To: Corrie Miller, Executive Director, Friends of the Mad River

From: Andres Torizzo, Watershed Consulting Associates, LLC

Date: January 4, 2017

RE: ***Pre-Grant Common Plan of Development Private Road and Lot GIS Analysis***

ATTACHMENTS:

Attachment A-1 – Subwatershed Prioritization Map
Attachment A-2 – Subwatershed Prioritization Ranking Table
Attachment A-3 – Priority Subwatersheds Common Plan of Development Areas

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A. Introduction

On behalf of the Friends of the Mad River, Watershed Consulting Associates, LLC (WCA) has performed an analysis to target unmanaged threats to water quality. This analysis focused on identifying priority subwatersheds within the Mad River Watershed and then identifying common plans of development (CPODs) associated with the private roadways and driveways in these priority areas. CPODs are defined as two or more residences accessed from one private roadway. This Geographic Information System (GIS) analysis utilized the existing Ridge to Rivers study (Stone Environmental, May, 2016) previously completed for the area.

B. Subwatershed Prioritization

Subwatersheds used by the Ridge to Rivers study were used as a basis for the prioritization effort. In total, nine different indicators of expected threats to water quality were scored. These characteristics are:

- Forest Cover (%)
- Water Quality Monitoring Data
- Developed Land in Proximity to Water Resources (% of Subwatershed)
- Road Density
- High Slopes (>15%)
- Road Erosion Risk Score (Sum of scores / road length (km))
- Road Stream Crossing Density
- Impervious Cover (%)
- Developed Land, Slopes ≥15%

The scoring for each of these subwatershed characteristics can be found in Attachment A-2. For eight of the nine factors, a classification method that determines natural clustering within data known as Jenks Natural Breaks was used to classify data into five groups. These groups were then scored with an integer from one to five where one indicates little risk to water quality and a five indicates a potentially significant threat to water quality. The remaining factor, water quality monitoring data, was scored as

either a 0 (meets water quality standards or no data available), 1 (mean total phosphorus exceeds water quality standards), or 2 (mean total phosphorus and turbidity exceed water quality standards). This factor was scored differently as it was the only categorical value whereas the other eight factors consisted of continuous numeric data.

Once each subwatershed was scored for each of the factors, the nine scores were summed. The total score was used to rank the subwatersheds into five priority classes: very low, low, moderate, high, and very high. The classes were again determined using Jenks Natural Breaks. The higher the score, the greater the risk to water quality and thus the highest priority. Each subwatershed and its prioritization can be seen in Attachment A-1.

Seven very high priority subwatersheds were identified with this methodology. These subwatersheds are Rice Brook, High Bridge Brook, and five unnamed tributaries (9, 12, 15, 16, and 17). These high priority subwatersheds were used to focus the remainder of this analysis.

C. Select Priority Common Plans of Development

The next step in this analysis was to identify common plans of development (CPODs) associated with private roadways and driveways within these seven high priority subwatersheds. CPODs are defined as two or more residences accessed from one private roadway.

E911 driveway centerlines were obtained and private roadways were extracted from the statewide publicly available Vermont Road Centerline GIS data. Both datasets were downloaded from the Vermont Center for Geographic Information (VCGI). Using this newly created dataset, all public roads and driveways that provide access to two or more residences were visually identified using GIS. To aid in this identification of CPODs, VT E911 Site Locations (building address points) were utilized (also from VCGI). These points helped to differentiate between residences and businesses and was useful when significant tree canopy obscured residences in aerial imagery. An example CPOD identified in this study is shown in Figure 1.

