PILOT TEST SUMMARY

Bureau of Land Management
West Mojave Plan Area Off-Highway Vehicle Monitoring Protocol
April 29, 2013

Task 4 – Pilot Test Results and Recommendations

Pilot Test Field Implementation

The WEMO OHV Monitoring Protocol pilot test was conducted by BLM between April 8, 2013 and April 16, 2013. BLM tested the monitoring protocol variables over a total of 60 miles within the Black Mountain subregion. The 60 miles represent a statistical sample of the 202.55 total miles of designated routes in the Black Mountain subregion (the total sample size was adjusted to account for a finite population). The size of the sample is intended to provide results with an 80 percent confidence level and a 10 percent sampling error (i.e., if a sample of Black Mountain designated routes was selected 100 times, 80 of the samples would provide results that are within +/- 10 percent of the true population value). Table 1 provides a summary of the key statistical parameters from the 2012 baseline data that were used to calculate the sample size. The randomly selected routes that were part of the pilot test within the Black Mountain subregion are listed in Appendix 1[1].

Table 1. Black Mountain Statistical Parameters

Total # of Routes	155
Total Miles	202.55
Confidence Level	80%
Sampling Error	10%
Mean (incursions/mile)	0.21
Pop Standard Deviation	0.358
Total Incursions	42
Percent of Routes with Incursions	20%

BLM staff conducted field testing of monitoring protocol variables by driving the routes listed in Appendix 1 and stopping at every incursion to record data related to the monitoring variables using a Trimble Global Positioning System (GPS) unit. Appendix 2 includes the Trimble GPS unit's data dictionary, which displays the monitoring variables for which field staff recorded data at each incursion. The Trimble GPS unit used by staff in the field was loaded with and showed previous monitoring data so that staff could

[1] Routes to be monitored were re-randomized after the 2/28/13 list of routes to be monitored was developed due to refinement of GIS data and selection of confidence level and sampling error. In addition, monitoring identified route numbering errors that were corrected. Thus, routes listed in Appendix 1 are different than those in the 2/28/13 list of routes.

stop at previously recorded incursions and record information and also allowed staff to record information for new incursions. No information was recorded for previous incursions that were no longer considered incursions. Monitoring efforts were conducted by BLM staff members over 7 days. Data was downloaded from the GPS unit on a daily basis. After data was downloaded, it was post-processed by BLM (for additional corrections to positional accuracy), converted to GIS data, and assembled in a geodatabase.

The data dictionary focused on variables needed to address: (1) public compliance with route closures, and (2) the creation of new illegal routes. These variables are listed in Table 2. Field staff also collected information on several other variables (e.g., GPS locations of incursions, type of use, route mileage, etc.) that help contextualize the field data and increase its usefulness for decision-making purposes. Appendix 2 includes the full list of variables included in the pilot test data dictionary.

Table 2. Monitoring Parameters and Variables

Monitoring Parameter	Variables
Public Compliance with Route Closures	• Incursion Usage • Incursion Width • Closure Type
Creation of New Illegal Routes	• Incursions

The variables were similar (and in many cases identical) to many of the 2012 baseline variables, were not cumbersome to collect in the field, and resulted in data that could be used for analysis purposes. Overall, BLM staff felt that the variables included in the data dictionary worked well in the field and captured the information that was needed to determine use of closed routes and creation of illegal routes.

Issues identified by BLM field staff during the pilot test included:

1. Two errors in route numbering where different routes had the same route number.

2. A few routes (BM7469 and BM7410) were duplicated in the baseline GIS data and thus mileages for these routes were doubled in the original list of routes to monitor. When corrected, removing the duplicate routes reduced the mileage to be monitored and required addition of route mileage to total 60 miles for the pilot test.

3. Typos in route numbers in GIS: BM7498 should be BM7490, BM6344 should be BM6364, and BM6355 was designated on two different routes. The shorter route was assigned route number BM6335.

4. On the ground, routes were not the same length as they were shown to be in GIS. In the field, the difference in route mileage between GIS and what was recorded by the Trimble GPS unit sometimes varied by 0.03 or 0.04 miles.

5. Some routes that were designated as open in GIS were not locatable on the ground or had been naturalized and were not visible on the ground anymore.

6. Routes that were less than 0.01 miles were hard to find in the field.

7. The ends (generally) of some routes were not passable by vehicle (Jeep or ATV) due to terrain. The route was monitored as far as staff felt was safe to drive. This generally meant that the end of the route as shown in GIS was within visual line of sight by direct ocular or binocular means (less than 0.03 miles).

