Julienne Bautista and Maika Nicholson
CEE266A - HW 3
GIS Watershed Delineation and Characterization:
Dead Horse Wash Catchment and
Elizabeth Lake Catchment
12 October 2010

1. **Drainage Lines:** The main differences between the NHD and DEM flowlines for the Elizabeth Lake and Dead Horse Wash catchments are the number of streams and the discrepancies of placement on certain sections of the flowlines, as exemplified for Deadhorse Wash on Map 1.1. The DEM created flowlines have more tributaries and this may be due to filling in all the sinks for the original raster (labeled as Deadhorse_projected). The sinks (errors due to rounding or determined by DEM processing may be incorrect due to data resolution or rounding errors.

2. **Catchment Area:**

   a. **Dead Horse Wash:** In exercise 1, the calculated catchment area was 11.751mi^2 (30.435km^2) while the GIS created catchment area calculated the area to be 12.469mi^2 (32.294km^2). The original totals are lower than the calculated totals by approximate 0.5mi^2 and 2.0km^2.The GIS created catchment area is more accurate due to the information given in the metadata for the raster image of Dead Horse Wash. The raster was created in 2009 while the USGS Quad sheet data was last edited in 1990 and field checked in 1986. The latest data can take into account changes in landscape which may have diverted the flow line different directions than USGS map.

   b. **Elizabeth Lake:** In Exercise 1, the catchment area was calculated to be 6.0 mi^2 (15.5km^2) while the GIS created catchment area calculated the area to be 5.982mi^2 (15.494 km^2). The difference between the GIS and hand-delineation methods resulted in a very slight difference of less than 0.02 mi^2 very slight, however in general (for reasons mentioned for differences in the Deadhorse Wash), the GIS measurement will likely be more accurate. Furthermore, GIS has elevation data at much smaller intervals than on the USGS Quad Sheet. The 40-feet contours spacing and scaling of the Quad Sheets makes it more difficult to locate the precise location of the divide.

3. **Catchment Relief:**
   a. **Deadhorse Wash:** According to the GIS catchment relief, the highest elevation value is 1023.82m (3359.0ft) while the lowest elevation is 704.31m (2310.74ft). This accounts for a total relief of 319.51m (1048.26ft) and a mid-relief of 864.07m (2834.87ft). The calculated GIS relief data

b. **Elizabeth Lake:** According to the calculated GIS catchment relief, the highest elevation value is 2067.10m (6782.16ft) while the lowest elevation is 1261.35m (4138.49ft). The resulting relief is 805.75m (2643.67ft) and a mid-relief of 1664.23m (5460.32ft). The relief calculated on the Quad Sheet was 2,624ft, approximately 20-feet less than the relief calculated in GIS. The discrepancy is partially due to the highest peak labeled on the Quad Sheet, which was listed at an elevation of 6,771-feet (11-feet lower than the highest elevation determined in GIS). This could be due to a higher elevation on a ridge in the catchment that would be difficult to assess from the quad sheet due to the 40-foot contour intervals.

Comparing the two catchments, it's clear that Deadhorse Wash is a much flatter catchment with approximately two times the catchment area and less than half the elevation relief of Elizabeth lake catchment.

4. **Elevation data for confluence points**:

Method	Dead Horse Wash	Elizabeth Lake
USGS quad sheets	716.3m (2350ft)	1264m (6771ft)
Interpolation in GIS*	710m	1269m (4162 ft)
Elevation of pixel cell in GIS	703.96m(2309.58ft)	1260m (4132.8 ft)

*The confluence point (in green seen on Map 4.1) was chosen due to its proximity to a contour line. Otherwise, the interpolation according to the GIS maps would be difficult since information regarding the next contour line is missing.

5. **Main Channel Length**
    a. **Deadhorse Wash:** Calculating the length of main channel requires the river profile tool seen in figure 5.1. The main channel is defined as beginning to the closest stream to the highest point of elevation. When determining the total length to the end of the watershed, the re-processing for a higher stream definition created more tributaries. These tributaries allowed for a delineation of the stream to the end of the basin (Figure 5.2).
    b. **Elizabeth Lake:** The main channel length was determined from the GIS data to be 5.76 kilometers, excluding the extension to the divide. The total main channel length was determined by setting a higher stream definition, as discussed above for Deadhorse Wash. The distance from the end of the main channel to the divide was measured using the GIS measurement tool. This distance was 0.42km, resulting in a total main channel length of 6.18km (3.83mi).
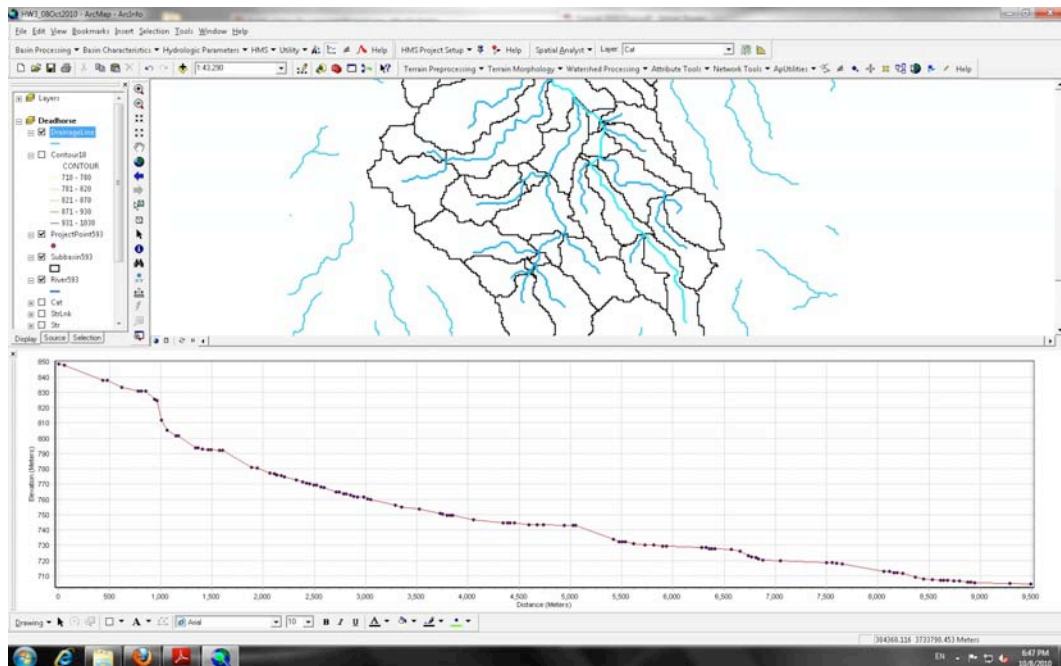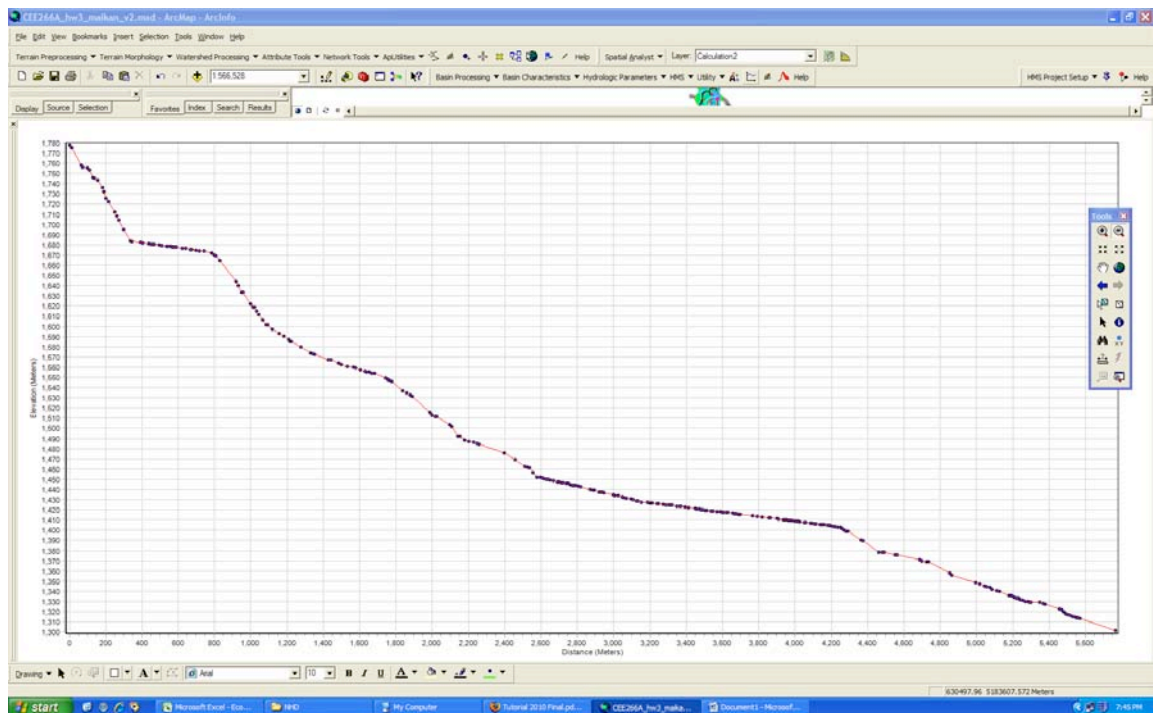
Figure 5.1a River Profile of Dead Horse Wash
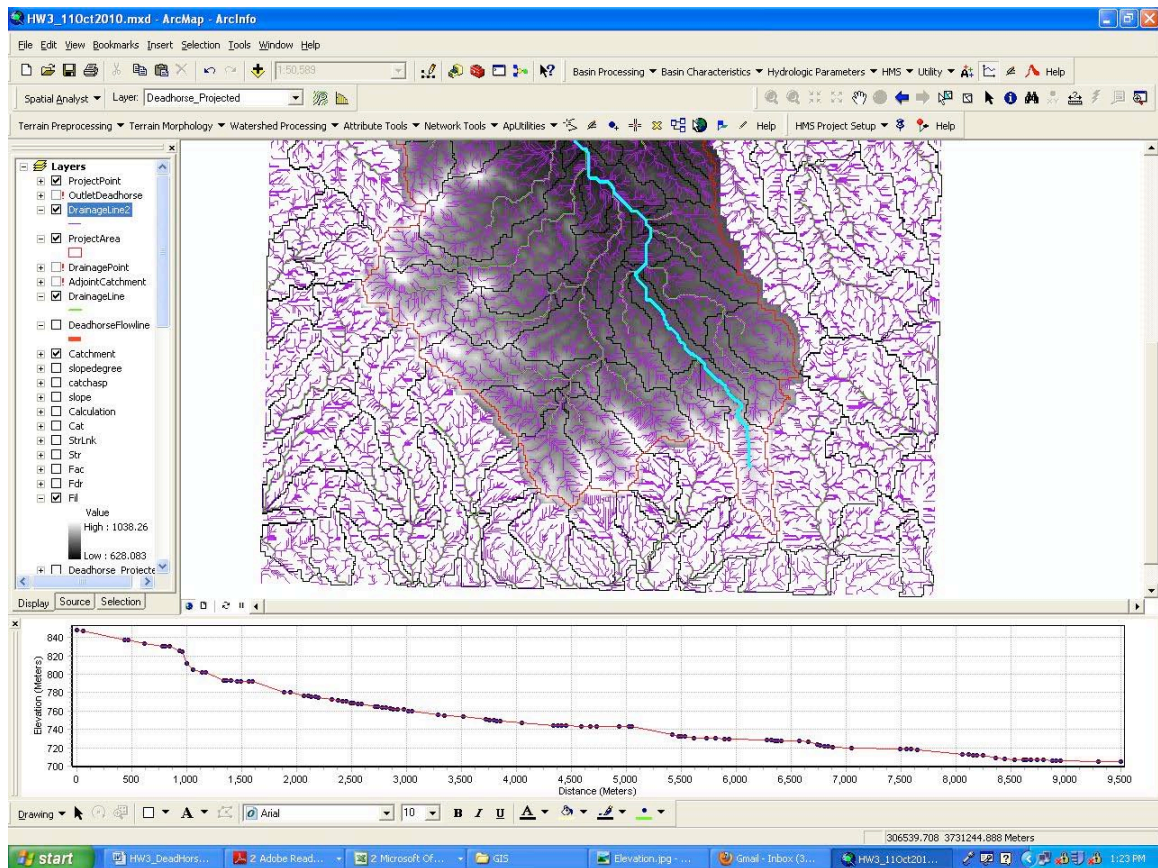