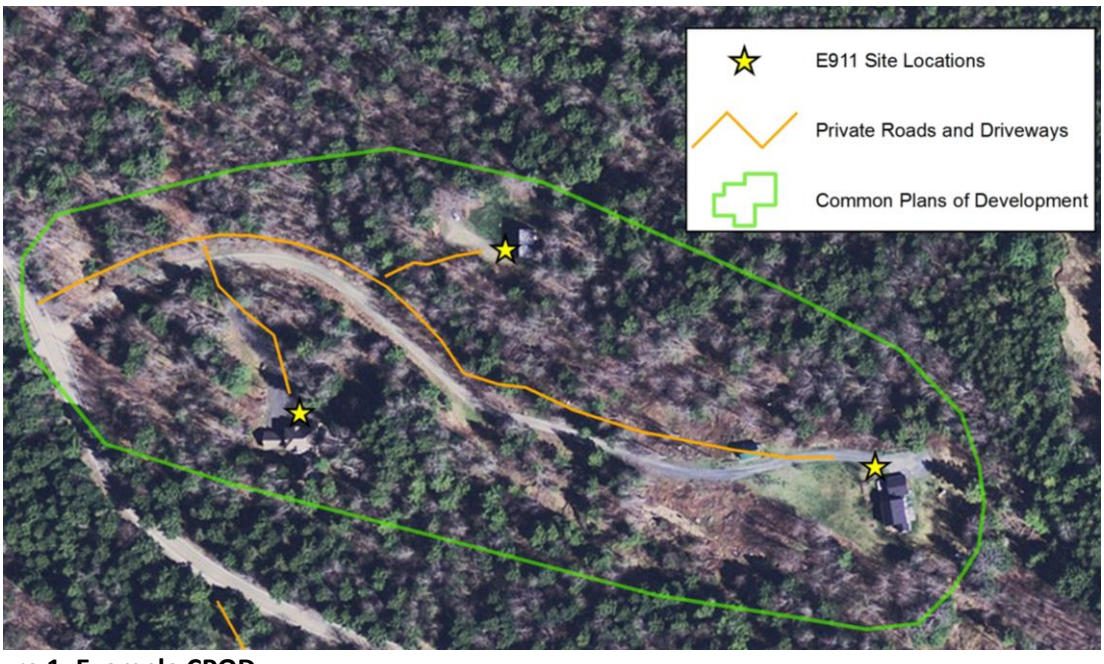


Figure 1. Example CPOD

D. Description of Identified CPODs

In total, 54 CPODs were identified within the seven priority subwatersheds. The location and extent of these CPODs can be seen in Attachment A-3. The CPODs identified varied significantly in both number of residences and areal extent. In total, 455 residences were within the 54 CPODs. CPODs averaged 8 residences, but number of residences was highly variable (standard deviation 16.7). Most CPODs contained a fairly small number of residences; 57% had fewer than 6 residences and 45% had either 2 or 3 residences. Conversely, a small number of CPODs (17%) had greater than 10 residences with one CPOD skewing the mean number of residences higher with its 119 homes. The distribution of residences can be seen in the histogram below (Figure 2).