The first three issues identified are related to errors within the baseline data in GIS. It is likely that similar minor GIS errors will continue to be identified during future monitoring efforts. Protocol changes to resolve these issues include:

- Selecting a slightly larger sample of routes than is required to provide some additional routes that would be used every year to address any route mileage issues that are identified;

- Converting GPS data to GIS data yearly and making corrections to baseline data (and GTLF) as needed;

- Identifying GIS data issues in the Year 1 and 2 memos and Year 3 monitoring report;

- Updating the list of routes to be monitored in the current year as issues arise and corrections are needed; and

- Reviewing the list of routes to be monitored in GIS in advance of monitoring activities to identify possible duplicate routes.

The issue regarding route length was resolved in the pilot test by adding a variable to the data dictionary that tracked the length of the route being monitored and also provided documentation of the routes that had been monitored. Because the statistical validity of the monitoring program is based on route mileage, it is important to have an accurate as possible mileage of each route. Though the route length differences between GIS and field measurements was not significant, the route length variable would establish correct mileages for each route over time and would therefore provide additional long-term value and is recommended for retention in the protocol. It should be noted that recording the route length on the Trimble GPS unit is more complicated than recording information for the other variables because the variable has to be started and

stopped after recording data for each incursion. Thus, using this variable will require some additional staff training prior to field work.

The issue regarding designated open routes that were not locatable on the ground or had been naturalized was resolved in the pilot test by adding a variable to the data dictionary that recorded a point where the route should have been and allowed staff to record the on-site conditions and the designated route number of the route that was not locatable on the ground. A designated open route that was not locatable or had been naturalized was reviewed at the expected beginning of the route, at the end of the route, and where it would be expected to cross another route. If, at all of these locations, there was no evidence of the route, it was determined that the route was no longer in use or had been naturalized. Due to the history of how routes have been converted into GIS over time, this error could arise in the future in other areas. Therefore, it is recommended that the variable for routes not present be retained in the protocol. In addition, the information regarding routes that were not locatable in the field, but were designated as open, could then be relayed to the BLM manager for evaluation and potential redesignation of the route as closed.

BLM staff had difficulty in the field with identifying routes that were less than 0.01 miles in length as often these were very short connector routes or pullouts. Typically these short connector routes are not signed or are developed as maintenance components of rights-of-way facilities and it can be difficult to pinpoint their beginning and end from the main route. Pullouts on the other hand, terminate a short distance (under 0.1 mile) and are not true routes in the sense of providing access and/or travel opportunities. Therefore, it is recommended that routes less than 0.01 miles in length be removed from the population of routes to be monitored in the protocol.

The last issue deals with drivability of routes. Text should be added to the protocol requiring staff to stop monitoring if the route is not passable. At the point that the route becomes impassable, staff should record a point as part of the route not present variable and a description of the on-site conditions.

In addition to adding variables for routes not present and route length, modifications to two variables were also made when the final data dictionary was developed for the pilot test. These modifications included additional types of incursion use and using a list of specific types of closure actions rather than requiring staff to write a description of closure actions.

The additional types of incursion use were added because, in the future, routes may be limited to certain types of uses, such as motorized and biking use, and monitoring could identify if non-allowable uses are occurring on incursions off of the route. Therefore, it is recommended that the types of incursion use listed in the data dictionary be retained in the protocol.

The variable for describing the closure action in place on an incursion was changed from a text variable where staff would write-in a description, to a list variable where staff would choose a closure action from a drop-down list, providing more consistency over

time and facilitating analysis. BLM staff felt the drop-down list used was an appropriate list of potential closure actions and was used successfully during field testing. Therefore, it is recommended that the drop-down list of closure actions be retained in the protocol rather than an open-ended text field where staff describe the closure action in writing.

In addition to the variables discussed above, two other variables were added to the pilot test: incursion use comment and photos. The incursion use comment variable allowed BLM staff to note anything regarding the incursion that may require further action or specific comment, such as vandalism or dumping. Therefore, it is recommended that this variable be retained in the protocol and information from this variable be relayed to management for further action.

