**Purpose:** To quantify how density of native large mammals respond to human development.

**Approach**: Distance sampling of groups along linear transects radiating out from an urban center.

**Materials:**

* A phone or GPS unit capable of showing your latitude and longitude and the current time of day.
  + Some phone apps are capable of showing you your current latitude and longitude but not all of these apps work offline (you will be out of cell phone coverage).
* Rangefinder for measuring distance
* Compass for measuring bearings
  + You can download an app like ‘Compass’ for iPhone or Android for a compass that works on phones with a magnetometer.
* Binoculars (or spotting scope or zoom camera) for counting group size
* Pencil and instructions and data sheet and clipboard.
* Coffee or tea

**Safety:**

Always use one driver and one spotter for safety, the driver should be focused on the road, but if the driver happens to see a group, record those detections as well. **Immediately** pull out of the lane of traffic for any detection or supposed detection. Remain stopped by logging the observation.

Please do not combine this survey with something other activity (like hunting).

**Things to keep in mind:**

You will often detect one or two individuals in a group first, and then detect the rest of the members of the group. The detection of most group members is therefore depending on the detection of this first individual(s). We will record a lot of information that only relates to the individuals in the group who were first detected (the ‘detection’). We will place a lot of emphasis on what these individuals were doing and where we were at the INSTANT of detection.

We will also record some information that refers to the whole group. ‘Groups’ are difficult to define but we will use the argument that any individuals within sight of each other that appear to be moving or hanging out together will be part of the same group. In general, I tend to ‘lump’ rather than ‘split’ individuals into groups.

**General instructions:**

Try to conduct transects in the morning when animals are most active.

Stop at the start and end of the transect to record your start and end times as the first and last rows of data. **Immediately** pull over for any detection or supposed detection of a native ungulate (pronghorn, mule deer, white-tailed deer, elk, moose, or bighorn sheep) or carnivorous mammal (coyote, fox, bobcat, black bear) group. Each group is a single row of data. Transect are only conducted one-way, however, you can choose to record groups on the way back to Laramie, just be sure to list these observations after the ‘End’ line in your data. If you need to end a transect prematurely, that is fine, just be sure to record your end location and time as the last row of data.

**Logging Observations:**

*Always be comfortable admitting you aren’t sure of what you see. False negatives and missing data are much easier to accommodate than false positives and errors!*

Every group is a row of data. For every group, record the following:

1. **Species:** Any large native mammal species (no livestock or wild horses). ‘Unknown’ if unsure of species but certain it is native. ‘Unknown deer’ if unsure of species but certain it is mule deer or white-tailed deer.
2. **Detection Activity:** The posture/activity of the first individual(s) detected in the group at the instant they were detected (not what they were doing right after detection – we want to know what they were doing the instant they caught your eye). Limit the categories to
   1. standing head down (or grazing)
   2. standing head up
   3. walking head down
   4. walking head up
   5. running
   6. resting
   7. fighting
   8. vocalizing
   9. grooming
3. **Detection Shadow**: Classify the light conditions of the first individual detection in the group as:
   1. Overcast
   2. Full sun
   3. Shadow (as from a tree or mountain)
4. **Detection Time:** The time the first individuals in the group were detected. 24 hour time
5. **Detection Age/Sex:** Classify the first detected individual as
   1. ‘Unknown’ if not 99% certain of the age or sex. If certain then classify as one of:
   2. ‘Adult’
   3. ‘Adult Male’
   4. ‘Adult Female’
   5. ‘Juvenile’
6. **Detection Surface:** What were the first detected individuals standing on at the instant of detection? Note ‘snow’ can occur WITH one of the other classifiers.
   1. snow (snow can be very patchy so only note whether it is under the feet of the detected individual at the instant of detection), also add once of the indicators below:
   2. road
   3. grassland
   4. shrubland
   5. forested
   6. riparian
   7. development (parking lots, yards, etc. other than road)
7. **Detection Angle:** Record the compass bearing in degrees off north to the animal from your location (0 – 360). If you do not have a compass, or it is malfunctioning, approximate the angle between your direction of travel on the highway and the heading to the group (0-180). Indicate weather this is a ‘bearing’ (off north) or a ‘heading’ (angle from direction of travel). If it is a heading you MUST also indicate whether the group is on the left or right side of the roadway.
8. **Detection Latitude:** Record your location, latitude in decimal degrees out to four decimal places. (##.####) using a phone or GPS. If the GPS malfunctions, you can record YOUR location and odometer reading on a map. Label your locations on the map with row numbers from the data table.
9. **Detection Longitude:** Record your location, latitude in decimal degrees (##.####) using a phone or GPS. If the GPS malfunctions, you can record YOUR location and odometer on a map. Label your locations on the map with row numbers from the data table.
10. **Detection Distance:** The rangefinder distance, in meters, to every group detected. Use the distance to the first animal in the group detected, if possible. If not, use another member of the group. If the rangefinder will not provide a distance to the animal, use a large object (hillside, tree, building, rock, bush) that is near the group as the target. If the range is beyond the maximum distance for the rangefinder, record “>1000m”. You can also estimate the distance, however, use the double tildas to indicate it is an estimate: “≈100 m”.
11. **Detection Aid:** The visual aid used at the instant of detection (naked eye, binoculars, spotting scope, camera). Most often this will be your naked eye, but sometimes after stopping to record one group, we end up detecting a second group with binoculars.
12. **Detector:** The initials of the individual who first detected the group.
13. **Group Size:** Record the total size of the entire group. Avoid overcounting. You can use a visual aid, such as binoculars, to confirm the size of the group. If some individuals moved off before they could be accurately counted use “≈” to indicate approximate number.
14. **Juveniles**?: ‘Unknown’ if not 99% certain juveniles (<12 months old) are present in the group otherwise, ‘Present’, ‘Absent’.

