Marysville Cemetery, Montana
June 23, 2018

Report Prepared for:
The Montana History Foundation

Prepared by:
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Adela Morris, 650 867-0171 adela@prusik.com

This report contains confidential archaeological information about the location of human burials, it should not be provided to third parties without the permission of The Montana History Foundation.
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Summary of Our Findings

The canine search identified nearly 40 burials in the Marysville Cemetery. The Earl Fred book on Marysville lists about 100 known burials. The dogs do not find every burial, but find a sampling of the burials within a cemetery. The combined scent field from multiple burials make it difficult for them to locate the maximum scent for each burial, particularly when several burials are close together. The canine alert map should be viewed as an indicator of the areas that contain human burials.

Project Information

<table>
<thead>
<tr>
<th>Date</th>
<th>June 23, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name</td>
<td>Marysville Cemetery</td>
</tr>
<tr>
<td>Client</td>
<td>The Montana History Foundation</td>
</tr>
<tr>
<td></td>
<td>1750 N. Washington St.</td>
</tr>
<tr>
<td></td>
<td>Helena, MT 59601</td>
</tr>
<tr>
<td>Contact</td>
<td>Charlene Porsild <a href="mailto:charlene@mthistory.org">charlene@mthistory.org</a> 406 475-4383</td>
</tr>
<tr>
<td>Other Agencies or Interested Parties:</td>
<td>Marysville Pioneer Association</td>
</tr>
<tr>
<td></td>
<td>Box 16</td>
</tr>
<tr>
<td></td>
<td>Marysville, MT 59640</td>
</tr>
<tr>
<td>ICF Personnel Responding</td>
<td>Name</td>
</tr>
<tr>
<td></td>
<td>John Grebenkemper</td>
</tr>
<tr>
<td></td>
<td>Adela Morris</td>
</tr>
<tr>
<td>Pertinent History</td>
<td>Marysville was founded in 1876 and was a prosperous gold mining town between the 1880’s and 1890’s. The cemetery is in need of restoration and maintenance.</td>
</tr>
<tr>
<td></td>
<td>June 21-23, 2018 The Montana History Foundation put on a cemetery preservation technology workshop. Part of that workshop was a field day exercise for participants to observe, participate and learn more about different techniques available to help document historic cemeteries. Our ICF teams worked to help identify unmarked burials.</td>
</tr>
</tbody>
</table>
General Information:

Weather Conditions

Weather and ground temperatures play a critical role in the dogs’ ability to locate scent. We monitor ground temperatures regularly during searches as this directly affects the availability of scent. For example, an air temperature of 80°F in sunny conditions can have a ground temperature of 100°F or higher. Hot weather conditions, especially ground temperatures 85°F and higher appear to decrease the scent available to the dog. We stop working the dogs when ground temperature reaches 100°F. Additional information about dog working conditions is available in Addendum A.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Weather Conditions during the search: Light rain in the morning; overcast in the afternoon. Air and ground temperature were in the 60's with no impact on the canine search capabilities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground temperature</td>
<td>ranged from 56°F at 10:00 am to 73°F at 2:30 pm</td>
</tr>
</tbody>
</table>

The following information is important to the individuals reading this report. For more detailed information, please refer to Addendum A, at the end of this document, which details the ICF Practices and Procedures. These Practices and Procedures address the following subjects in more detail:

- General information About the Dogs
- Search Strategy
- Percent of Accessible Terrain
- Alert Quality Key
- Dog Working Conditions
- Dog Training and Certification
- Scent Travel
- Reports

Percentage of Terrain Accessible to the Dogs

While reading this report it is important to remember the following:

- The percentage of terrain accessible to the dogs is different at each site.
- The percentage of terrain accessible affects the amount of area that can be covered by the dogs.

Alerts

Our dogs are specifically trained to detect the scent of human remains. Once they have detected the scent of human remains, they are taught to give a trained “alert.” The alert is either a sit or down at the strongest source of the scent they have located. At times it is not physically possible to alert near the source due to vegetation or other obstacles, so the dog tries to communicate that they have scent but are unable to get to the source. Since the dogs can only communicate in limited ways, the handler must interpret their actions. We do this by observing the dog’s actions and comparing it to past experiences working known graves or human bones. For example, when we observe the dogs
with their heads up, sampling the air after we ask them to indicate the location, we interpret this action as the scent being airborne and an exact location cannot be pinpointed. Dogs have varying abilities and scent thresholds. For more detailed information on alerts, see Addendum A.

