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Hanford Site Snake Hibernacula Report for Calendar Year 2016

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

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1.0 Introduction

The U.S. Department of Energy, Richland Operations Office (DOE-RL) conducts ecological monitoring on the Hanford Site to collect data needed to ensure compliance with an array of environmental laws, regulations, and policies governing DOE activities. Ecological monitoring data provide baseline information about the plants, animals, and habitats under DOE-RL stewardship at Hanford required for decision-making under the *National Environmental Policy Act* (NEPA) and *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). The *Hanford Site Comprehensive Land Use Plan* (CLUP, DOE/EIS-0222-F) which is the Environmental Impact Statement for Hanford Site activities, helps ensure that DOE-RL, its contractors, and other entities conducting activities on the Hanford Site are in compliance with NEPA.

The Hanford Site Biological Resources Management Plan (BRMP, DOE/RL 96-32 Rev 2) is identified by the CLUP as the primary implementation control for managing and protecting natural resources on the Hanford Site. According to the CLUP,

> The BRMP Provides a mechanism for ensuring compliance with laws protecting biological resources; provides a framework for ensuring that appropriate biological resource goals, objectives, and tools are in place to make DOE an effective steward of the Hanford biological resources; and implements an ecosystem management approach for biological resources on the Site. The BRMP provides a comprehensive direction that specifies DOE biological resource policies, goals, and objectives.

DOE-RL places priority on monitoring those plant and animal species or habitats with specific regulatory protections or requirements; or that are rare and/or declining (federal or state listed endangered, threatened, or sensitive species); or are of significant interest to federal, state, or tribal governments or the public. The BRMP ranks wildlife species and habitats (Levels 0-5), providing a graded approach to monitoring biological resources based on the level of concern for each resource. Hibernacula provide habitat essential to the life cycle of snake species on the Hanford Site. Snake hibernacula are ranked as a level 3 resource in the BRMP. The management goal for level 3 resources is conservation and requires a moderate level of status monitoring. A single hibernaculum may contain hundreds of snakes, often of several different species, including both common and sensitive species. Among the species that are known to inhabit the Hanford Site, the striped whipsnake (*Masticophis taeniatus*) is listed as a "State Candidate" by the Washington Department of Fish and Wildlife (WDFW) and is ranked as a level 3 resource in the BRMP. The night snake (*Hypsiglena torquata*) and racer (*Coluber constrictor*) are also known to occur on Hanford and are listed as "State Monitor" species by the Washington Department of Fish & Wildlife (WDFW).

1.1 Purpose and Scope

The protection and conservation of sensitive species and habitats requires regular monitoring to assess the status and long-term trends of these valuable resources. The purpose of this monitoring effort is to gain better knowledge of which snake species utilize the known snake hibernacula across the Hanford Site. The data collected will increase understanding of the diversity and distribution of the snake species that occur on Hanford, allowing for more informed management and conservation of snake populations.

1.2 Snakes on the Hanford Site

Snakes are one of the most misunderstood orders in the animal kingdom, often resulting in the intentional killing of individuals and destruction of habitat. Snakes fill an important role in the ecosystems they occupy, eating a variety of prey and providing a source of food for many other predators.

Snakes are ectothermic, meaning their bodies take on the temperature of their surroundings. As a result, they are unable to remain active during temperature conditions that are too hot or too cold. Snakes must seek refuge to avoid temperature extremes. During the winter months, snakes seek out underground refugia known as a den or hibernaculum, where they spend the winter hibernating. These locations have specialized temperature, humidity, and airflow conditions that allow snakes to survive without becoming frozen during the winter months. Snakes are thought to return to these locations year after year, making these habitats critical for the survival of snake populations.

In south eastern Washington, snakes typically seek out hibernacula in mid-Autumn, and remain inside until mid-Spring. Upon emergence, snakes will typically spend 1-3 weeks around the den prior to dispersing to feeding ranges, although some species may remain nearby longer for breeding and egg laying (Larsen 1997). Hibernacula locations are readily identifiable during the emergence period, due to the presence of snakes at the openings.