Figure 5.1b River Profile of Elizabeth Lake

Figure 5.2 Deadhorse Wash Main Channel Extension with higher Stream Definition

6. Main Channel Length & Slope:

a. Dead Horse Wash calculations are in Table 6.1. There is a considerable difference between the GIS and USGS channel lengths. In contrast, the slope has a small difference of 0.005. The first characteristics can be attributed to the differences in drawing the catchment area. But due to site conditions, there are no dramatic changes in elevation leaving less room for error or lack of similarity in the two values.

b. Elizabeth lake calculations are shown in Table 6.1. There is a slight difference between the GIS and USGS main channel lengths and slopes. When determining the distance to the divide on the USGS Quad Sheet, I chose a different location and therefore a longer distance. From the GIS sub-catchment layer, it was easier to determine the channel extension to the divide with the largest sub-catchment area draining to it, and also easier to measure the distance to the divide. The smaller contour interval also made it easier to pinpoint the elevations at the high, low, 85% and 10% elevation locations as needed to calculate main channel slope.

Dead Horse Wash				
Channel Length	meters	feet	miles	slope
GIS Calc	10570.52	34680.18	6.568	0.024
USGS	8984.97	29478.24	5.583	0.019
Elizabeth Lake				
Channel Length	meters	feet	miles	slope
GIS Calc	6180	20,221	3.83	0.078
USGS	6260	20,331	3.88	0.072

'

Table 6.1 GIS and USGS Channel Lengths and Slopes

7. **Hypsometric Curves:**
   a. For Dead Horse Wash, the USGS point on the hypsometric curve (0.018, 0.50) representing the mid-relief proportion of the area and height to the basin. Using the GIS calculation, the mid-relief proportion of the area over basin height is (0.04693,0.5).
   b. The hypsometric curve for Elizabeth Lake is represented by the cumulative area below the corresponding elevation represented on the y-axis. See Figure 7.2, below. The percent area above the mid-relief elevation was calculated at 57% for both the GIS and Quad Sheet characterizations.
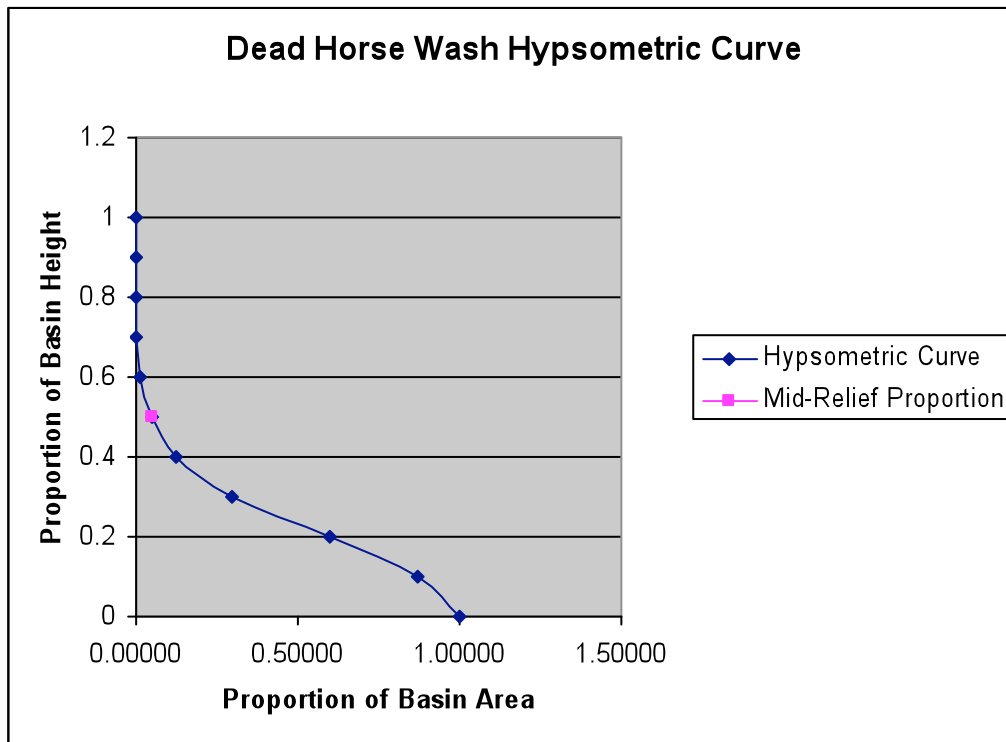