Figure 1. The difference betwee a bearing off of north between an observer and her observation and a heading off of her direction of travel. If your compass fails, heading angles can be easily estimated. If you use heading angles instead of bearings, be sure to label the angle on the data sheet as a heading and not wether it is on the left or right side of the roadway, for example, “head 30° right”. Bearings do not need the side of the roadway indicated because they span a full 360° while headings only span 180.

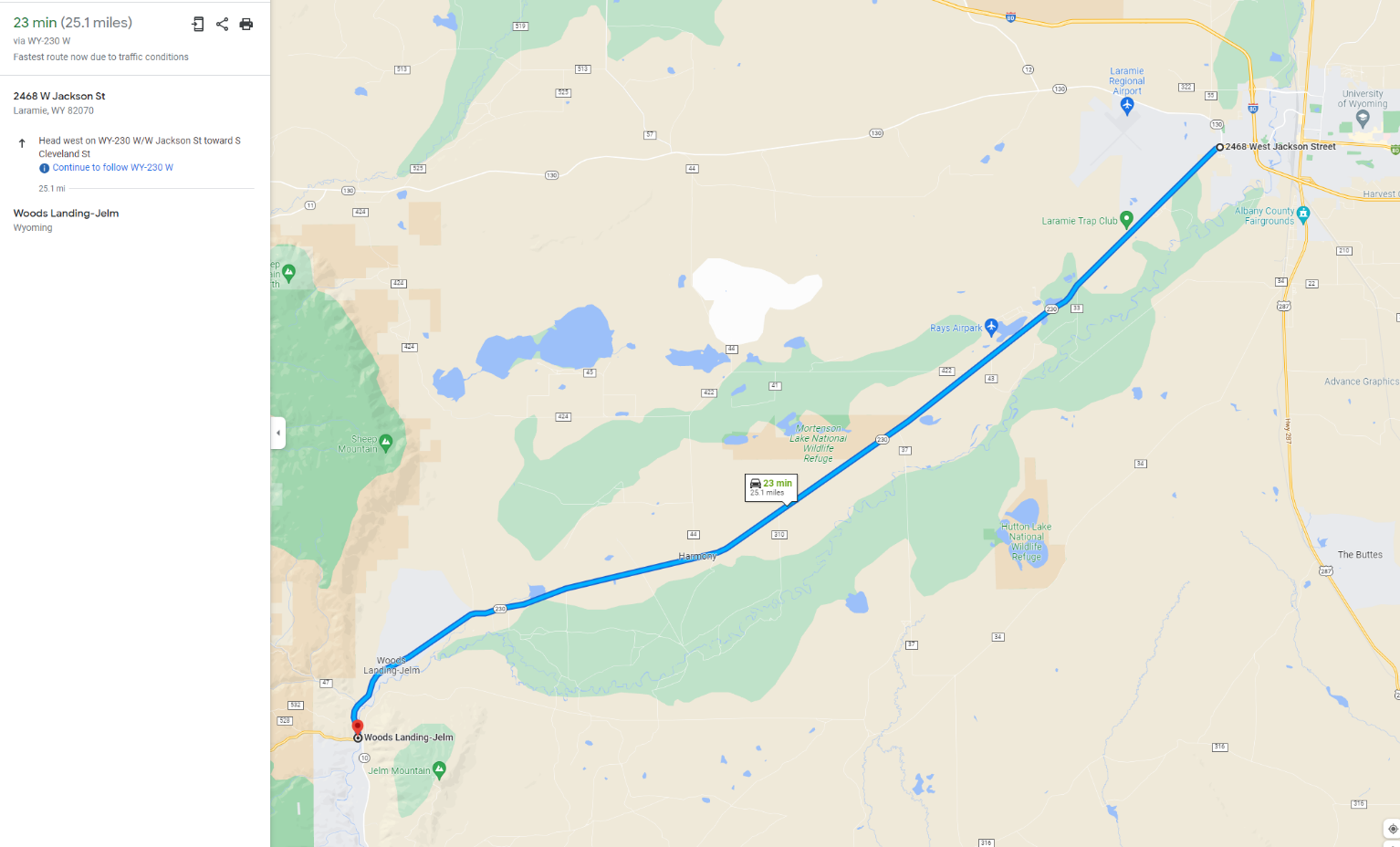
Diagram

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**Transects**: Work in pairs, one driver, one spotter. If there are additional spotters in the vehicle, they must be identified at the top of the worksheet and they must be indicated as the ‘Detector’ if they spot a group first.