Regarding photos, the ease of recording photos depends on the type of GPS unit used in the field. Juno GPS units have a built-in camera that can associate the photo with the incursion and will upload the photo as part of the GPS data recorded. GeoXM GPS units do not have built-in cameras and thus BLM staff using these units had to take photos with a separate camera. The variable for photos on the GPS unit allowed staff to record the photo number from the camera (subvariable Comment) as well as an auto-generated date, time, and location, in case there was a discrepancy later on and the date and time were needed to identify the correct photo for the incursion. BLM staff felt that photo documentation was helpful in recording how conditions have changed over time and felt that, despite the added burden of recording photos when a GeoXM unit was used, photos should be taken where conditions have changed from previous monitoring efforts. Therefore, it is recommended that the protocol stipulate that photos should be taken at new incursions and at existing incursions where conditions have changed from previous monitoring efforts. Staff that conducted monitoring activities recommended using Juno GPS units in the future due to ease of use and reduced chance for error with photo numbering. It should be noted that using Juno GPS units would require some additional staff training.

BLM staff also recommended that certain routes may necessitate the use of vehicles other than four-wheel-drive vehicles for monitoring. In the future, routes may be designated as limited to certain vehicle types (e.g., motorcycles, ATVs) and thus the appropriate vehicle will need to be used for monitoring. It is recommended that the protocol state that the appropriate vehicle should be used for monitoring each route.

BLM staff conducting monitoring activities also recommended using teams of two people when minor route maintenance, authorized implementation activities, and incursion response activities were going to be conducted in the field in conjunction with OHV monitoring activities.

Although, during the pilot test, BLM staff did not record any data at incursions identified in the baseline data that did not appear to be incursions now, future monitoring efforts should record data at previously identified incursions even if no use is currently occurring at that incursion. If this was the case, “none” should be selected under the incursion usage variable and “no” or “none” selected for subsequent required variables

in the data dictionary. This will require adding “none” to the incursion width and type of incursion use variables, which are currently not options under these two variables in the data dictionary. It is important to track the lack of use on existing incursions over time to help gauge the success of the BLM’s efforts to encourage responsible route usage (e.g., through route closures, education and information efforts, etc.).

Analysis of Pilot Test Data

The BLM post-processed all of the data from the Trimble GPS units, converted the data to GIS data, and combined the monitoring GIS data with baseline data in one geodatabase. AECOM then took this geodatabase and converted the GIS data into a Microsoft Excel spreadsheet for analysis. Data analysis consisted of reviewing monitoring data for any inconsistencies or missing data, as well as comparing monitoring data to baseline data.

The monitoring data contained expected information regarding the monitoring variables and only contained a few inconsistencies in the subregion name field (Red Mountain was selected instead of Black Mountain). In addition, a few incursions with no closure actions did not have a response for closure action description (should be “none”). Therefore, it is recommended that text be added to the protocol describing data checks that should be performed once the GPS data has been converted to GIS data, including checking for the correct subregion (compared to the route subregion code) and checking to make sure “no” for closure action is accompanied by “none” for description of closure action. Also, the “route not present” variable is used for both routes that are not locatable on the ground and portions of routes not passable by vehicle. Therefore, it is recommended that once GPS data is converted to GIS data, the GIS specialist review any “route not present” points to determine which points are for routes not locatable versus which points are for where routes become impassable, and adjust baseline data as necessary.

In order to compare monitoring data to baseline data, re-attributing of some baseline data was necessary, which was expected due to changes in the monitoring variables between baseline data collection and monitoring. Baseline data for width, frequency (now usage), and past management (now closure action and description of closure action), need to be reattributed. For consistent reattribution of data, it is recommended that the protocol provide specifics on how to reattribute these fields.

When analyzing the monitoring data in Excel, it was difficult to correlate incursions within the monitoring data to incursions in the original baseline data. Based on their location, most of the incursions were easily identified as new; however, those in close proximity to baseline incursions were reviewed against aerial imagery to see if they were baseline or new incursions. To avoid this issue in the future, it is recommended that baseline incursions be given Incursion ID numbers that begin with the same 2 letter subregion code as the route they are on, followed by 4 numbers. After monitoring data is converted to GIS data, new incursions can be given Incursion ID numbers. In addition, it is recommended that a required variable be added to the data dictionary

(Incursion ID) to allow staff to enter the ID number for existing incursions that are re-visited as part of monitoring activities.