**Alert Quality Key**
The handlers use 1-3 designation to rate the alerts the dogs give at each location. This is based on each handler’s experience and their dog’s behavior when they work burials and perform their trained alerts. For more detailed information on alerts, see Addendum A.

1. **Strongly Committed**: The dog immediately identifies and alerts at a specific location.
2. **Committed**: The dog took time to locate and alert at the strongest source of scent.
3. **Scent Pool**: The dogs are getting scent but are unable to locate the exact source. Scent pools may be the result of disturbed, scattered or fragmentary remains; or, they may be created by wind and/or moving water. It could be scent remaining in the soil where a burial was located but where physical remains are no longer identifiable.

**Note**: The alert quality will vary depending on the search conditions.

**Recording Alerts**
Once a dog alerts to the scent of human remains, the handler uses a pin flag to mark the location and a GPS position is taken. Each handler uses a distinctive flag color (see table below for this project). We flag the dogs’ alerts, so the client can use a more accurate measuring device to get coordinates should they so choose. Alert waypoints are given using the handler initials and their GPS waypoint number.

<table>
<thead>
<tr>
<th>Handler ID &amp; Flag colors</th>
<th>AM = Adela Morris / Jasper, blue flags</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AJ = Adela Morris / Jett, red flags</td>
</tr>
<tr>
<td></td>
<td>JG = John Grebenkemper / Kayle, pink flags</td>
</tr>
</tbody>
</table>

We use the Garmin 60CSx GPS, which gives us approximately 3- to 9-meter accuracy in optimal conditions. We use the standard WGS 84 geodetic datum settings on our GPSs, we use UTM unless the client has another preference.