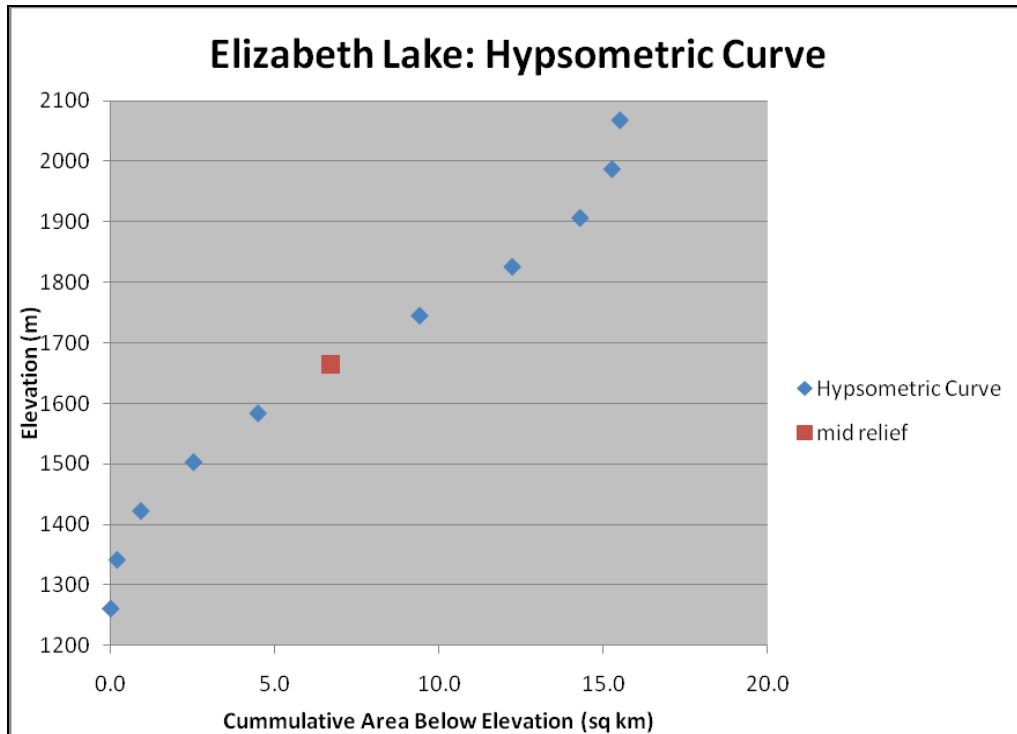Figure 7.1 Dead Horse Wash – Hypsometric Curve

Figure 7.2 Elizabeth Lake Hypsometric Curve

8. Slope:
    a. **Dead Horse Wash:** In the Dead Horse Wash Basin, there is approximately 0.26% of the area above a 30 degree slope. Figure 8.1 illustrates the cumulative distribution of slope for Dead Horse Wash. Map 8.1 displays the slope over the entire basin in degrees for Dead Horse Wash.
    b. **Elizabeth Lake:** In the Elizabeth Lake basin, approximately 30.1% of slopes were higher than 30-degrees. The cumulative slope distribution is shown in figure 8.2.

Elizabeth Lake has a higher percentage of areas with larger slopes, which is reflected by the overall lower catchment relief of Deadhorse Wash.
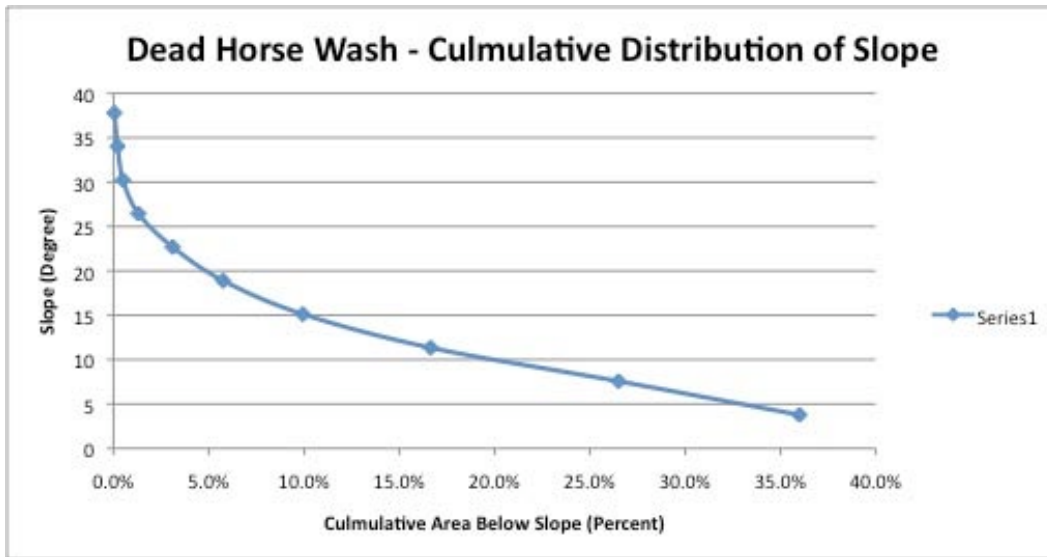
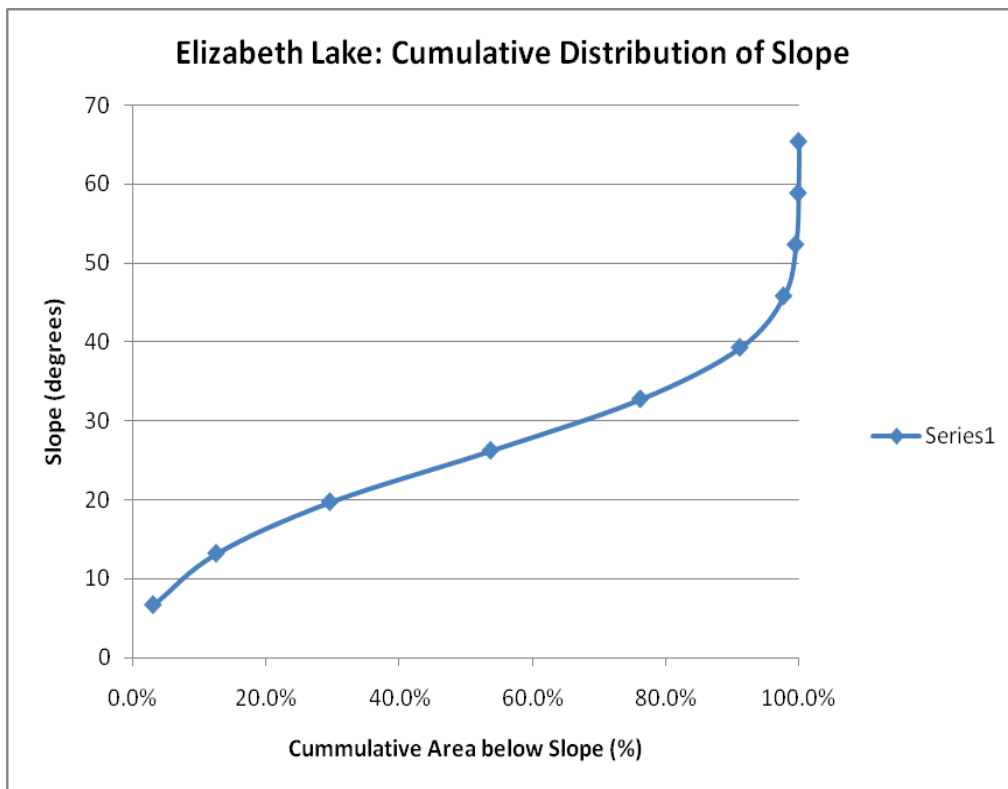Figure 8.1 Dead Horse Wash Cumulative Distribution of Slope

Figure 8.2: Elizabeth Lake Cumulative Distribution of Slope

9. **Catchment Aspect:**
   a. **Dead Horse Wash**: The Aspect Map is found in section 10, Map 8.1. Below is the cumulative distribution of catchment aspect shown in figure 9.1
   b. **Elizabeth Lake**: The Aspect Map is found in section 10, Map 8.2. The Cumulative distribution of catchment aspect is shown in Figure 9.2

Dead Horse Wash aspect was calculated with a Equal Interval for the following directions in the correct order: Flat, North, Northeast, East, Southeast, South, Southwest, West, Northwest and North. The main channel topography for Dead Horse Wash has a direction of flow are Northeast and East on one side of the channel and the other side is Northwest and West. This was determined through the histogram data exported from GIS to Excel in figure 9.1

The topography of Elizabeth Lake drains towards the center of the watershed along the main channel. The main directions of flow are from the south/southeast on one side of the channel, and the west and northwest on the other side of the channel. This is reflected in the distribution of aspect values as shown in Figure 9.2.