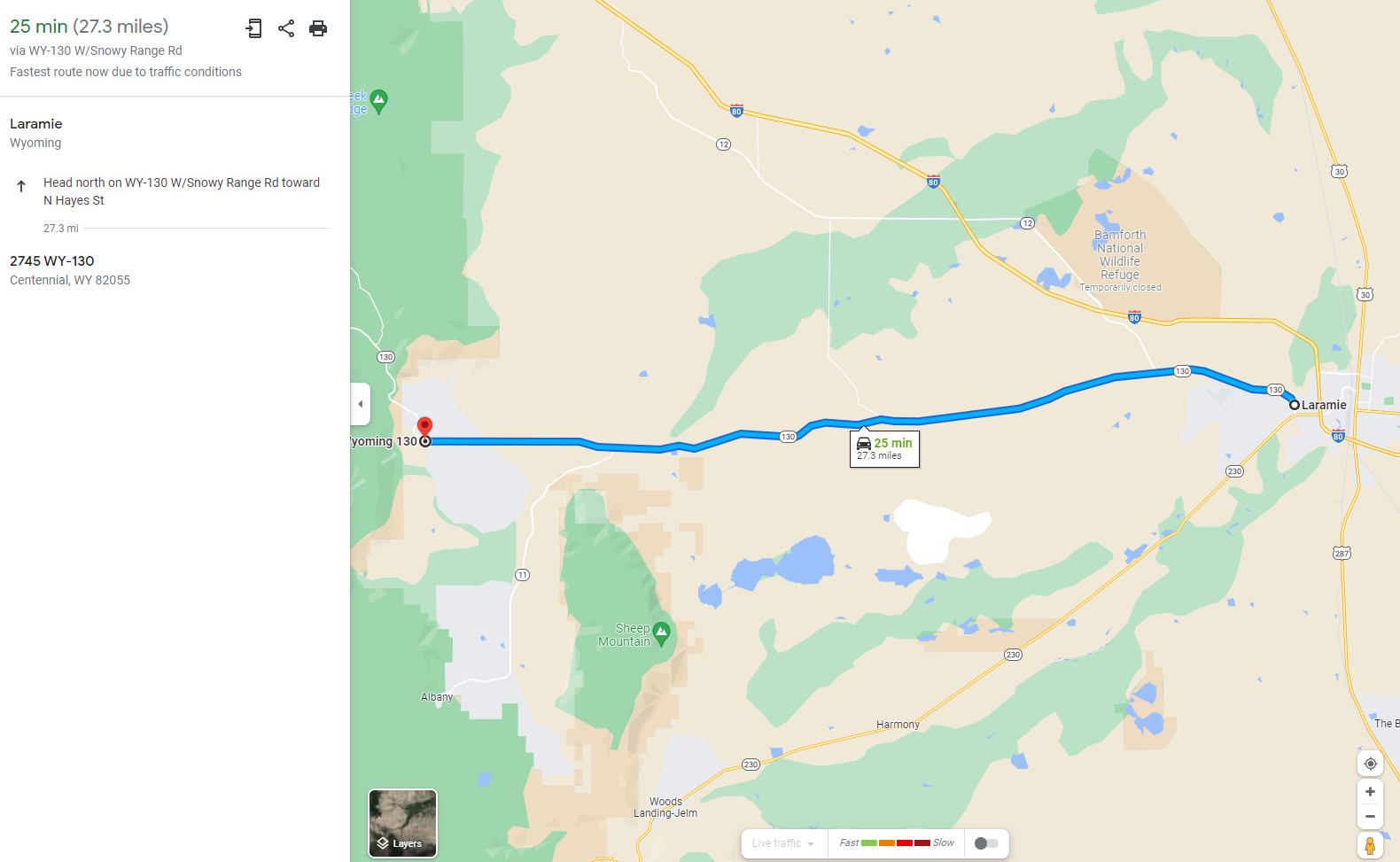
**Woods Landing Transect**

Wyoming 230, Laramie to Woods Landing. 25.2 Miles Head west on WY 230. Transect begins at the gas station at the junction of highway WY 230 and highway WY 130 in West Laramie. Transect ends at the junction of WY 230 and the turnoff to WY-10 Woods Landing – Jelm at the base of the Snowy Mountains.

