4.0 FIELD DATA COLLECTION

The following section outlines the approach and methods used to collect data. Before the field surveys began; field staff training was completed, equipment and software needs were evaluated, community partners were contacted, data collection sheets were developed, and procedures were established for data collection. Below is a summary of those activities.

4.1 Training

Training consisted of review of and discussions around the Young Environmental Gully 101 presentation (Presentation), and health and safety.

The Presentation focused on defining a gully, the factors affecting the development of gullies, and the purpose for each characteristic that would be recorded on the data collection sheets to develop the erosion potential index. Additionally, types of pipe outfalls were reviewed and the different types of erosion that could be encountered and observed in the field around a pipe outlet were discussed. The Presentation included example pictures of all features discussed.

In addition to the Presentation, the team studied reports on how to assess gully severity during field surveys. These reports included the Natural Resources Conservation Service's *National Engineering Handbook Technical Supplement- Gullies and Their Control*, the New South Wales *Gully Erosion Assessment and Control Guide*, and the Chisago Soil and Water Conservation District's (SWCD) *Lower Sunrise River Gully Stabilization Inventory*.

Safety training was provided in partnership with Riley-Purgatory-Bluff Creek Watershed District. The training including topics like creating an emergency action plan detailing the nearest medical center to field survey locations; required personnel protective equipment (PPE), such as a first aid kit, safety glasses, and high-visibility vests; things to take precautions to avoid (e.g., stinging nettle and poison ivy); and daily weather and equipment checks. Additional protocols were established in light of COVID-19; these included wearing masks; traveling on opposite corners of the car with the windows down; supplying additional PPE such as hand sanitizer, disposable face masks, and bleach to clean shared surfaces; and maintaining a 6-foot distance from anyone encountered during the field surveys.

The training was also complemented by an 8-hour OSHA Construction Safety Course: General Safety and Health Provisions.

4.2 Equipment and Software Requirements

The teams used Wi-Fi+Cellular-enabled iPads paired with the ArcGIS Suite field applications (apps) for data collection and navigation. The Wi-Fi+Cellular-enabled iPads were selected because this model contains a GPS unit integrated within the 3G/4G cellular chip, which allows for offline mapping. The decision to go fully offline for the field survey was made in light of limitations with the iPad's battery life when connected to the internet all day. Utilizing offline mapping on Wi-Fi+Cellular-enabled iPads increased the efficiency and battery life of the iPads, reducing the need for charging during a day of field surveys.

Two offline-capable cloud-based ArcGIS Suite field apps were used on the Project: Collector and Survey123. Collector is a mapping application used to navigate to each waypoint and map additional waypoints identified in the field. Survey123 is a survey application used for data collection purposes. At the end of each field day, both field apps synced back to a cloud-based database. Using these apps allowed for easy organization and analysis of the data collected, while integrating the geospatial data collected with a web map created for the Project. The last equipment used was the UTM Coordinates Tool IOS app developed by Nicholas Schotten. The app allowed for coordinates to each waypoint to be collected using iPhones while in the field.

Survey 123 was used to generate the report; the *Generate Feature Report* tool allowed for a fully automated process of creating data sheets.

4.3 Community Outreach

Residents were provided with information about the Project in real-time in a letter from the District about the Project. Because of the large amount of points located on or near private property, advance notice provided to landowners would have been beneficial and could prevent future conflict with landowners.

4.4 Field Data Collection

Field data collection consisted of assessments of 2008 waypoints and new sites found both opportunistically in the field and during the desktop analysis. Data collected during the field surveys were more detailed and precise than the data gathered in the 2008 Inventory.

The following outlines the individual data components collected and assessed during field surveys.

4.4.2 General Site Information

For every site surveyed, the general characteristics captured included:

- Survey date and time
- Location
- Type of site (gully, pipe outfall, or combination site)
- 2020 waypoint ID
- 2008 waypoint ID
- Point correction coordinates
- Current weather conditions
- Whether there was a storm/rainfall event within the preceding 24 hours
- Water level and velocity
- Access conditions
- The presence of trash or debris
- The presence and abundance of invasive species
- Photos and captions for each site

4.4.3 Gully Site Information

For locations where only a gully was observed, the gully survey datasheet in Survey123 was used, which included the following information:

- Estimation of the gully depth, bottom width, top width, head cut UTM, and length
- Gully bottom or gully bank conditions: e.g., bare soil, armored, some or heavy vegetation
- Gully materials: bedrock, boulder/cobble/gravel, sandy, fine-grained cohesive
- Gully shape: U-shape, V-shape, trapezoid, other
- Problem indicators: Slumping, Channel Incision, Undercut/Overhanging Banks, Pistol-Butted or Leaning Trees, Aggradation, Degradation, Loss of Bank Vegetation, None, Other
- Existing stabilization features and if they were successful
- Gully classification: Gully, Stream, Unsure, Other
- General site observations
- Apparent causes: Channel Obstruction, Slope, Seep/Groundwater, Dense Canopy, Channel Incision, Game Trails, Unstable Drainage Features, None/Unknown

A qualitative erosion potential (the likelihood of erosion) of *high, moderate,* or *low* was assigned for each location, determined using the information collected on the gully inventory sheets. Assigning the erosion potential did not constitute a quantitative erosion volume estimate. A gully survey datasheet was completed for each site, capturing the information noted above, and photos were taken with descriptions provided.