Several species of snakes have been observed using a single hibernaculum on the Hanford Site. In February of 2009, three species of snakes [western rattlesnakes (*Crotalus viridis*), garter snakes (*Thamnophis spp.*), and racers (*Coluber spp.*)] were observed in one hibernaculum in the 100-B/C Area during cleanup excavation activities that unintentionally unearthed a portion of a den. This adds to the importance of protecting hibernacula because sensitive snake species are using these hibernaculum to survive the winter months. The snake species known or suspected to occur on the Hanford Site are listed in Table 1 (Hallock 2005).

Table 1. Snake species known or predicted to occur on the Hanford Site

Species	Predicted	Documented	State Status
Striped Whipsnake (*Masticophis taeniatus*)	Yes	Yes	Candidate
Nightsnake (*Hypsiglena torquata*)	Yes	Yes	Monitored
Racer (*Coluber constrictor*)	Yes	Yes	Monitored
Western Rattlesnake (*Crotalus viridis*)	Yes	Yes	
Gopher Snake (*Pituophis catenifer*)	Yes	Yes	
W. Terrestrial Garter Snake (*Thamnophis elegans*)	Yes	Yes	
Common Garter Snake (*Thamnophis sirtalis*)	Yes	Yes	
Ringneck Snake (*Diadophis punctatus*)	Yes	No	

1.3 Hanford Site Snake Monitoring

In 1995 and 1998 a site-wide biodiversity inventory was conducted by the Nature Conservancy (Hallock 2005). This is the most extensive reptile study performed at Hanford to date. The study area included central Hanford along with areas now within the Hanford Reach National Monument. Prior to 1995, reptile research had been conducted mainly through site-specific, small-scale projects and those in conjunction with waste cleanup activities (TNCW 1999). Other reports came from incidental sightings. Snake hibernacula monitoring was performed by Mission Support Alliance (MSA) in 2012 and 2013

(Lindsey et al. 2012, 2013). These surveys focused on the identification of potential hibernacula and confirmatory visits to determine if these hibernacula were being utilized. The combined 2012 and 2013 surveys increased the known snake hibernacula on the Hanford Site from three to twenty-three (Lindsey et al. 2013). These surveys relied primarily on the auditory presence of rattlesnakes which were in or near the hibernacula during emergence. Snakes of other species, including sensitive species, were unlikely to be detected using auditory methods.

1.4 Objectives for the 2016 Snake Monitoring Efforts

Prior monitoring has involved surveying for snakes during their active periods (while they are widely dispersed) by performing day and night road surveys and walking visual encounter surveys. Recent snake hibernacula monitoring (Lindsey et al. 2012, 2013) occurred during hibernacula emergence, but used methods that rely on the detection of a single species (western rattlesnake). Snake hibernacula monitoring for 2016 attempted to take place during the similar period of emergence. The specific goals set for this monitoring effort were to:

- Monitor emergence patterns to better predict emergence activities during this and future monitoring events
- Determine which species are present within each of the known hibernacula on the Hanford Site
- Update distribution and abundance of hibernacula on the Hanford Site

2.0 Methods

The monitoring of snake hibernacula in 2016 proceeded in two phases: emergence detection and known hibernacula surveys. Monitoring staff intended to perform a bi-weekly visit to three-to-four hibernacula, document weather conditions, and determine if snakes were present at or near the surface. During the emergence detection phase, surveyors also deployed trail cameras (set for time-lapse) at a known snake hibernaculum. Surveyors aimed the cameras at possible entrances, attempting to include potential basking areas. The cameras were intended to be deployed prior to the beginning of emergence and were retrieved after all monitoring was complete.

Once emergence was confirmed, monitoring staff surveyed and documented the status of all known hibernacula on the Hanford Site. The 2016 snake hibernacula monitoring efforts included the use of a RIDGID SeeSnake® pipe inspection camera to attempt to determine the structure of each hibernaculum and detect snakes that were not present on the surface.