**Search Strategy**
The various search modes used in this project are:
- Free
- Wide Grid
- Detail
- Fine Grid

See Addendum A for definitions and more detailed information.
Search Areas

Search Area: Marysville Cemetery

<table>
<thead>
<tr>
<th>Vegetation &amp; Terrain Description</th>
<th>The grasses had been recently cut, there was still some thick vegetation in some locations. A few scattered trees and other bushes were in the area.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Terrain Accessible to the Dog</td>
<td>We estimate this search area was between 50% and 75% accessible to the dogs.</td>
</tr>
<tr>
<td>Search Strategy</td>
<td>Dog handlers used a perimeter and grid search of this area.</td>
</tr>
<tr>
<td>Please see Addendum A for the full description of Search Strategies.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Handler/Dog</th>
<th>Way-point #</th>
<th>GPS Coordinates, UTM</th>
<th>Alert Quality</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adela/Jasper</td>
<td>AM16</td>
<td>12 T 401416 5178891</td>
<td>2</td>
<td>Unmarked area</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM17</td>
<td>12 T 401407 5178910</td>
<td>2</td>
<td>Unmarked area</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM18</td>
<td>12 T 401405 5178896</td>
<td>2</td>
<td>Rock</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM19</td>
<td>12 T 401393 5178893</td>
<td>2</td>
<td>Rock, outside of iron fence with graves inside</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM20</td>
<td>12 T 401405 5178935</td>
<td>1</td>
<td>Wooden box</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM21</td>
<td>12 T 401394 5178935</td>
<td>2</td>
<td>Depression with flowers, corroborated</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ22</td>
<td>12 T 401391 5178901</td>
<td>3</td>
<td>Outside of iron fence with graves near AM19</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ23</td>
<td>12 T 401401 5178890</td>
<td>2</td>
<td>Corroborated JK14</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM24</td>
<td>12 T 401438 5178932</td>
<td>3</td>
<td>By boundary fence</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM25</td>
<td>12 T 401433 5178931</td>
<td>2</td>
<td>Wood, corroborated JG25</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM26</td>
<td>12 T 401426 5178908</td>
<td>2</td>
<td>Collapsed wooden fence, corroborated JG22</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM27</td>
<td>12 T 401417 5178898</td>
<td>2</td>
<td>Down wooden fence next to Franklin grave</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM28</td>
<td>12 T 401404 5178925</td>
<td>2</td>
<td>Downed wooden fence, corroborated JG31</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM29</td>
<td>12 T 401402 5178946</td>
<td>2</td>
<td>Downed wooden fence, corroborated JG28</td>
</tr>
<tr>
<td>Adela/Jasper</td>
<td>AM30</td>
<td>12 T 401411 5178950</td>
<td>2</td>
<td>Depression, corroborated JG27</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ31</td>
<td>12 T 401401 5178941</td>
<td>2</td>
<td>Corroborated JG28, AM29</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ32</td>
<td>12 T 401423 5178909</td>
<td>2</td>
<td>Corroborated AM26, JG22</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ33</td>
<td>12 T 401425 5178919</td>
<td>2</td>
<td>Corroborated JG24</td>
</tr>
<tr>
<td>Adela/Jett</td>
<td>AJ34</td>
<td>12 T 401410 5178922</td>
<td>2</td>
<td>Corroborated AM28, JG31</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG12</td>
<td>12 T 401419 5178892</td>
<td>2</td>
<td>Mead</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG13</td>
<td>12 T 401406 5178888</td>
<td>2</td>
<td>Allinson</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG14</td>
<td>12 T 401403 5178887</td>
<td>2</td>
<td>Rock Mound</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG15</td>
<td>12 T 401398 5178893</td>
<td>2</td>
<td>Thompson</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG16</td>
<td>12 T 401388 5178897</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG17</td>
<td>12 T 401403 5178905</td>
<td>1</td>
<td>Schenk</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG18</td>
<td>12 T 401400 5178912</td>
<td>2</td>
<td>Schaffer</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG19</td>
<td>12 T 401390 5178909</td>
<td>2</td>
<td>Mound</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG20</td>
<td>12 T 401425 5178899</td>
<td>2</td>
<td>Decayed Wood</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG21</td>
<td>12 T 401421 5178905</td>
<td>2</td>
<td>Strom (4 mos)</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG22</td>
<td>12 T 401425 5178909</td>
<td>2</td>
<td>Decayed Wood</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG23</td>
<td>12 T 401426 5178919</td>
<td>2</td>
<td>William ??hurin</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG24</td>
<td>12 T 401427 5178917</td>
<td>2</td>
<td>Depression</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG25</td>
<td>12 T 401437 5178929</td>
<td>3</td>
<td>Decayed Wood</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG26</td>
<td>12 T 401437 5178933</td>
<td>2</td>
<td>Anderson</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG27</td>
<td>12 T 401407 5178946</td>
<td>2</td>
<td>Near Powers grave</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG28</td>
<td>12 T 401402 5178945</td>
<td>2</td>
<td>Wood Structure</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG29</td>
<td>12 T 401401 5178918</td>
<td>1</td>
<td>James</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG30</td>
<td>12 T 401399 5178933</td>
<td>2</td>
<td>Depression, AM21</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG31</td>
<td>12 T 401409 5178923</td>
<td>2</td>
<td>Decayed Wood, AM28</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG32</td>
<td>12 T 401414 5178913</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG33</td>
<td>12 T 401427 5178930</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG34</td>
<td>12 T 401429 5178941</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG35</td>
<td>12 T 401423 5178927</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG36</td>
<td>12 T 401412 5178917</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG37</td>
<td>12 T 401435 5178945</td>
<td>2</td>
<td>Goers</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG38</td>
<td>12 T 401445 5178947</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG39</td>
<td>12 T 401433 5178946</td>
<td>2</td>
<td>Rock Ring</td>
</tr>
<tr>
<td>John/Kayle</td>
<td>JG40</td>
<td>12 T 401384 5178904</td>
<td>2</td>
<td>White Marker</td>
</tr>
</tbody>
</table>
Map A - Handler Tracks

It’s important to note that the tracks on this map are those of the handlers and not the dogs. The dogs range away from the handlers and cover more area than indicated by the handlers’ tracks.

John / Kayle = Pink
Adela / Jasper = Blue
Adela / Jett = Red
Map B - Canine Alerts

John / Kayle = Pink
Adela / Jasper = Blue
Adela / Jett = Red
Photographs

Jasper surveying the outside of the fenced area, Kayle alerting on an unmarked burial.
Jasper alerts on a stone marker while participants GPS and document the grave.
Jett corroborates an alert that Jasper and Kayle have already identified.