As much of the analysis is based on comparing baseline incursion information and monitoring information for the 5 variables (see Section 5, Year 3 Monitoring Results Report outline in the protocol), there needs to be a way to identify results for baseline incursions that were re-visited and results for new incursions. It is recommended that after GPS data is converted to GIS data, a field be added in GIS titled “Origin” and attributed as “Baseline” for incursions that are in the baseline data that were not part of monitoring, “Baseline/New” for incursions that are in the baseline data that were re-visited and “New” for incursions that are new and were not part of the baseline data. The analysis can then exclude “Baseline” incursions and review results for “Baseline/New” and “New” incursions.

After some modifications to the data were made, including reattributing baseline data and adding fields for Incursion ID and Incursion Origin, pivot tables of the data were created in an Excel spreadsheet to determine if this would be an acceptable way to analyze the data for reporting or if a different program or medium was necessary. The pivot tables were determined to provide the data in a format conducive to conducting the analysis necessary to complete the tables located within the outline for the Year 3 Monitoring Results Report (in the protocol document), particularly after adding another four fields to the data to show level changes in width and usage of baseline data compared to monitoring data. This was done by converting the usage and width categories to numbers and calculating the difference between monitoring and baseline values. The pivot tables were easy to both create and manipulate to show the data needed to fill in each table and should facilitate analysis and report preparation.

The data collected from the pilot test provided anticipated information on incursion width, usage, type of use, and closure actions. For instance, after a brief review of the data for new incursions, it was easily identified that 1) Over 50% of identified incursions were new, 2) The majority of the new incursions were likely from motorcycles as they were single track routes of motorcycle width, and 3) Closed routes with closure actions in place were still being used and increasing in width. Therefore, the pilot test demonstrated that, regardless of the level of statistical validity, the monitoring variables will provide the information needed to evaluate the monitoring objectives of public compliance with route closures and the creation of new illegal routes, as well as provide site specific information for management decision-making related to enforcement, education, and closure action implementation.

Summary of Pilot Test Data

As noted previously, about 60 miles of designated routes were randomly selected in the Black Mountain subregion. The primary purpose of the pilot monitoring was to test the efficacy of the field variables from a field collection perspective. That said, the pilot monitoring effort yielded data that are summarized below for the primary variables of interest of the monitoring protocol.

Creation of New Illegal Routes

The creation of new illegal routes is measured through monitoring incursions on each sample route. The Black Mountain sample included 53 designated routes that were monitored both during the 2012 baseline and 2013 pilot study. Table 3 summarizes incursion data (both 2012 baseline and 2013 pilot study) from the sample of Black Mountain designated routes. In general, the number of incursions, percent of sample routes with incursions, and incursions per mile of route all were higher during the 2013 pilot study compared to the 2012 baseline data.

Table 3. Black Mountain Sample Incursion Summary

	2012 Baseline	2013 Pilot
Number of Incursions	16	40
Percent of Sample Routes with Incursions	18.9%	24.5%
Incursions per Mile of Route	0.26	0.66

In total, field staff identified and recorded 24 new incursions on the sampled routes in the Black Mountain subregion. Of the sampled routes, two that previously had incursions (identified during the 2012 baseline) no longer had incursions, while five (which previously had no incursions) had new incursions. The number of incursions also went up on six sampled routes and stayed the same on two sampled routes.

Public Compliance with Route Closures

Public compliance with route closures is measured primarily through three variables: 1) closure action, route width, and route usage. In general, increasing width and/or usage is indicative of continued non-compliance, which is readily apparent as soon as it occurs. Decreasing width and/or usage is indicative of increased compliance that has been sustained over a substantial period of time, so that it shows evidence of repair. As the monitoring protocol is implemented over time, these two variables (width and usage) may be aggregated by closure action to determine the efficacy of specific closure actions on public compliance. Only two of the existing incursions had previous closure actions so an assessment of the efficacy of these closures is generally not feasible at this time.

Figure 1 displays route width (estimated based on the type of vehicle that could access the incursion) and Figure 2 displays estimated usage levels (light, moderate, high) for the incursions present on sampled routes in the Black Mountain subregion during the 2012 baseline and 2013 pilot study. Most of the new incursions (from the 2013 pilot study) had narrower widths (i.e., more incursions with estimated motorcycle widths than truck widths) compared to the 2012 baseline data (more incursions with estimated truck widths than motorcycle widths). Both the baseline and pilot study monitoring pointed to more incursions with light use compared to heavy use.