3.0 Results

3.1 Snake Hibernacula Emergence Detection

Emergence monitoring was initiated on March 29, 2016. The first survey resulted in the observation of six western rattlesnakes at the surface of the West of Rolling Rock 1, 2, 3 hibernaculum in the 100 B/C Area, indicating that emergence was already underway (Figure 1). Although emergence had been detected, snakes typically spend 1-3 weeks moving into and out of their hibernaculum prior to dispersal. Trail cameras were deployed at the Rolling Rock hibernaculum in an attempt to document the behavior of snakes during this period. The trail cameras were operational between March 28 and April 25, 2016.

Each camera was set in time-lapse mode to capture one picture every five minutes for a total of 8,111 pictures. No snakes were detected through the use of remote trail cameras during 2016 monitoring.

Figure 1. A western rattlesnake in striking position at the West of Rolling Rock 1, 2, 3 hibernaculum

3.2 Known Hibernacula Surveys

A total of 14 previously known snake hibernacula were surveyed between March 29 and 31, 2016. A total of 29 western rattlesnakes were observed at 6 of these locations. Den 4 & 5 on Gable Mountain were the most active hibernacula of the 2016 surveys, where 11 western rattlesnakes were observed on March 31. Incidentally, this was also the coolest temperature day of all surveys, with a field reading of 17.9°C (64.2°F). The second most active hibernaculum was Vernita Bridge, where 10 western rattlesnakes were observed on March 30. During this survey, the temperature was 20.7°C (69.2°F).

Two additional hibernacula were discovered while surveying on March 30. The McGee Pipe hibernaculum is located in a defunct military installation septic tank. Five western rattlesnakes were observed (Figure 2) at the bottom of a vertical section of underground pipe using the inspection camera. Due to the abrupt contour change of the pipe and the concentration of snakes, the camera could not be positioned further into the hibernaculum, but field staff were confident that more snakes were likely to occupy the structure. The second hibernaculum was discovered while surveying the Vernita Cliffs. While climbing down a talus slope en route from the Utility Pole Base hibernaculum to Vernita Cliff 3, field staff discovered that the talus slope was itself a den, and it was given the name Vernita Cliff 4.

In all, 50 western rattlesnakes and no other species were observed during the 2016 hibernacula surveys. With the exclusion of the new hibernacula surveyed, the overall total is nearly identical when comparing the 2012 and 2013 surveys to the same hibernacula surveyed in 2016, although eight of the fourteen hibernacula known to be historically active were found vacant. Because snakes typically return to the same hibernaculum annually, this vacancy can possibly be explained by the emergence prior to monitoring. Table 2 provides a summary of the results of these surveys.