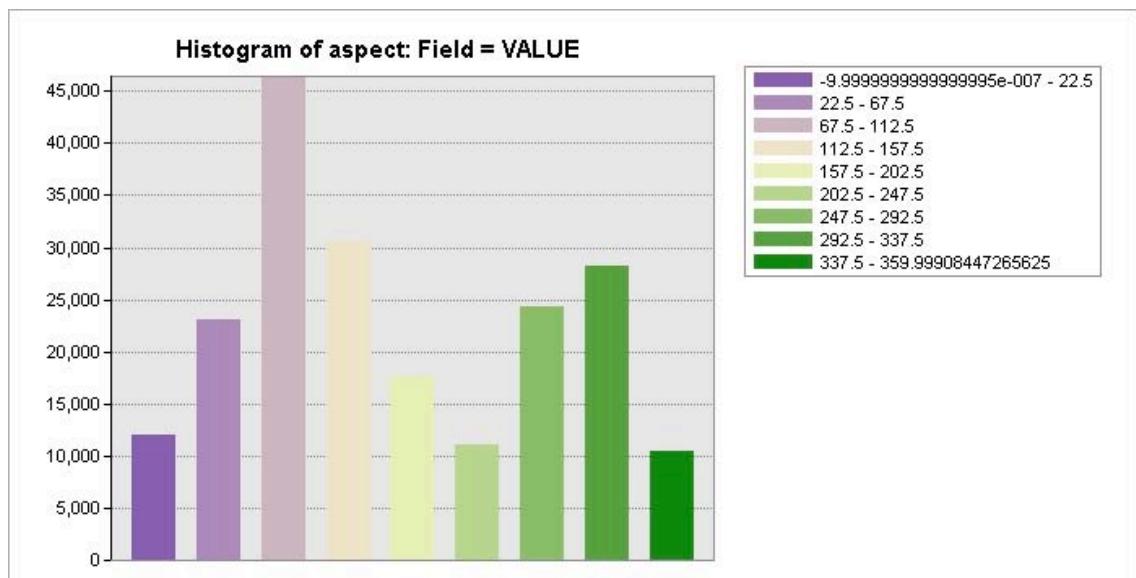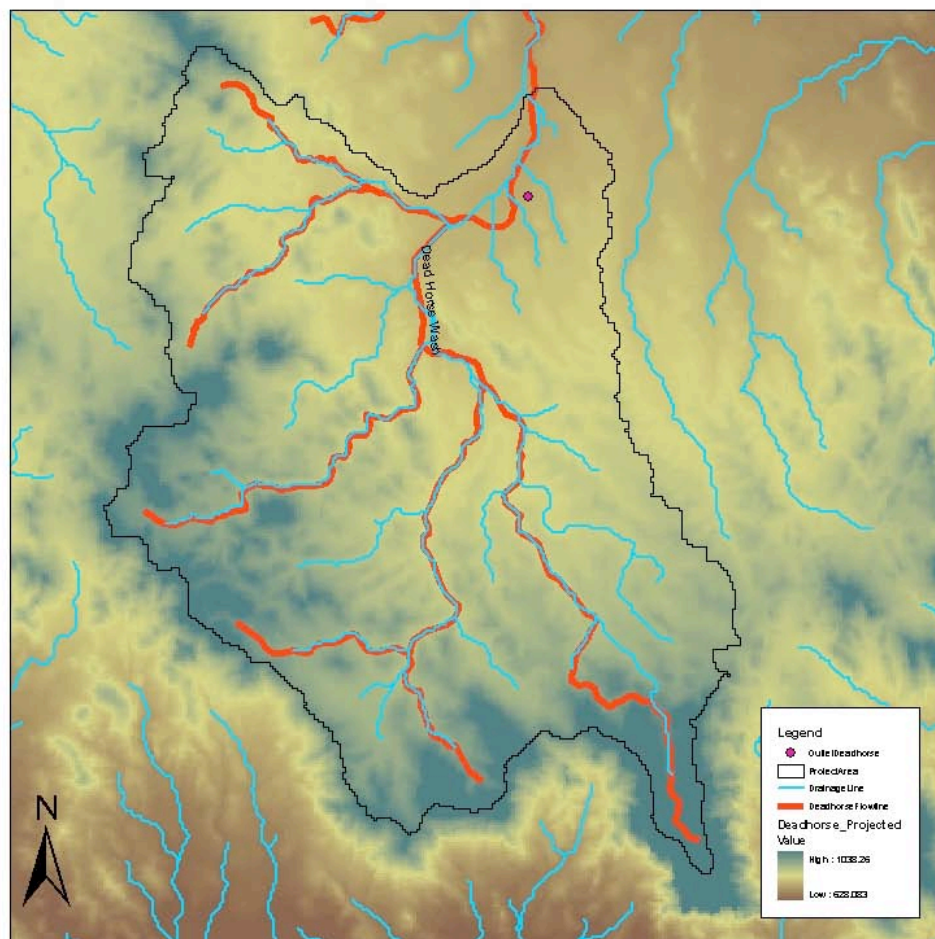Table 9.1 Dead Horse Wash – Cumulative Distribution of Catchment Aspect

Histogram of aspect: Field = VALUE

Legend:
- -9.9999999999999995e-007 - 22.5
- 22.5 - 67.5
- 67.5 - 112.5
- 112.5 - 157.5
- 157.5 - 202.5
- 202.5 - 247.5
- 247.5 - 292.5
- 292.5 - 337.5
- 337.5 - 359.99908447265625

Table 9.2 Elizabeth Lake: Aspect Values

10. Maps

Map 1.1 Dead Horse Wash - Flowline Comparison

Dead Horse Wash Basin

Determing Elevation of Confluence point - GIS Interpolation
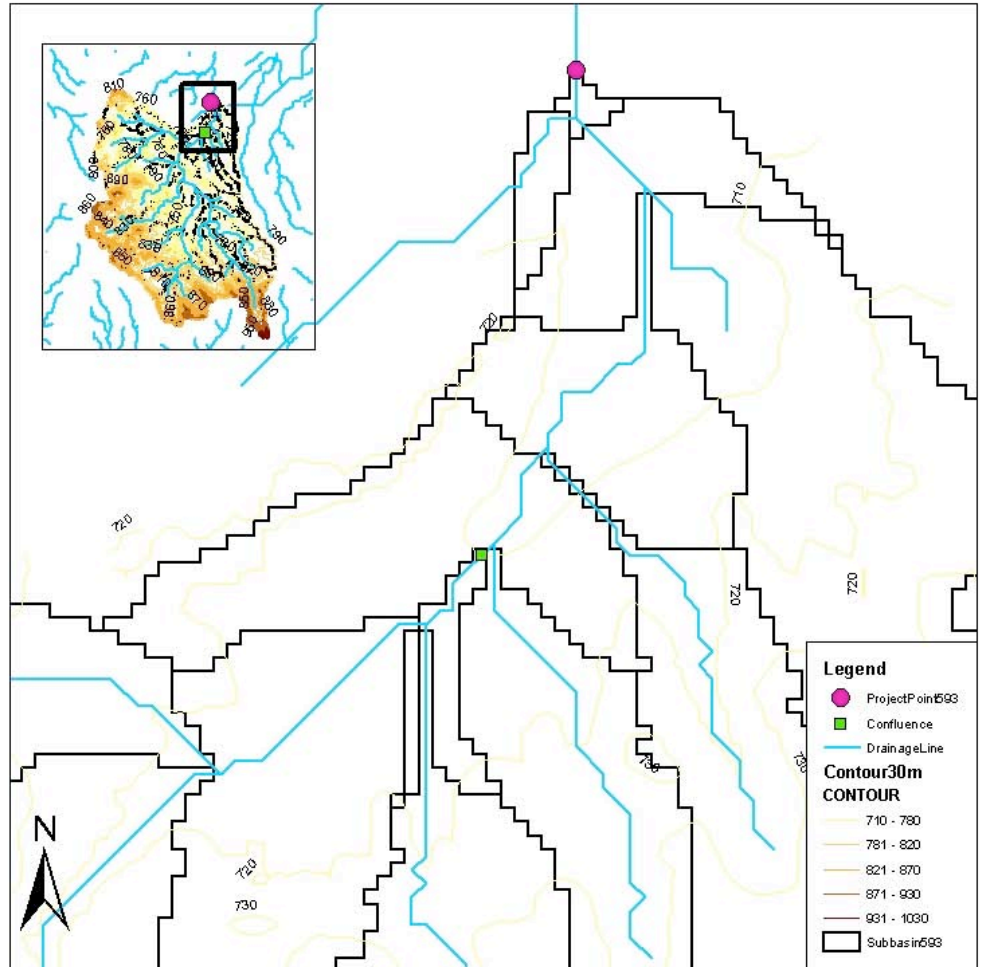
Legend