Kayle alerts at Schenk grave
Kayle alerts at an unmarked grave

View of cemetery looking Northeast
## Handler Biographies

| Adela Morris | Historical Human Remains Detection Specialist  
| Instructor: Human Remains Detection |

Adela has been involved in human remains detection with her dogs since 1986 and has deployed her dogs on hundreds of searches specializing on cold cases, crime scenes and historical burials.

She is the founder of the Institute for Canine Forensics, a nonprofit organization for the advancement of research and education for the use of canines in the gathering of forensic evidence. Adela is also the founder of the Canine Specialized Search Team, a volunteer resource for Santa Clara County Sheriff’s Office.

Adela is an evaluator and instructor for Human Remains Detection, Canine Decontamination and Canine First Aid. She has served as an expert witness. Jasper is her 7th certified detection dog.

**Canine:** Jasper  
**Historical Human Remains Detection Dog**  
**DOB:** January 1, 2011  
**Breed:** Border Collie, Tri Blue Merle  
**Certification:**  
Historical Human Remains Detection; re-certified every year since initial certification in 2012

**Canine:** Jett  
**Historical Human Remains Detection Dog in Training**  
**DOB:** November 17, 2016  
**Breed:** Border Collie, Black & White  
**Certifications:**  
Historical Human Remains Detection; certified June, 2018
<table>
<thead>
<tr>
<th>John Grebenkemper</th>
<th>Historical Human Remains Detection Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td>John joined ICF in 2007 and certified his first dog in less than a year. One area of special interest is using canine scent detection to locate western emigrant graves.</td>
<td></td>
</tr>
<tr>
<td>John’s current dog, Kayle, is his second certified historical human remains detection dog. He has worked numerous HHRD projects with ICF.</td>
<td></td>
</tr>
<tr>
<td>Before joining ICF, John spent 40 years working in the field of physics and engineering research. He received a PhD from Stanford University, has published more than 20 technical papers, and received 8 U.S. patents.</td>
<td></td>
</tr>
</tbody>
</table>

**HHRD Publications**

**Canine: Kayle**
- **Historical Human Remains Detection Dog**
- **DOB:** January 10, 2009
- **Breed:** Border Collie, Black & White
- **Certification:** Historical Human Remains Detection (HHRD), certified in January 2011.
Addendum A

Using Historical Human Remains Detection Dogs

The Institute for Canine Forensics (ICF) is a 501(c)(3) non-profit corporation established in 1998. ICF is singularly dedicated to training and certifying Historical Human Remains Detection (HHRD) dogs. HHRD dogs have unique and specialized training to teach them to locate historic and prehistoric human remains. We work closely with archaeologists and anthropologists to ensure our training and methods are consistent with current standards of practice. This document describes some basic requirements clients need to know to ensure their project would be enhanced by using HHRD dogs. For more information on the Institute for Canine Forensics, including articles, advisory board, past projects and testimonials you can go to our web page at: www.HHRDD.org.

This document will address the following subjects:
- General information about the dogs
- Search strategy
- Alert Quality Key
- Dog working conditions
- Dog training and certification
- Scent travel
- Percentage of Accessible Terrain
- Reports provided

General Information about the Dogs
Each handler owns their own dog and is responsible for their dog’s training, health and wellbeing. Along with scent training, the dogs are taught obedience and socialized to other animals and humans. Most of our dogs have flown all over the country and, in some cases, internationally. They fly in-cabin with us under the umbrella of service and working dogs. We use a variety of dogs, but all are working breeds, usually from working lines. Typical breeds we use include Labradors, German Shepherds, Australian Shepherds, Border Collies, Golden Retrievers, as well as some mixed breeds.

Our dogs are trained to perform an alert when they detect the scent of human remains. The alert is either a sit or down at the strongest source of the scent they have located. At times it is not physically possible to alert near the source due to vegetation or other obstacles, so the dog tries to communicate that they have scent but are unable to get to the source. Since the dogs can only communicate in limited ways, the handler must interpret their actions. We do this by observing the dog’s actions and comparing it to past experiences working known graves or human bones. For example, when we observe the dogs with their heads up, sampling the air after we ask them to
indicate the location, we interpret this action as the scent being airborne and an exact location cannot be pinpointed. Dogs have varying abilities and scent thresholds.