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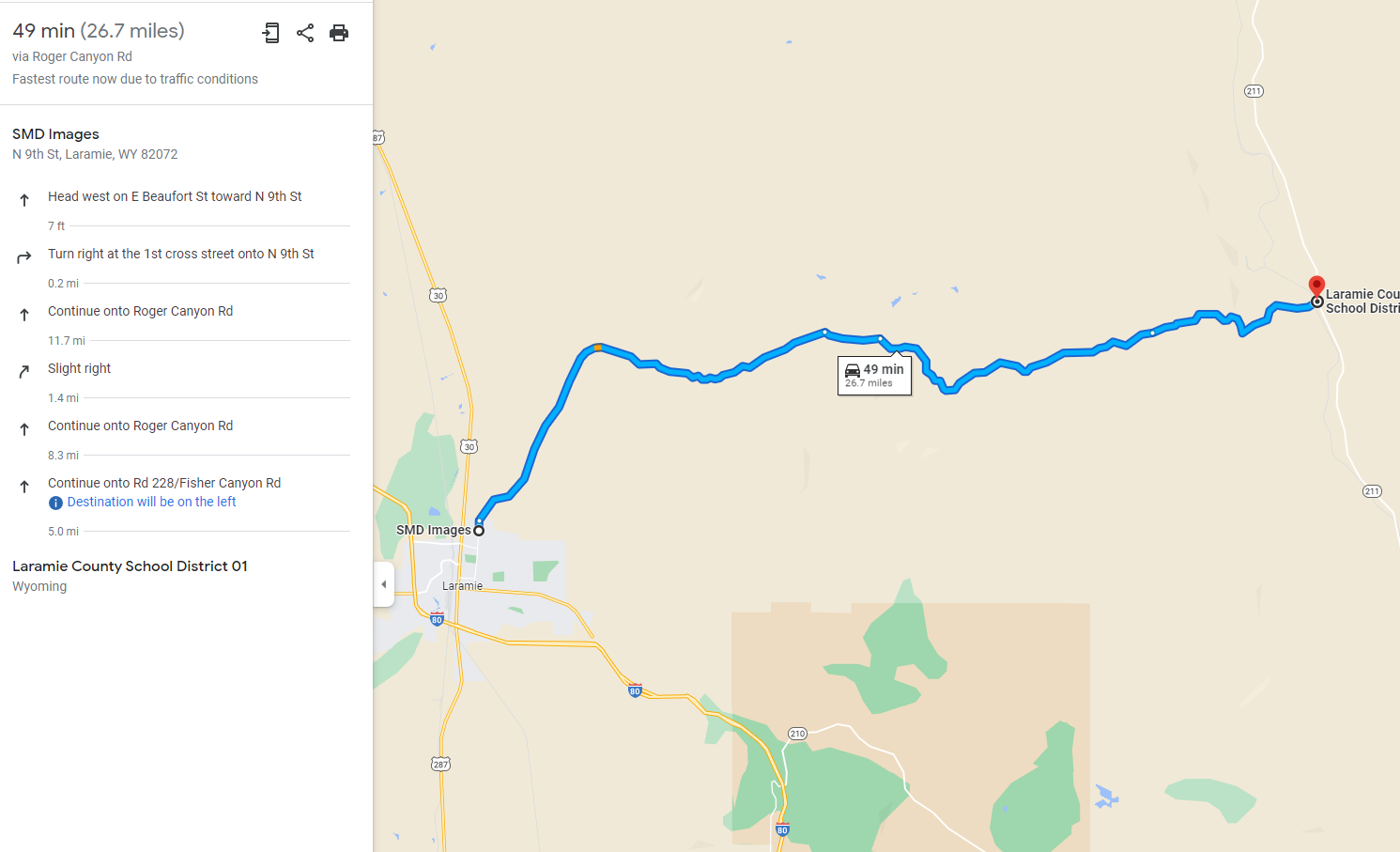
**Centennial Transect.**

Wyoming 130. Laramie to Centennial. 27.3 miles. Head west on WY 130. Transect begins at the Kiwanis Park in West Laramie. Transect ends at the ice-cream shop in Centennial.