Table 2. Results from 2012 and 2013 versus 2016 hibernacula surveys

Date Surveyed	Hibernaculum Name	General Location	Habitat Description	Snakes Observed: 2012 and 2013 (Quantity)	Snakes Observed: 2016 (Quantity)
March 29, 2016	West of Rolling Rock 1, 2, 3	100-B/C	Boulder pile covered in soil	*C.viridis(6)* *C. constrictor(1)*	*C. viridis(6)*
March 29, 2016	North of Asphalt Tanks	West of Hanford Townsite	Large hole with exposed pre-Hanford irrigation pipe showing in bottom	*N/A*	*C. viridis(5)*
March 30, 2016	McGee Ranch	McGee Ranch	Large hole with exposed pre-Hanford irrigation pipe showing in bottom	*C. viridis(2)*	*0*
March 30, 2016	Utility Pole Base	Vernita Cliffs	Rocks at base of utility pole	*N/A*	*0*
March 30, 2016	Vernita Cliff 2	Vernita Cliffs	Talus slope	*C. viridis(2)*	*0*
March 30, 2016	Vernita Bridge*	Vernita Bridge	Rock piles under base of bridge	*N/A*	*C. viridis(10)*
March 30, 2016	McGee Pipe*	On top of Umtanum Ridge	Underground septic void	*N/A*	*C. viridis(5)*
March 30, 2016	Vernita Cliff 4*	Vernita Cliffs	Talus slope	*N/A*	*C. viridis(6)*
March 31, 2016	MB43A	Vernita Cliffs	Rocks at base of utility pole	*C. viridis(5)*	*0*
March 31, 2016	Den 1	Vernita Cliffs	Talus slope	*C. viridis(2)*	*0*
March 31, 2016	Gable 1 Den 3	Gable Mountain	Covered void created by quarry activities	*C. viridis(2)*	*0*
March 31, 2016	East Gable Quarry	Gable Mountain	Rock mound	*C. viridis(1)*	*0*
March 31, 2016	White Bluffs Sinkhole	White Bluffs	Small hole opening to an underground void	*C. viridis(1)*	*C. viridis(5)*
March 31, 2016	East Gable Roadside	Gable Mountain	Rock pile on side of road	*C. viridis(1)*	*C. viridis(1)*
March 31, 2016	Rolling Rock	100-B/C	Covered rubble piles	*N/A*	*C. viridis(1)*
March 31, 2016	Den 4 & 5	Gable Mountain	Rock piles	*C. viridis(6)*	*C. viridis(11)*
March 31, 2016	Vernita Pit	Vernita Bridge	Hole down into old septic tank	*C. viridis(1)*	*0*
Total				30	50

** Incidental hibernaculum discovered post 2013.*

Figure 2. Western rattlesnakes discovered in the McGee Pipe hibernaculum

4.0 Discussion

The snakes detected at hibernacula entrances during these surveys are expected to only represent a portion of the total number of western rattlesnakes using each den. In addition, snakes of other species, potentially including sensitive species, often share dens with rattlesnakes, but due to the lack of rattles, confirmation is much more difficult without the acoustic clues. Future research efforts could include using pit-fall traps as well as using reduced trail camera intervals at known hibernacula, prior to snake dispersal, to determine if sensitive species are present.

When comparing surveys conducted April 1-3, 2013, and March 29-31, 2016, the average temperatures recorded at the Hanford weather station # 24 at noon, it was 21.2°C (70.2°F) during the 2013 surveys and 19.0°C (66.2°F) in 2016. The western rattlesnake is generally only active from April through September. The pivotal body temperature for both arousal and dormancy is 10°C (50°F) (Jacob and Painter, 1980), but a body temperature of 16°C (60.8°F) may be necessary for them to emerge from the den (Woodbury, 1951) (Lueneburger). Both survey years were completed in warmer temperatures, further backing the evidence that emergence had begun prior to survey initiation. Having observations of definite first emergence can be correlated with local meteorology to provide a better understanding of the conditions required for snakes to begin emerging from hibernacula on the Hanford Site. Future survey efforts should begin when weather conditions have not yet met this temperature threshold of 10°C (50°F). One method

which could ultimately provide definite first emergence and, would be to choose a hibernaculum with high survey counts, such as Den 4 & 5 on Gable Mountain, and strategically place multiple trail cameras on the den entrances. With multiple cameras set to a shorter trigger interval, the margin of error is greatly decreased from the previous method, which consisted of one camera set for a 5 minute interval.

As of this 2016 report, there are twenty-seven hibernaculum known on site. Because some are closely clustered, such as West of Rolling Rock 1, 2, and 3, they were surveyed as one, and in retrospect without knowledge of the subterranean caverns, it is possible that 1, 2, and 3 are simply emergence holes connecting to one central den. As for the distribution of snake hibernacula on the Hanford Site, there appears to be a very prominent cluster of dens along the Vernita Cliffs and along Gable Mountain. Figure 3 below illustrates this distribution.

By knowing where hibernacula are located on the Hanford Site, and by having a better knowledge of when they are occupied, a heightened awareness for workers safety is achieved, and decisions can be made during site cleanup activities to reduce disturbance to both den sites and snakes. If known sites are to be disturbed, mitigation actions will include waiting until after full emergence and developing mitigation efforts.