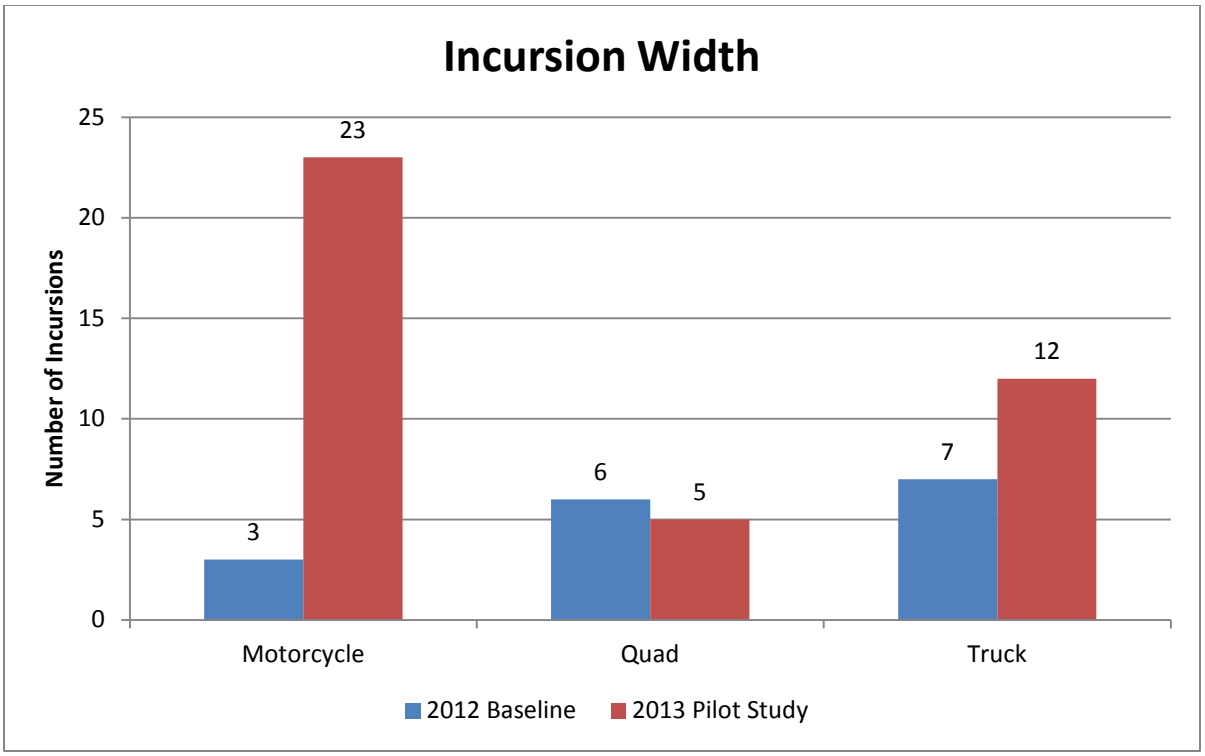

Figure 1. Estimated Incursion Width

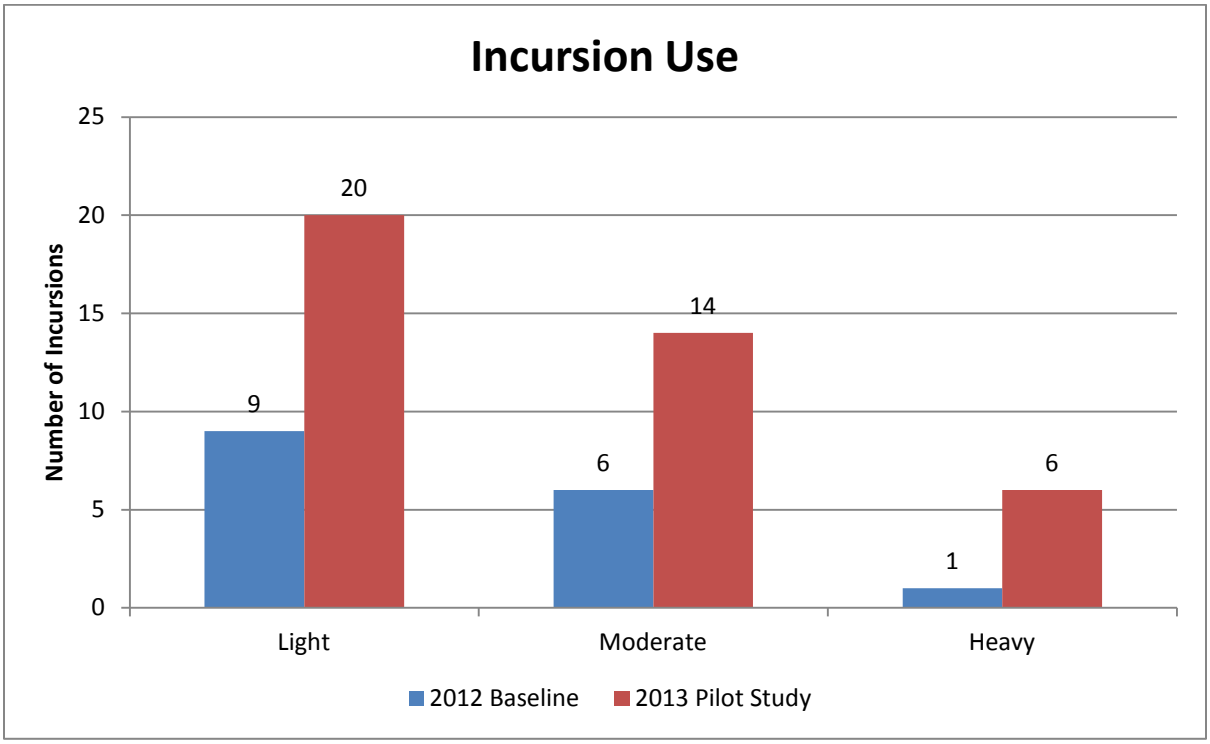

Figure 2. Estimated Incursion Use Level

Summary of Recommended Changes to the Monitoring Protocol

Based on issues identified during the pilot test, recommended changes to the monitoring protocol are:

- Select a slightly larger sample of routes at the beginning of the monitoring cycle than is required to provide some additional routes that could be used every year to compensate for any route mileage issues encountered in the field.
- Convert GPS data to GIS data yearly and making corrections to baseline data (and GTLF) as needed (route numbering, route line features, route length, etc.).
- Identify GIS data issues in the Year 1 and 2 memos and Year 3 Monitoring Results Report;
- Update the list of routes to be monitored in the current year as issues arise and corrections are needed.
- Review the list of routes to be monitored in GIS in advance of monitoring activities to identify possible duplicate routes.
- Add the route length variable as shown in the revised data dictionary and ensure BLM staff are trained on how to record this variable on the GPS unit prior to field work.
- Add the route not present variable as shown in the revised data dictionary.
- Exclude routes 0.01 miles or less in length from the population of routes to be monitored.
- Include text in the protocol document requiring staff to stop monitoring if the route is not passable and record a point for the route not present variable at the location where the route becomes impassable and provide a description of the on-site conditions.
- Use the list of types of incursion use as shown in the revised data dictionary.
- Replace the open-ended description of closure action text variable with the list of closure actions as shown in the revised data dictionary.
- Add the incursion use comment variable as shown in the revised data dictionary.
- Add the photos variable as shown in the revised data dictionary.

- Encourage use of the Juno (or other location-linked photo) GPS units if available and require photos of new incursions and existing (i.e. previously identified) incursions where conditions have changed from previous monitoring efforts.