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**Roger Canyon Transect.**

CR 17, Roger Canyon Road. Laramie to Horse Creek RD-Laramie County Fire District #2 Station 3. 26.7 miles. Transect Begins at the junction of Beaufort Street and 9th Street in Laramie. Transects ends 26.7 miles down the road on the east side of the Laramie Range where the road jopins Horse Creek Road/WY 211.



**Colorado Transect.**

US 287. Laramie to Wyoming/Colorado border. 23.4 miles. Head south on 287. Start at the Fairgrounds/Wyoming Port of Entry on the edge of town. Stope at the ‘Welcome to Colorful Colorado’ on the Wyoming/Colorado border.

**Map

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**Bakery Transect**

WY 12 – CR 57 – I-80 on ramp 279 I-80. 26.9 miles. Golden Prairie Bakery to on-ramp 279 I-80. Transect Starts at on WY 12-Herrick Lane (just off of WY 130) where the B W J road to the Golden Prairie Bakery leaves the highway. Transect continues NW down WY 12, past Alsop Lake then west under the interstate at Bath Stone House, then continuing west, northwest when it becomes Dutton Creek Road, Stay on this road. You will go back under the instate, twice more endingbup on the southwest side of the interstate. Until you come to the I-80 on-ramp at mile marker 279. Transect ends at the on-ramp.

**Map

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**Bosler Transect.**

US 30 Laramie to Sand Hills Road. Transects Starts at Peking Chinese Restaurant on US-30. Transect ends 26.7 miles north on US-30 at the turn-off for Sand Hills Road.

**Map

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**Vedawoo Transect**

CR 124-WY 210-CR 700 Old US Hwy 30 and Happy Jack Road – Vedawoo Glen Road. 25.3 miles. Transect starts at Vedawoo exit 329 on I-80 towards Cheyenne. Turn right off the exit ramp and head NW on CR 124/Old US Hwy 30 (heading back towards Laramie, parallel to interstate). Cross over the interstate at the Lincoln monument and turn north onto WY 210/Happy Jack Road. Continue north, then east, then southeast down Happy Jack Road/WY 210 for 11 miles until you get to CR-700/Vedawoo Glen Rd (gravel road). Stay on this road for 7.3 miles until you come to the Interstate again. Transect ends at the I-80 Interstate on-ramp 329. This transect is one complete loop.

Map

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**Chimney Rock Transect.**

CR 34 Sand Creek Road to Wyoming Colorado border. 22.3 miles Transect Starts at the Mountain Cement Company on southwest side of town (over the tracks). CR-34/Sand Creek Road heads south/south west for 22.3 miles until you arrive at Chimney Rocks just on the other side of the Wyoming border.

Map

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**Bull Mountain Transect.**

Sportsmen Lake Road CR 316, Bull mountain road 322. 21 miles. To get to the transect start head down US-287 towards Fort Collins Transect starts about 0.75 miles west of US-287 where the road cross Grant Creek/Willow Creek. Head west down Sportsman Lake Road for 12.5 miles until you come to CR-34/ Sand Creek Road. Head southwest down Sand Creek Road for 0.5 miles until you cross Sand Creek. Take a right onto Bull Mountain Rd/CR 322. Stay on this road heading southwest until you come to the Wyoming Colorado border in 8 miles. Transect ends at the border.

Map

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**Sybille Creek Transect**

Transects starts on WY 34 at junction with US 30. Transect ends 19.0 miles down WY 34 at Keil Outdoor Adventures.

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**Laramie River Transect**

CR 55/Welsh Lane – CR 51/Howell Road, Aspenwood Arena and Stables to Bosler, Wy. 19.1 miles. Transect starts at Junction of WY 130 and CR55/Welsh Lane. Transect ends at junction of CR 51/Howell Road and US 30/287.

**Map

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**Lakes Transect**

CR 422 to Lake Hattie Reservoir. 11.3 miles. Transect starts at Juction of WY 230 and CR 422/Pahlow Lane. Transect ends on the edge of Lake Hattie Reservoir.

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