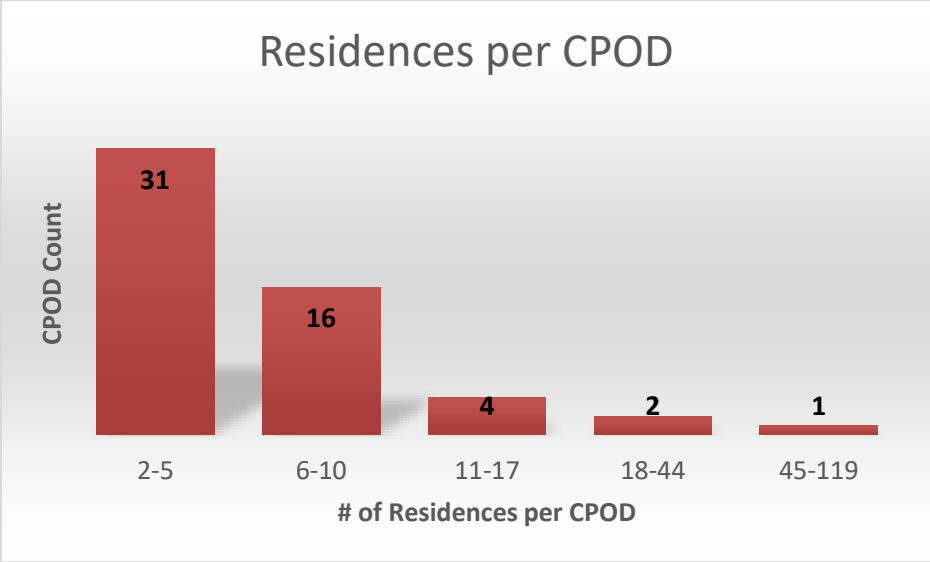


Figure 2. Number of residences per CPOD

The approximate area of each of the CPODs was calculated by creating a bounding polygon around each of the residences as well as the driveways and private roadways associated with the CPOD. These areas calculated are approximate, as no standard method was developed for area identification, and are meant only to give an idea of the extent of the CPODs identified. As with number of residences per CPOD, the areal extent of the CPODs was varied with a mean area of 15 acres and a standard deviation of 23.5 acres. See Figure 3 for a histogram of all CPOD areas (acres). The majority of CPODs were less than 14.3 acres (72%). The mean area was inflated by the one large CPOD in Rice Brook that is nearly 160 acres in size.

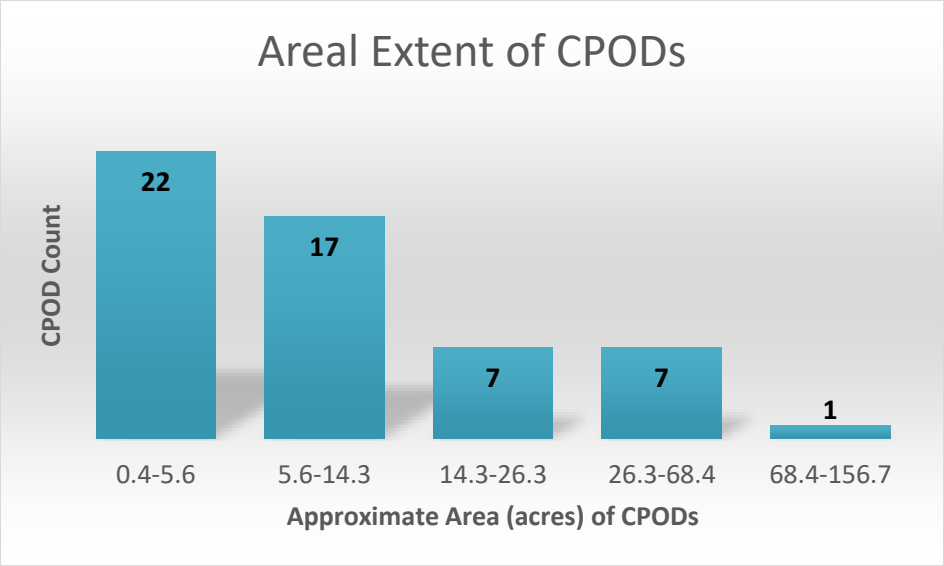


Figure 3. Approximate areal extent of CPODs.

