proposed changes they would like to see. Century Link (Lumen) has a significant duct bank in-place currently which they would prefer to remain, adding only that they may install conduits into buildings if the opportunity is there. MDU has not responded. Midco has not responded. Vast has not responded.

f. Incidental infrastructure improvements

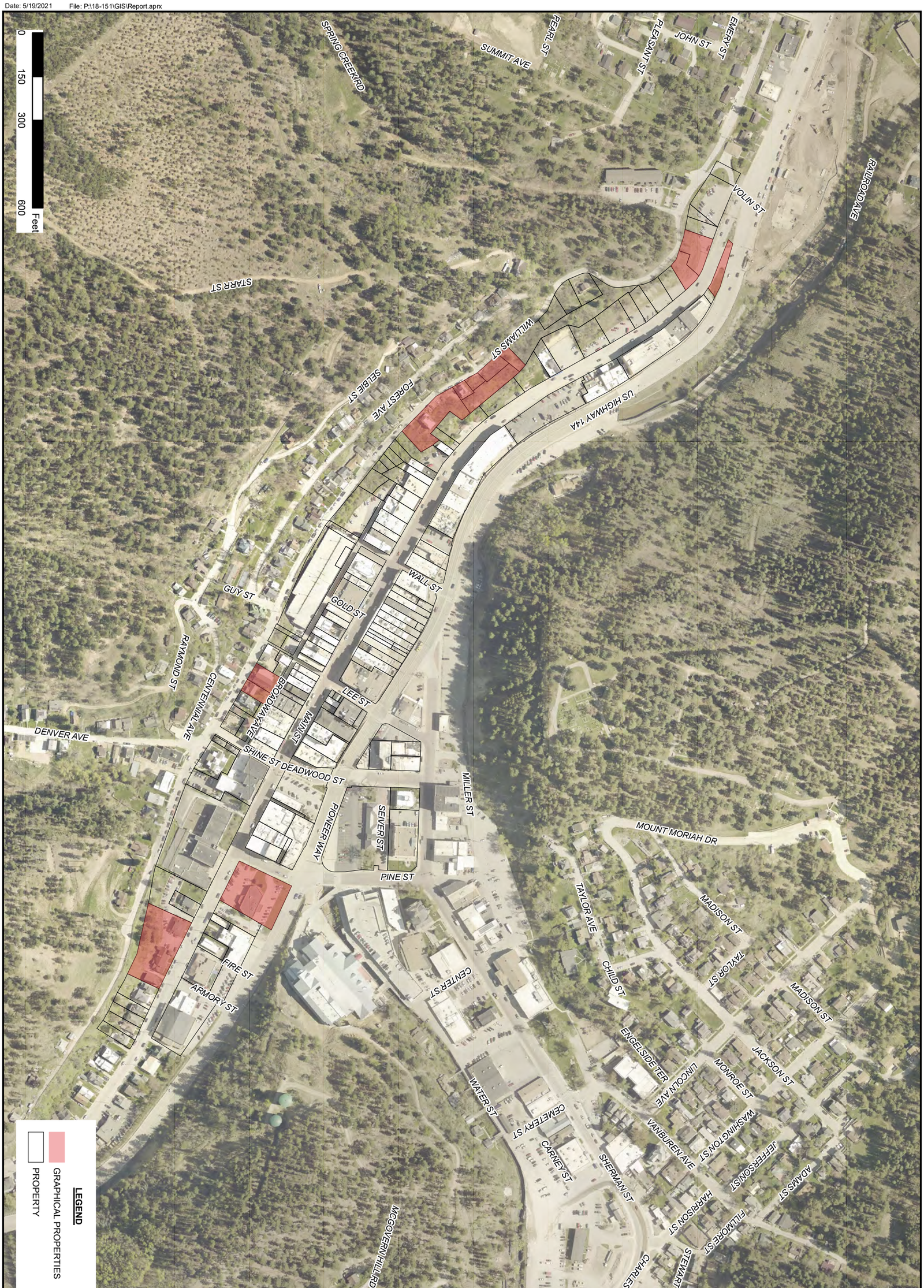
The team is not recommending the reuse of any of the existing street lighting system, including footings and wiring. Rather we propose a wholesale replacement with new historically appropriate lighting and electrical systems following the design by a qualified electrical engineer.

Regulatory signing along Main Street is currently being installed as part of a broader county-wide signing project and will meet the requirements of the MUTCD upon completion. The placement and quantity of signing should be reviewed during the design phase of a reconstruction project and will most likely consist of removing and resetting the in-place signage.

g. Construction schedule and phasing

The construction schedule of the box project will weigh heavily on the timeline of Main Street reconstruction. Historic Preservation has expressed the desire for construction to be complete in time for the City's sesquicentennial celebrations in 2026. Given the success of two-season construction during the Outlaw Square project it is within reason to assume a similar construction method could be successful in achieving this goal. Ultimately pedestrian flow and the maintenance of water services will be the heaviest drivers in construction phasing.