- 🟣 ProjectPoint593
- 🟩 Confluence
- — DrainageLine

Contour30m
CONTOUR
- 710 - 780
- 781 - 820
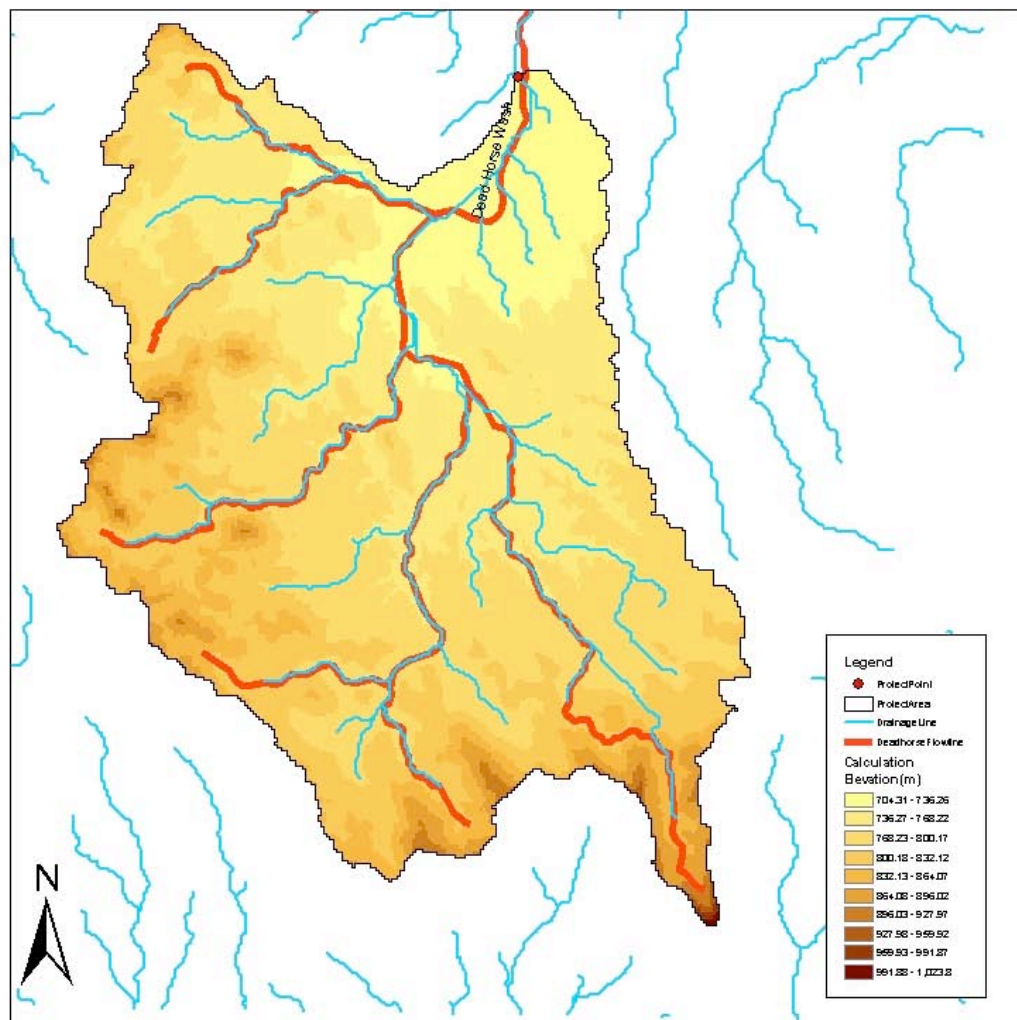- 821 - 870
- 871 - 930
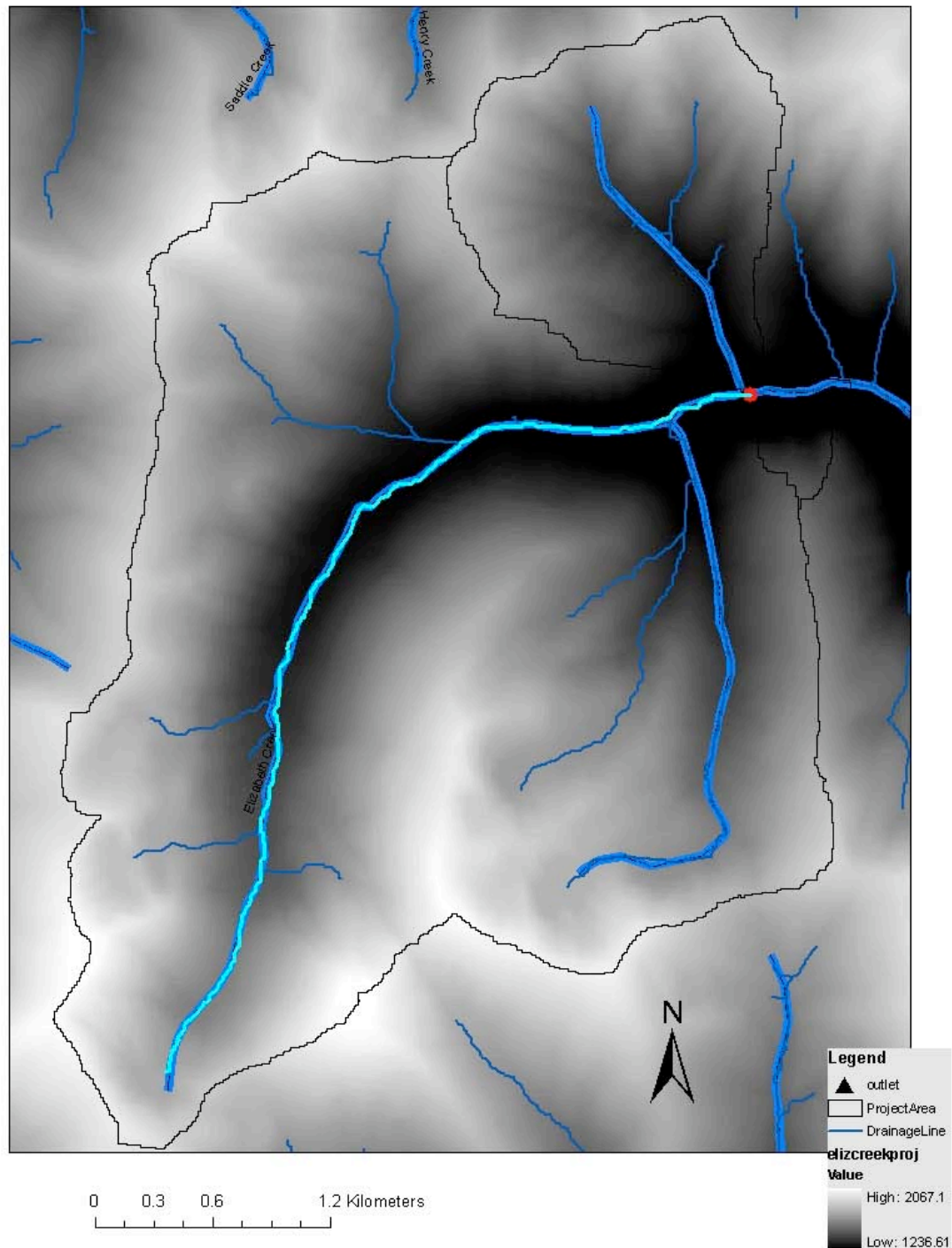- 931 - 1030
- ☐ Subbasin593