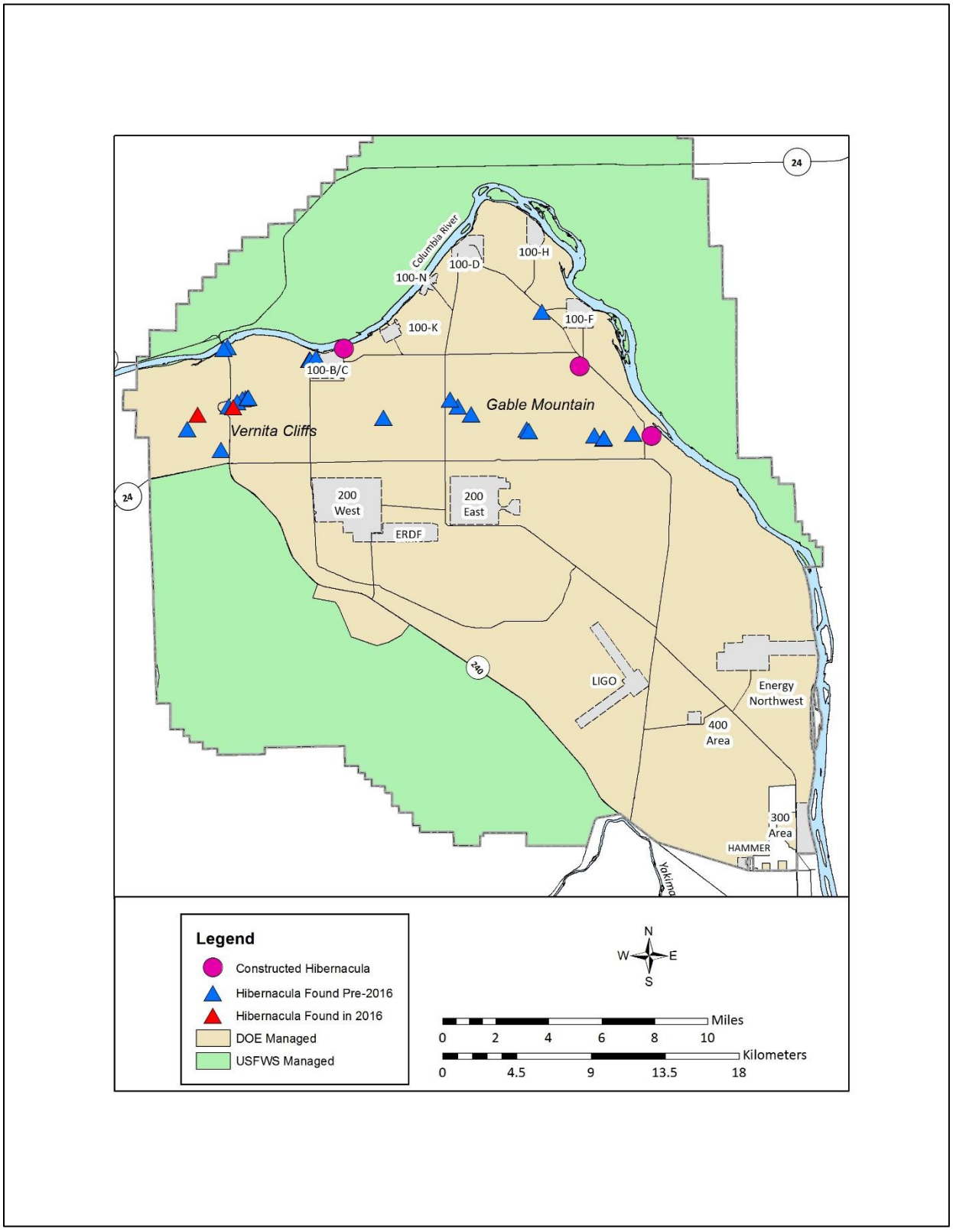

Figure 3. All known snake hibernacula on the Hanford Site

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