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx



Sheet: A-1

Sheet Title: FIGURE 1. PROPERTY RECONSTRUCTION

MAIN STREET MASTER PLAN
EXISTING PROPERTY PARCELS
DEADWOOD, SD

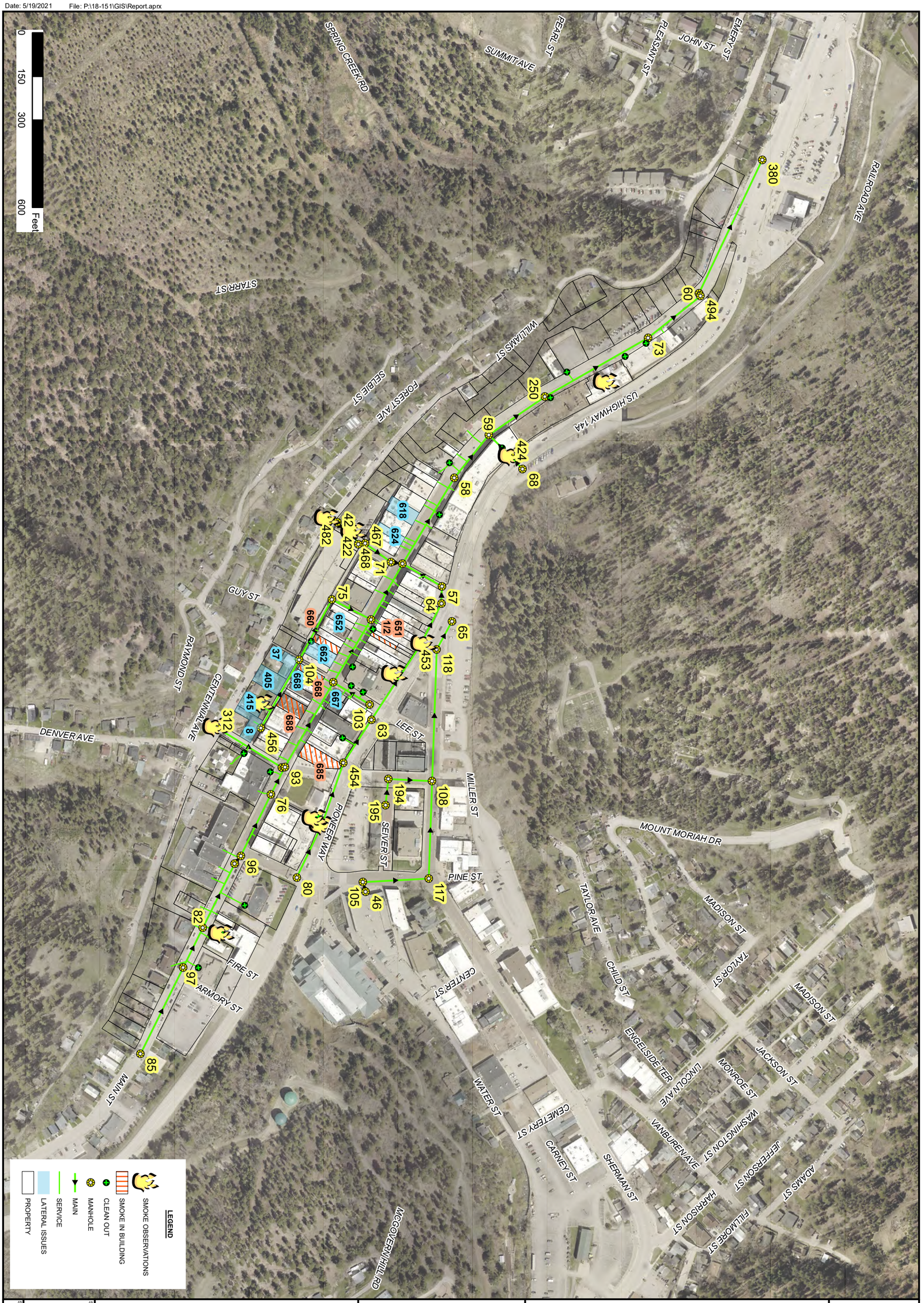
Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

FEC
• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying
729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx



MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For:
DEADWOOD 1876 HISTORIC PRESERVATION

Prepared By:
WC
FEC
• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying
729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