**Search Strategy**

Archaeologists use a wide range of multidisciplinary techniques to locate historic and prehistoric sites. Many times they combine techniques such as oral history, historical records, remote sensing like metal detectors and GPR and physical remains to help locate sites. Historical Human Remains Detection dogs are another type of remote sensing. Their unique ability to detect and recognize the scent of human remains makes them a tool that can aid archaeologists as well as a tool to combine with other more traditional techniques. Using scientific methodologies, archaeologists can build predictive models to help determine the possibilities for unknown burials in a given location. HHRD dogs can be used to add layers to a predictive model.

Each project is unique, as is each search area. An initial strategy is defined based on information given to us by the client during the negotiation phase. This is re-evaluated once we arrive at the search site and may be adjusted to fit current conditions. The terrain, weather and amount of time we have to search the designated areas dictate the search mode we will use.

These search modes are:

- **Free:** This style of search lets the dog choose the area it wants to search and is not as controlled as a grid search. It can be useful when speed is needed but it can be more difficult to keep track of the areas the dog has searched. The benefit of this search mode is if the dog has scent they will gravitate to that location and work it first.

- **Wide Grid Search:** The size of the grid spacing depending on terrain, it ranges from 10 to 30 meters. This style of search covers areas faster and is used when we have limited time or large areas to search. This usually means less coverage of a search area. To increase the probability of detection, the area is often searched with a cross-grid.

- **Detail Search:** A detail search is commonly used when we are looking for or believe we have located a cemetery. It typically uses grid spacing from 3 to 5 meters and often is searched with a cross-grid to get better coverage and probability of detection.

- **Fine Grid Search:** A fine grid search is used to search for single bones and teeth. It typically uses a grid of about 1 to 2 meters and often is searched with a cross-grid to get better coverage and probability of detection. We do not use it very often in the field because we are usually not asked to search for individual bones and teeth. A Find Grid Search covers about ¼ acre per hour. It is tiring on the dog and they usually need a rest break after covering their ¼ acre.
The search location is broken down into multiple, manageable areas and handlers are assigned to each area. Each area is usually searched by at least 2 dogs in order to get the best coverage. We use different colored flags for each dog and mark each flag with the team’s identification, waypoint number and other important information. Single-flagged alerts are given the same creditability as multiple-flagged alerts.

The dogs work at different times during the day with different weather conditions and for varying lengths of time. Each handler chooses the best search strategy based on the weather conditions, terrain and their dog. Typical search patterns include searching boundaries followed by gridding in 2 directions. Grid spacing depends on terrain, soil conditions and what we are looking for. Using multiple dogs to cover an area increases the probability of detection.

Some projects dictate that we use a blind approach where alerts from the dogs are not flagged, only recorded by the initial handler. A second team then works the same area without knowing what the previous team has done. A monitor may observe each team to make sure any areas in question are searched. This strategy is used when more scientific information is desired.

Some projects have time constraints where we need to find potential burials quickly and do not have a need for a blind study. The first team searching the area will flag any alerts and record GPS UTM coordinates.

In past projects, native monitors and/or archeologists have located areas they deem significant due to their knowledge of the terrain, topography, and presence of artifacts or features that were used in historic or prehistoric burial practices. The handler/dogs are given a narrowed down area to search but are not told exactly where these features are. This eliminates the potential to cue or guide the dogs to a specific object or location.

Percent of Accessible Terrain

The percent of accessible terrain is estimated by how much of the search area the dogs can get access to the surface of the ground. Scent can be trapped in plants above the burial. Brush, thick grasses, downed trees, etc. can make it very difficult for the dogs to cover some areas. Dry grasses like foxtails, needle grass, rip gut, wild rye and wild oats can be very dangerous to the dogs as they propagate by seed pods that have one-way barbs. These seeds can attach to the animals’ fur and can lodge in the dog’s nose, eyes, ears or skin, sometimes requiring surgical removal.