4.4.4 Pipe Outfall Site Information

For locations where only a pipe outfall was observed, the Pipe Outfall Survey datasheet in Survey123 was used, which included the following information:

- Pipe diameter
- Pipe material: corrugated metal pipe, plastic, concrete
- The presence of an apron, and its condition if applicable
- Erosion noticed: inlet, outlet, both, none
- Outlet condition: hanging, erosion, scour, sediment delta
- Observations: illicit discharge, presence of a pipe within a pipe
- Whether the pipe requires attention

4.4.5 Combination Site Information

Sites where a pipe outfall directly discharged into a gully were designated as combination sites. The combination survey datasheets in Survey123 were used to capture all the data in these locations, presenting both the full pipe outfall and gully site information in a single datasheet. Additional information collected for combination sites included determinations of whether it was a new pipe site or a new gully site and whether the gully was upstream or downstream of the pipe.

4.4.6 Inaccessible Sites

Unreachable sites were locations in which the field team visited and were unable to access for evaluation due to heavy vegetation, or steep slopes, or other hazardous field conditions. The sites might serve as viable candidates for future drone surveys or be considered for evaluation during the fall–spring months before leaf-on conditions.

4.4.7 Non-Applicable Sites

Non-applicable (N/A) sites, miscellaneous sites, and unfound locations were documented as part of the field survey, using a separate N/A survey form. Miscellaneous sites, or N/A sites, were locations included in the 2008 Inventory that did not include a gully or an outfall, such as dump sites. These waypoints were visited to determine in the field whether or not they were applicable to the Project. Unfound points were waypoints from the 2008 Inventory which, upon field visit in 2020, were determined to not contain any feature applicable to the Project and for which the cause or intention behind the original waypoint's inclusion in the inventory could not be readily determined. The following abbreviated information was collected at N/A sites to document the visit to the area:

- Site name

- 2008 waypoint ID
- City
- Date and time
- Site totes
- Photos and captions

4.5 Data Evaluation and Review

The Project's site evaluation and analysis process improved on the 2008 Inventory by integrating enhanced data collection and more precise methods of characterizing gullies, pipe outfalls, and combination sites. New sites were identified and evaluated concurrently with existing sites and integrated into the Project, providing a more robust data set for the District. This Project compared the 2008 benchmarked erosion potential against observation during the 2020 field survey, developing erosion progression ranking to determine high-priority sites. The methods used are detailed in the sections below.

4.5.1 2020 Gully Condition Assessment

The protocol established for the Project included collecting more qualitative data during the field surveys than the 2008 Inventory. Erosion potential rankings assigned during the field surveys matched the scale used to benchmark the 2008 Inventory. Field rankings were based on observed primary and secondary factors. Primary factors included the presence of problem indicators at each site, providing evidence of slope movement, active erosion, and inherent instability in the gully. Apparent causes were also primary characteristics incorporated into the ranking because they gave evidence of the way the gullies formed as well as providing a rationale for whether a given gully will continue to persistently erode. Secondary factors were inherent properties of the gully and surrounding area that contributed to the erosion potential of the channel. Gully geometry, shape, and slope gradient, conditions of the channel, and the presence of water or seeps in the channel were the main secondary factors considered. Minor secondary factors such as the gully material and the presence and abundance of invasive species were also considered. These factors assisted in determining whether the channel possessed any inherent instability.

The benchmark assessment of the 2008 Inventory was compared to the 2020 field rankings to determine the evolution of the site from 2008 to 2020. High-priority sites included gullies that retained high erosion potential between the two surveys; sites that increased in severity from low or moderate potential to high potential; and sites with no previous benchmark data that nonetheless rated as having high erosion potential in the 2020 study. High-priority regions (HPRs) were determined by grouping clusters of high-priority sites based on shared characteristics, geographic proximity, or shared access conditions.

Groupings were also made for clusters of sites that formed larger gully systems, such as several sites in and around a stream channel and valley walls.

4.5.2 2020 Pipe Outfall Ratings

The pipe outfalls were evaluated in the field based on the data collected and discussed in Section 4.4.3. The overall pipe outfall rating was determined by whether the outfall was in need of immediate repair, might need repair in the near future, or appeared stable. The determination used the characteristics noted below.

- **In need of immediate repair (Figure 7)**:
    - Severely hanging pipes
    - Causing direct destabilization in the downstream gully
    - Presence of severe rust, corrosion, or broken outlet features
    - Buried in sediment

Figure 7. Example of a pipe outfall marked as needing immediate repair.

Maybe in need of repair (Figure 8):

- Possible hanging or minor erosion present at outfall and discharging into downstream gully; current state did not make it possible to determine if immediate attention was required
- Exhibited some signs of destabilization, but did not appear to need immediate attention

Figure 8. Example of a pipe outfall marked as "maybe" needing repairs.

Stable or not in need of repair (Figure 9):

- Showed no signs of significant erosion or aggradation at the outfall.
- Structure appeared to be stable and intact.

Figure 9. Example of a pipe rated as being stable and not in need of immediate repairs.