Sheet Title:
FIGURE 2.
SANITARY SEWER
INVESTIGATION

Sheet:
A-2

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-3

Sheet Title: FIGURE 3. WATER SYSTEM INVESTIGATION

MAIN STREET MASTER PLAN

EXISTING UTILITIES - SANITARY SEWER

DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

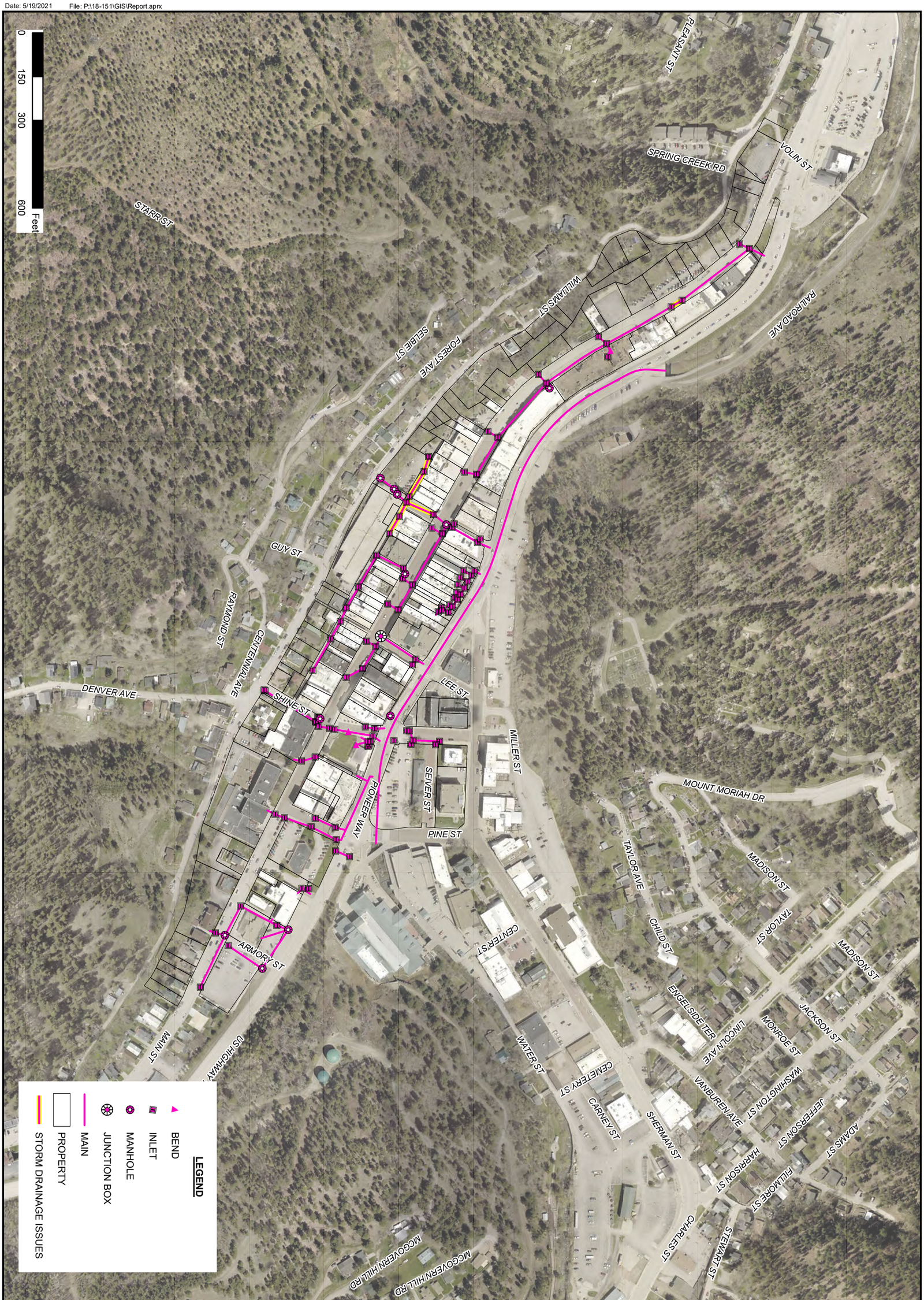
Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx



Sheet: A-4

Sheet Title: FIGURE 4. STORM SEWER INVESTIGATION

MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

FEC
- Civil Engineering
- Geospatial Solutions
- Water Resources
- Transportation
- Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-5

Sheet Title: FIGURE 5. DEADWOOD CITY POWER SYSTEM

MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying
729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-6

Sheet Title: FIGURE 6. BLACK HILLS POWER SYSTEM

MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying
729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-7

Sheet Title: FIGURE 7. GAS SYSTEM

MAIN STREET MASTER PLAN

EXISTING UTILITIES

DEADWOOD, SD

Prepared For:

1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-8

Sheet Title: FIGURE 8. CENTURY LINK SYSTEM

MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying
729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-9

Sheet Title: FIGURE 9. MIDCO SYSTEM

MAIN STREET MASTER PLAN
EXISTING UTILITIES
DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-10

Sheet Title: FIGURE 10. VAST SYSTEM

MAIN STREET MASTER PLAN

EXISTING UTILITIES

DEADWOOD, SD

Prepared For: 1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:

• Civil Engineering
• Geospatial Solutions
• Water Resources
• Transportation
• Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S

Date: 5/19/2021 File: P:\18-151\GIS\Report.aprx

Sheet: A-11

Sheet Title: FIGURE 11 SDN SYSTEM

MAIN STREET MASTER PLAN

EXISTING UTILITIES
DEADWOOD, SD

Prepared For:
1876 DEADWOOD HISTORIC PRESERVATION

Prepared By:
WC
FEC
- Civil Engineering
- Geospatial Solutions
- Water Resources
- Transportation
- Land Surveying

729 East Watertown St, Rapid City, SD 57701 ~ Phone: (605) 343-3311

N W E S