Dense grass above four (4) inches in height can degrade the Probability of Detection (POD) for the dogs. Grass above one (1) foot in height has a significant degradation in POD. The taller grasses,
and other groundcover, trap scent in a localized area and the dog must pass directly above that area, with their nose at ground level, in order to catch the scent. It is recommended that tall grass be cut a week before a search. If that isn’t possible, a shorter time interval than a week is preferable over searching in tall grass. Ideally it is recommended that the cut grass be removed if it leaves large, thick clumps, which can result in trapping the scent between the clumps and the ground and not allowing it to rise.

Paved areas create scent barriers. Asphalt can be worked if it is old, cracked, and/or has holes, although it has a very low Probability of Detection (POD.)

It is important to note that there is a difference in the Percent of Accessible Terrain and the amount of area covered by a dog. The area covered is dependent on the terrain, ground and weather conditions, search mode and the amount of time allotted to work an area. The more dogs that are worked in a specific area, the greater the area covered and the higher the Probability of Detection.

Alert Quality Key
The handlers use 1-3 designation to rate the alerts the dogs give at each location. This is based on each handler’s experience and their dog’s behavior when they work burials and perform their trained alerts.

1. Strongly Committed: The dog immediately identifies and alerts at a specific location.
2. Committed: The dog took time to locate and alert at the strongest source of scent. This may be due to soil, weather conditions, and/or the age or condition of the bones.
3. Scent Pool: The dogs are getting scent but are unable to locate the exact source. Scent pools may be the result of disturbed, scattered or fragmentary remains; or, they may be created by wind and/or moving water. It could be scent remaining in the soil where a burial was located but where physical remains are no longer identifiable.

The alert quality key has been developed over several years by observing the dogs’ typical reaction to different kinds of known locations of remains, for example scattered remains from a burial or intact burial at a cemetery. The dog is taught a specific alert when they locate the imprinted scent. They are taught to get as close as they can to the strongest scent. In some cases, the strongest scent location may be a crack in the ground or a rodent hole next to the burial.

In the case of scent pools, there may not be a “source” in the area for the dogs to give a definitive alert on; however, their body language will indicate that they are getting diffused scent in the area.

Multiple flags in close proximity do not necessarily mean more than one grave but most likely are because each dog chooses a different location to alert on at a single grave. Each burial may be
anywhere between 3ft to over 5ft in length. Multiple flags in close proximity can also mean the burial has been scattered by ground dwelling rodents, roots, or earth moving equipment.

When a body has decomposed in the ground the “grave soil” contains the scent that the dogs recognize as human remains. Alerts on disturbed, “scattered” burials can be grave soil, or actual remains (bones/teeth).

One of the most difficult sources for the dogs to locate by scent is surface bone in a desert environment where it has been bleached and deteriorated due to sun and other elements. Bone or other human remains (scent) are protected when they are buried in soil. Winter conditions make long-term exposed bone somewhat easier to locate as the moisture brings out the scent.

**Dog Working Conditions**

Our dogs are living creatures and subject to weather, especially heat. Cool, moist conditions are best. The best conditions are not always possible due to the season or location of the project. We have adopted some standard working practices to help ensure the dogs are safe and we get the best possible results. Our dogs are athletes and our training program builds their endurance to extend the duration of time they can work. Each project has its unique set of circumstances.

A basic list of guidelines we subscribe to follows:

- The dogs’ workday varies from 4 to 6 hours per day, depending on weather and conditions. A workday is not the same as “nose time”. Nose time is the amount of time the dog is actively working.
- The dogs can cover anywhere from 2 to 10 acres per workday depending on what they are looking for, the weather, the terrain and the search strategy used.
- Our dogs typically work 3 days on and 1 day off.
- We stop working dogs when the ground temperature reaches 100°F, or the dogs internal body temperature reaches 104°F.
- Weather and ground temperatures play a critical role in the dogs’ ability to locate scent. We monitor ground temperatures as this directly affects the availability of scent. Hot weather conditions, especially ground temperatures 85°F and higher appear to decrease the scent available to the dog.
- In general ground temperatures below 85°F work best for locating burials. The higher the ground temperature, the lower the probability of detection. Ideal ground temperatures are between 40°F and 85°F. The most desirable conditions are mist and light rain. Heavy rain is difficult to work in for both the handler and the dog. Standing water or flooded conditions may make it more difficult to pinpoint a burial as it can block scent or move it around.
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Client Report

- We do not work in rain heavier than a slight drizzle or on ground with standing water due to degradation of scent conditions.
- The safety of our dogs always comes first. For example, we do not work deserts at night in the summer due to the presence of rattlesnakes. We prefer that any electric fences in the area be turned off. Livestock and other animals, like loose dogs, can cause undue safety issues. At some locations we work the dogs on a long line for their safety.
- Each handler has their own personal protection equipment (PPE) including a hard hat, high visibility vest for themselves and a high visibility vest for the dog.