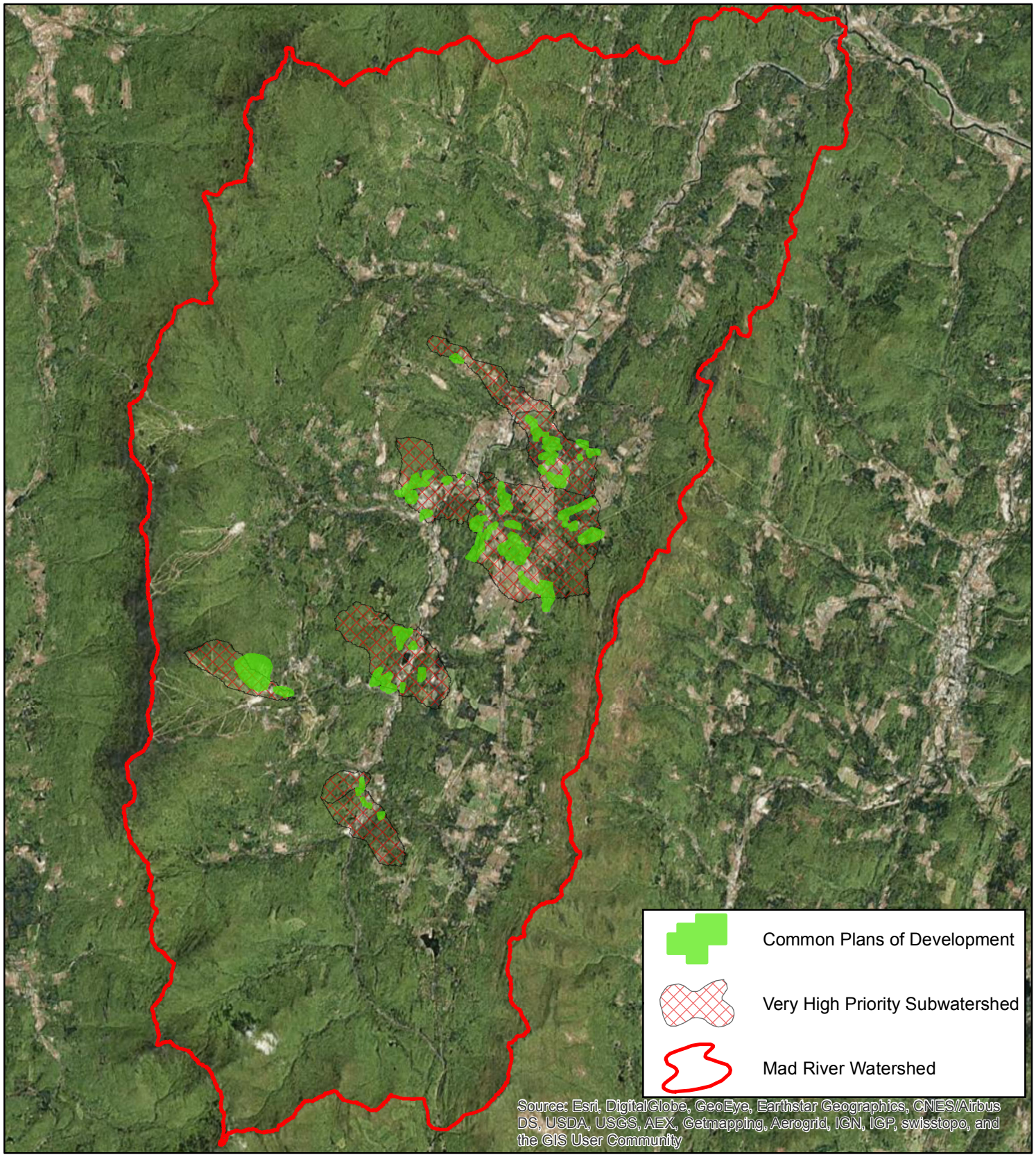
E. Summary

This analysis provides a targeted approach to identify high priority subwatersheds that pose a risk to water quality and identify common plans of development within those subwatersheds. This approach will allow the Friends of the Mad River, given their limited time and funding, to target resources to best protect and improve water quality.

Please feel free to call at (802) 497-2367 or email at andres@watershedca.com with any questions.