Author: Julenne Bautista
Data Source: CEE266A. David Freyberg,
TAs Katy Ashe & Will Martin
HUC: 17060307
Geographic Coordinate System: NAD 1983 UTM 12N
Date: 12 October 2010

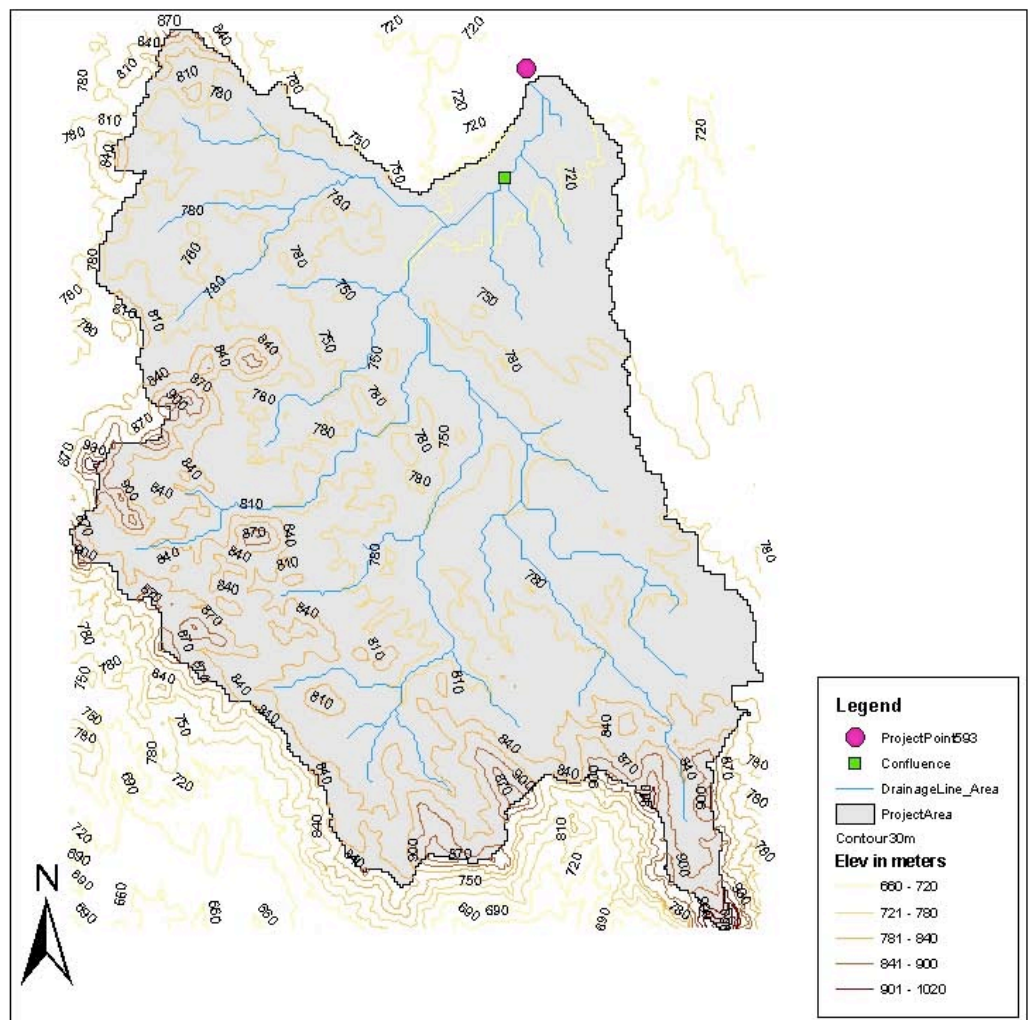0   125   250   500 Meters

Map 4.1 Dead Horse Wash Confluence Points in GIS

Dead Horse Wash Basin
Elevation in meters

Map 5.1 Dead Horse Wash Elevation Map

Map 5.2 Elizabeth Lake Elevation Map

Dead Horse Wash Basin

Contour (30m Intervals)

Legend

● ProjectPoint593
■ Confluence
— DrainageLine_Area
▢ ProjectArea
Contour30m
Elev in meters
660 - 720
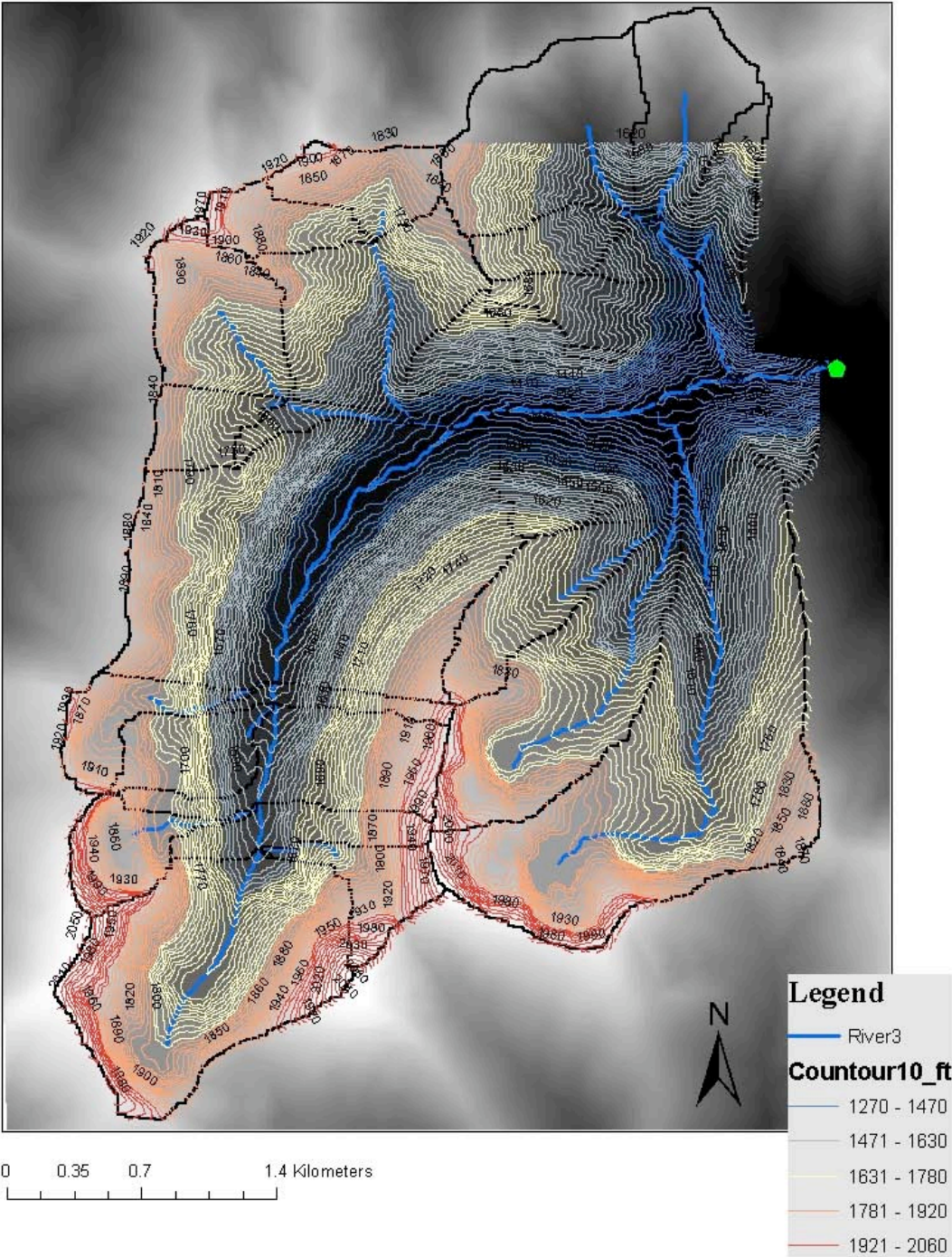721 - 780
781 - 840
841 - 900
901 - 1020