In addition to the ideal cool, moist conditions, our dogs have successfully worked projects in the following conditions:
- Hot, dry desert conditions (Southern California deserts)
- Cold, wet conditions (Alaska, although we have not worked in snow)
- Hot, humid tropical conditions (Nikumaroro, Republic of Kiribati)

Training and Certification
We start training our dogs as soon as we get them and do not stop until they retire. We meet or exceed best practice standards for similar detection dogs in the industry. Typically, we train several days per week. Best practice for the industry states that a canine shall complete a minimum of sixteen (16) hours of training per month. Most of our dogs train 40 or more hours a month. We train in all types of weather conditions and terrains, including buildings, urban and wilderness. Although our dogs have no difficulty locating human remains in various stages of decomposition, their training is focused on bones and burials that are no longer in the active stages of decomposition.

Additionally, our dogs are:
- not cross-trained for other scent disciplines
- socialized to many different situations, people and places
- trained to alert as close as possible to the strongest scent available. An alert is either a sit or down
- taught to preserve scent sources and are not allowed to dig or mouth potential remains
- routinely trained with flags present so they learn that flags in their search area are insignificant and do not necessarily relate to an alert by another dog.

We track our training sessions in a database that includes nose time, location of trainings and whether problems were worked blind or known.

To become certified, the dog-handler team must complete pre-certification signoffs of specific criteria and have obtained required search equipment to demonstrate the team is ready for certification.
Certification tests are set up and run by a team of two pre-approved evaluators, one is from the team and one is an outside evaluator. They have specific criteria they follow when preparing and running a test. The evaluators have a checklist of test scoring criteria that must be met for the team to pass. The certifying team must have an efficacy score between 75% and 100% to pass. Once a team is certified, they must complete an ongoing annual certification that ensures skills and evaluations are done throughout the year, and maintain a 75% or higher efficacy.

**Scent Travel**

Human remains scent (vapor) travels away from the decomposing body or skeleton by way of diffusion, or vapor transport. Scent will follow the path of least resistance and can flow by means of water movement, animal or insect activity, and plant or root activity. Burrowing animals, such as rodents, as well as some insects like ants, create channels in the soil that can allow the release of scent to the surface.

Dogs can only detect what is available in the air. Water molecules compete with vapor molecules for binding sites. Water physically displaces odor molecules thus causing human remains scent to appear to be stronger, or pool, at vegetation or moist soil. Humidity is higher in and around photosynthesizing vegetation because it is transpiring. As vegetation transpires, it releases water into the atmosphere and bumps the odor molecules off of whatever they are bound to, making odor in the air more available to a dog’s nose.

**It is important to note that the dogs do not necessarily alert directly over a burial.** Disturbance of the land, be it man-made, rodent and/or insect activity or the natural movement of the earth, including floods or landslides, can spread the scent over the area. The soil in which the body has decomposed retains the human signature that the dogs are trained to recognize and alert on. Disturbed burials will often create larger scent pools, making pinpointing by the dogs more difficult. However, even after years of disturbance and movement, the dogs can still detect, and alert, in reasonably close proximity to a burial.

Bones that have been on the surface for extended periods of time will deteriorate, losing most of their scent, especially in areas with direct sunlight and hot conditions. Environmental conditions that break down scent include sunlight, heat and wind. Intact, undisturbed graves have more scent available than do disturbed graves or bones.

**Accuracy**

The ICF canine accuracy at finding graves has been measured in only a few unmarked historical cemeteries. In these measurements, the position of the canine alerts is compared to the position of
the center of the grave. Results show that the standard deviation of the canine alert position is about 4 meters as compared to geophysical positions taken at the same cemeteries. No excavation was done at any of these graves. These same tests also showed that the dogs cannot accurately discriminate between burials immediately adjacent to each other.