- Use appropriate vehicles for monitoring of each route (four-wheel-drive, ATV, or motorcycle).
- Use teams of two for monitoring activities when other minor route maintenance, authorized implementation activities, and incursion response activities will also be conducted.
- Consistently record information for all new incursions AND all previously identified incursions. If there is no use of a previously identified incursion, “none” should be selected for the incursion usage variable and “no” or “none” selected for remaining required variables in the data dictionary.
- Add text to the protocol describing data checks that should be performed once the GPS data has been converted to GIS data, including checking for the correct subregion (compared to the route subregion code), checking “no” for closure action is accompanied by “none” for description of closure action. Also, review any “route not present” points to determine which points are for routes not locatable versus which points are for where routes become impassable, and adjust baseline data as necessary.
- Add text to the protocol describing how to reattribute the width, frequency and past management variables from baseline data for the Barstow Field Office.
- Give Incursion ID numbers to incursions within the baseline data that begin with the same 2 letter subregion code as the route they are on, followed by 4 numbers. After monitoring GPS data is converted to GIS data, new incursions can be given Incursion ID numbers.
- Add a required variable to the data dictionary (Incursion ID) to allow staff to enter the ID number for existing incursions that are re-visited as part of monitoring activities.
- After GPS data is converted to GIS, add a field titled “Origin” and attribute as “Baseline” for incursions that are in the baseline data that were not part of monitoring, “Baseline/New” for incursions that are in the baseline data that were revisited and “New” for incursions that are new and were not part of the baseline data
- Add text to the protocol describing how to convert width and usage categories to numbers and calculate level changes between baseline and monitoring data.