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0   600   1,200   2,400 Meters

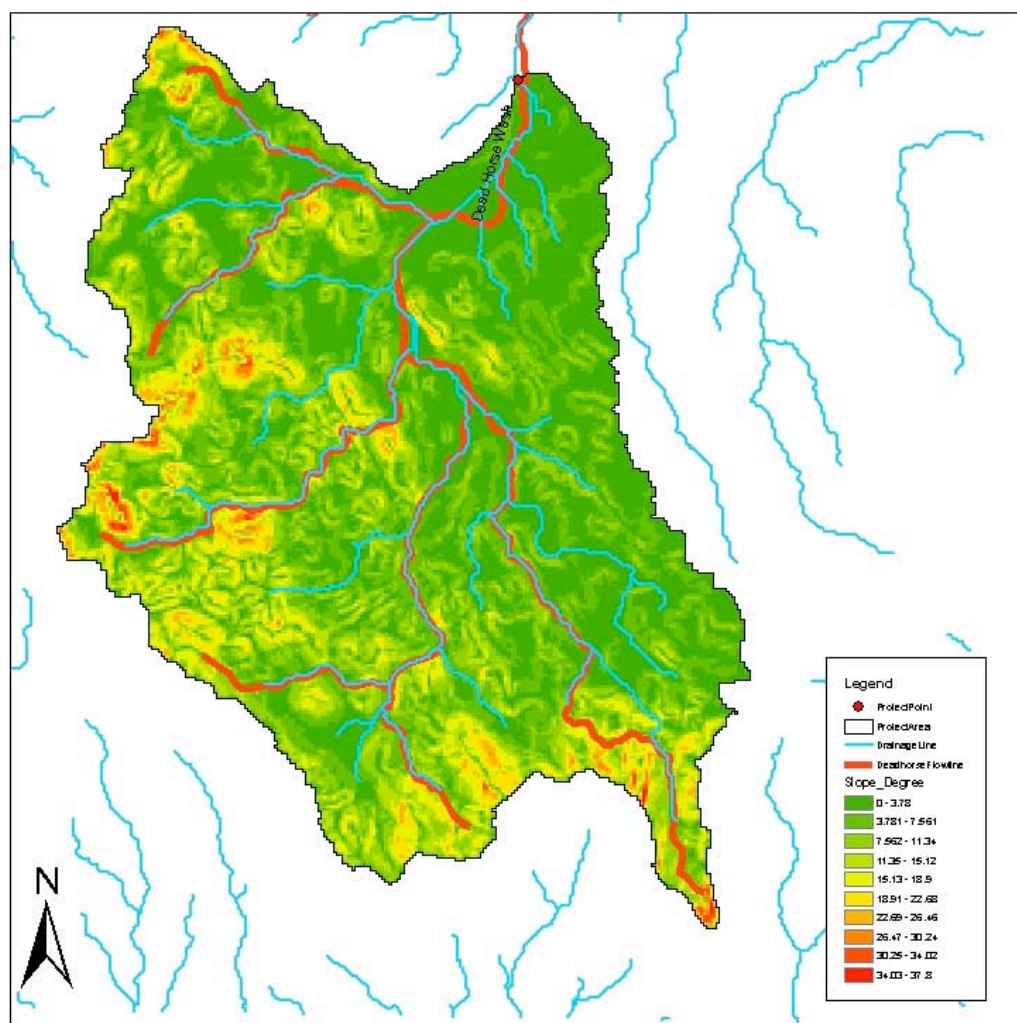Map 6.1 Dead Horse Wash Contour Map (30m Interval)

Elizabeth Lake Basin: Contours

Map 6.2 Elizabeth Lake Contour Map (10m Interval)

Dead Horse Wash Basin

Maximum Rate of Change: Slope

Legend

ProjectPoint

ProjectArea

Drainage Line

Deadhorse Flowline

Slope_Degree

- 0 - 3.78
- 3.781 - 7.561
- 7.562 - 11.34
- 11.35 - 15.12
- 15.13 - 18.9
- 18.91 - 22.68
- 22.69 - 26.46
- 26.47 - 30.24
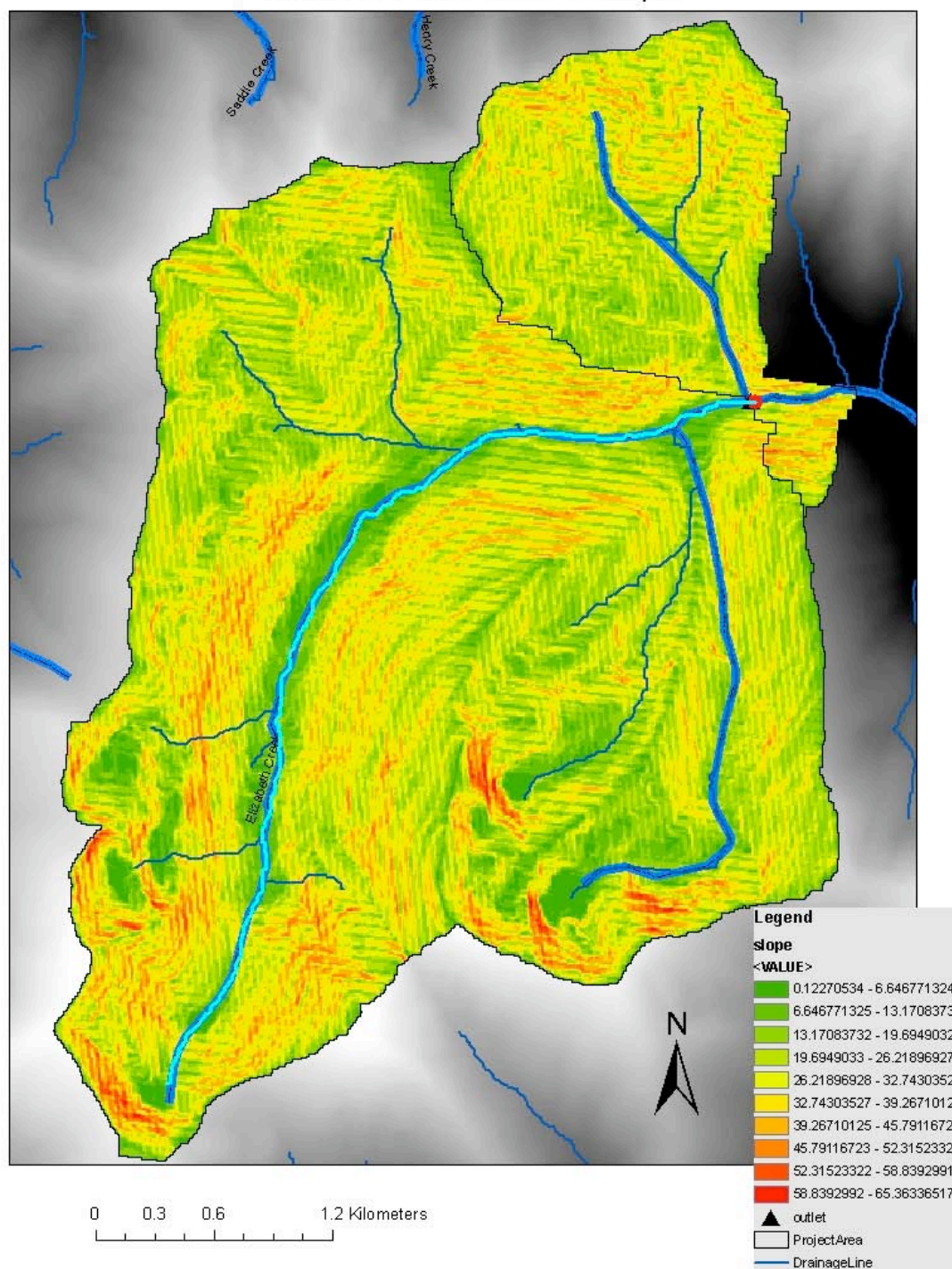- 30.25 - 34.02
- 34.03 - 37.8