Reports
We produce a final report on each project for the client. The report generally contains the following information:

- Coordinates of all dog alerts using a Garmin 60CSx or similar device, which has an approximate 3-9 meter range of accuracy
- A map of the search area(s) and any recorded alerts therein
- Description of the terrain
- Alert interpretation, comments and observations
- Sample pictures of terrain and dog alerts, as available
- Weather
- Handlers’ Biographies
- Summary of our findings
Addendum B

Client List

Over the years the ICF has contracted with many federal, state and local agencies and cultural resource management firms to provide them with assistance in locating historic and prehistoric human remains, both inhumations and cremations.

Our clients include:

Federal Level
- US Army Corps of Engineers, Engineering Research Development Center, Construction Engineering Research Laboratory. Worked with author Carey Baxter, Archaeologist, on a study to Determine the Effectiveness of Historic Human Remains Detection Dogs - published in 2015. A link is on the home page of our website www.HHRDD.org
- US Army - Hawai‘i, Schofield Barracks, Dr. Laurie Lucking, Cultural Resources Mgr.: ICF participated in a study in Hawai‘i where our dogs correctly identified a site where known ancient Hawaiian burials had been discovered during construction many years ago. Still awaiting the paper.
- National Park Service
  - Tahoe National Forest, Donner Camp
  - Plumas National Forest, Feather River Ranger District
- US Army Corps Research Lab / Ft. Leavenworth KS
- US Department of Veterans Affairs, Palo Alto Health Systems
- Bureau of Land Management

State Level
- University of California San Diego, Lynn H. Gamble, Ph. D
  CA-SDI-860 - Dr. Gamble tested the ICF canines on a known (cremated remains) cemetery that had been excavated in 1966 by Delbert True. Dr. Gamble states that the ICF canines were “highly successful in the identification of the cemetery area …”
- California State Parks: Bodie, where graves found by the dogs were corroborated by park rangers; North Coast Redwoods; Central Valley; and, Jedediah Smith, where the dogs located and alerted on a Native American burial known only to park management; Sutters Fort, Sacramento
- California Department of Transportation (CalTrans), Districts 1, 9 and others
- City of Port Angeles, WA, predictive model for Tse-whit-zan, to protect the Lower Elwha Klallam tribe prehistoric burials
Local Level
- City of Fort Bragg, CA
- City of Riverside, CA
- Camp Atterbury and Muscatatuck Urban Training Center, Indiana
- Indiana Department of Homeland Security SAR
- Sacramento (CA) Area Flood Control Agency

International Level
- Equipo Peruano de Antropologia Forense (EPAF), project in Peru
- National Geographic Society & The International Group for Historic Aircraft Recovery (TIGHAR), Nikumaroro Island, Phoenix Island Group, South Pacific

Native American
- Native Village of Tyonek, AK: President Alfred Goozmer
- Kwaaymii, Laguna Band of Indians, CA: Carmen Lucas, Native American Monitor, tested teams on burials on her ancestral land
- Greg Castro, Salinan, CA
- Salinan tribe, CA-MNT-2296
- Me-wuk, Tuolomne Economic Development Authority
- Mutsun/Ohlone, CA: Ann Marie Sayers, Most Likely Descendent
- Manzanita Band of the Kumeyaay Nation, Ocotillo Valley, CA
- Yocha Dehe Wintun Nation, CA
- Tolowa tribe, CA

Cultural Resource Management
- Applied Earthworks, CA
- Native American Rights Fund, Boulder, CO
- Rosenfeld Consultant Services, Homer, AK
- PAR Environmental Services, Inc., Sacramento, CA
- ASM Affiliates, Carlsbad, CA
- Pacific Legacy, Inc., Berkeley, CA
- Far Western Anthropological Research Group, Inc., Davis, CA
- Tetra Tech, Inc., Pasadena, CA
• Thomas F. King, PhD, LLC

Other Organizations
• Desert Research Institute, Reno, NV
• La Senora Research Institute, Santa Monica, CA
• LDS Church, Willie and Martin Handcart Parties, Hawn’s Mill Massacre
• Santa Clara University, Santa Clara, CA
• Mission San Antonio de Padua, CA
• Silverado Power, San Francisco, CA
• Santa Barbara Presidio (CA)