Appendix 1 – Routes Monitored in Pilot Test

Designated Route ID	Route Mileage
BM5395	1.16
BM6237	1.78
BM6241	1.66
BM6241C	2.93
BM6251	3.74
BM6265c	0.41
BM6321	0.48
BM6327	0.77
BM6330	1.10
BM6335	0.67
BM6337	0.72
BM6343A	0.10
BM6344	1.73
BM6355	3.81
BM6357	0.11
BM6362	1.25
BM6366	3.83
BM6367	0.19
BM6368	2.33
BM6375	0.85
BM6384	0.86
BM6443C	0.04
BM7153	11.29
BM7153B	0.06
BM7227	0.68
BM7401A	0.27
BM7410	0.98
BM7410A	0.06
BM7414	1.35
BM7417A	0.24
BM7468	1.08
BM7469	0.65
BM7474	1.21
BM7477	4.80
BM7483	0.66
BM7490	4.66
BM7495	0.86
BM7497	0.51
CG7223	0.14
CG7225	0.15
FP6237	0.26
TOTAL	**60.43**

Appendix 2 – Pilot Test Trimble GPS Unit Data Dictionary Used


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Monitoring Sampling
Pilot Test 4_5_2013

Start Incursion        Point Feature, Label 1 = DesignatedNumber, Label 2 = StaffNames
                       Incursion Info
   DesignatedNumber    Text, Maximum Length = 8, DesignatedNumber
                       Required, Normal
   StaffNames          Text, Maximum Length = 50, StaffNames
                       Required, Normal
   Date                Date, Auto generate Create, Month-Day-Year Format, Date
                       Required, Normal
   Subregion           Menu, Required, Normal, Subregion
      Darwin
      Sierra
      North Searles
      South Searles
      Ridgecrest
      El Paso
      Jawbone
      Rands
      Red Mountain
      Middle Knob
      Fremont Peak
      Black Mountain
      Coolgardie
      Harper Lake
      El Mirage
      Kramer Hills
      Iron Mountain
      Mitchel Mountains
      Calico Mountains
      Cronese Lake
      Afton Canyon
      Broadwell Lake
      Barstow
      Stoddard Valley
      Ord Mountains
      Newberry/Rodman
      Johnson Valley
      Pisgah Crater
      Juniper Flats
      Rattlesnake Canyon
      Morongo Valley
      Wonder Valley
      Joshua Tree
   Usage               Menu, Required, Normal, Incursion Usage
      None
      Light
      Medium
      Heavy
   Width               Menu, Required, Normal, Incursion Width
      Truck
      Quad
      Motorcycle
   Type                Menu, Required, Normal, Type of Incursion Use
      Single Track
      Two Track
      Multi-Track
      Hiking
      MtnBiking
      Equestrain
      Animal
      CampingStaging
      Other
   ClosureAction       Menu, Required, Normal, BLM Closure Action in Place?
      Yes
      No
   DescribeClosure     Menu, Normal, Normal, Describe Closure Action
      Fencing
      Boulders
      Vegetation
      Closed Sign
      Natural
      None
   TypeUseComment      Text, Maximum Length = 25, IncursionUseComment
                       Normal, Normal
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Photo                Point Feature, Label 1 = Comment, Label 2 = Date
                     Photo
   Comment           Text, Maximum Length = 50, Comment
                     Normal, Normal
   Date              Date, Auto generate Create, Month-Day-Year Format, Date
                     Normal, Normal
   Time              Time, Auto generate Create, 24 Hour Format, Time
                     Normal, Normal

LinearSample         Line Feature, Label 1 = RouteID
                     Lenght of Open route driven
   RouteID           Text, Maximum Length = 10, Designated Open Route ID
                     Required, Normal

RouteNotPresent      Point Feature, Label 1 = Describe Conditions, Label 2 = Designated RouteID
                     RouteNotPresent
   Describe Conditions      Text, Maximum Length = 40, Describe Conditions
                     Normal, Normal
   Designated RouteID Text, Maximum Length = 8, Open Route Number
                     Normal, Normal
```