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Data Source: CEE266A. David Freyberg,
TAs Katy Ashe & Will Martin
HUC: 17060307
Geographic Coordinate System: NAD 1983 UTM 12N
Date: 12 October 2010

0   750   1,500   3,000 Meters
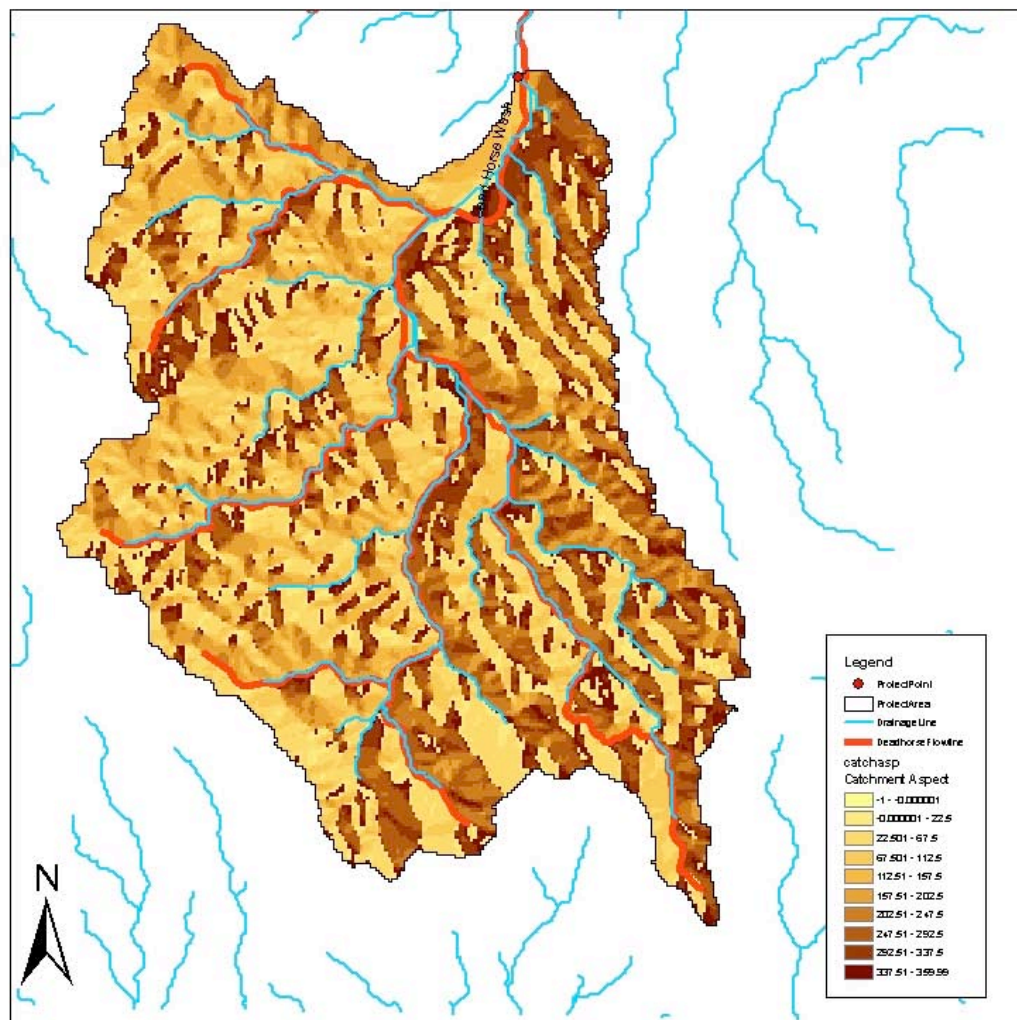
Map 7.1 Dead Horse Wash Slope Map

Map 7.2 Elizabeth Lake Slope Map

Dead Horse Wash Basin

Catchment Aspect

Legend

- Project Point
- Project Area
- Drainage Line
- Deadhorse Flowline

catchasp
Catchment Aspect

- -1 - -0.000001
- -0.000001 - 22.5
- 22.501 - 67.5
- 67.501 - 112.5
- 112.51 - 157.5
- 157.51 - 202.5
- 202.51 - 247.5
- 247.51 - 292.5
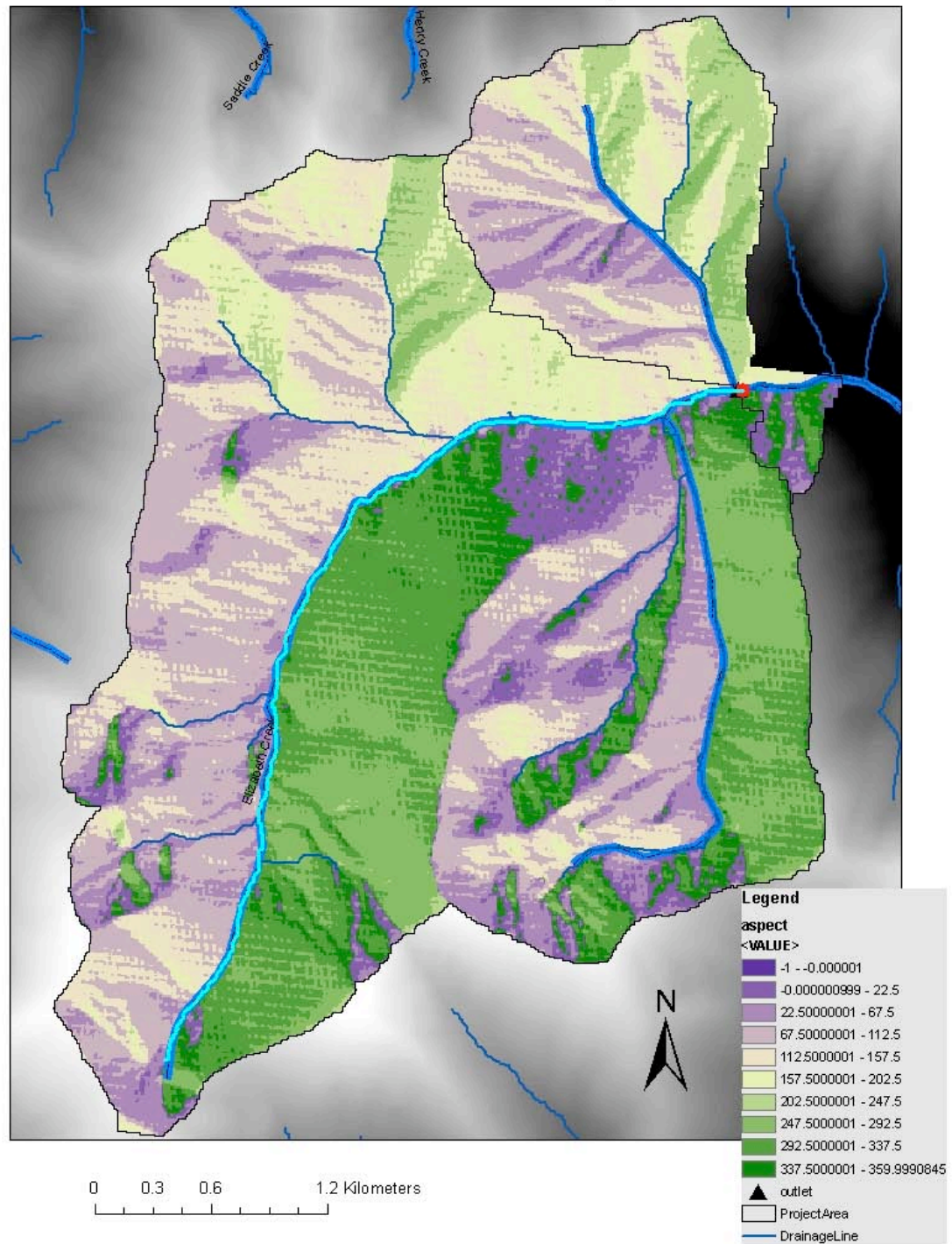- 292.51 - 337.5
- 337.51 - 359.99

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0   750   1,500   3,000 Meters

Map 8.1 Dead Horse Wash Catchment Aspect Map

Map 8.2 Elizabeth Lake Catchment Aspect Map