Sincerely,

Andres Torizzo
WCA Principal



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0 0.75 1.5 Miles

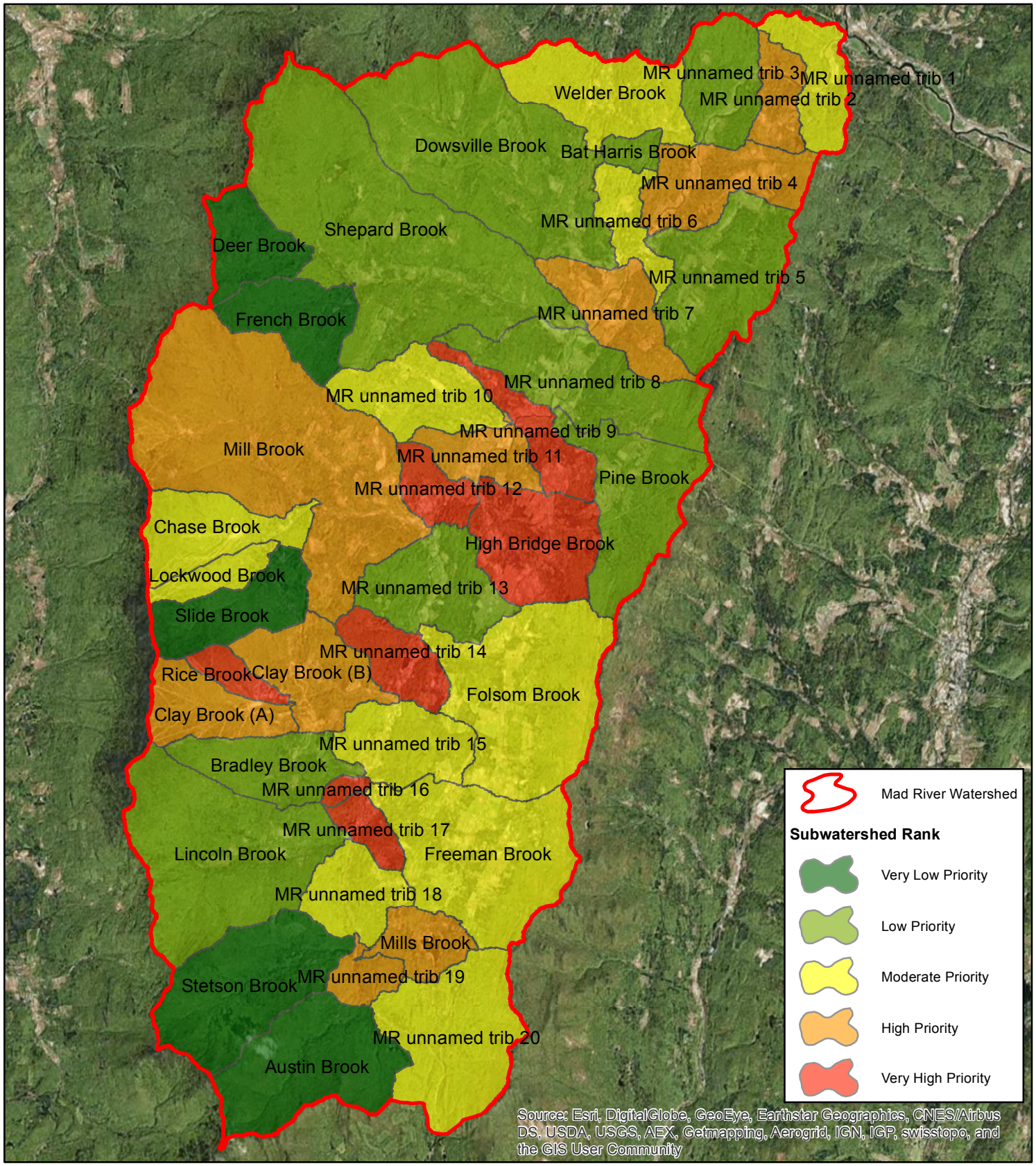
Priority Subwatersheds: Common Plan of Development Areas Mad River Watershed

WATERSHED CONSULTING ASSOCIATES, LLC

Map Produced: 01/03/2017

Memo Attachment 2 – Subwatershed Prioritization Ranking Table

Subwatershed Characteristic	Value	Score
Forest Cover (%)	> 92.86	1
	85.34 - 92.86	2
	81.08 - 85.34	3
	71.34 - 81.08	4
	≤ 71.35	5
Water Quality Monitoring Data	Meets Water Quality Standards or No Data	0
	Mean Total P ≥ WQS	1
	Mean Total P and Turbidity ≥ WQS	2
Developed Land, Slopes ≥15%	≤ 0.84	1
	0.84 - 1.95	2
	1.95 - 4.33	3
	4.33 - 7.8	4
	> 7.8	5
Road Stream Crossing Density	> 0.0019	1
	0.0019 - 0.0036	2
	0.0036 - 0.0053	3
	0.0053 - 0.0069	4
	> 0.0069	5
Impervious Cover (%)	≤ 0.49	1
	0.49 - 1.77	2
	1.77 - 3.51	3
	3.51 - 5.59	4
	> 5.59	5
Road Erosion Risk Score (Sum of scores / road length (km))	≤ 6.92	1
	6.92 - 17.22	2
	17.22 - 30.9	3
	30.9 - 61.79	4
	> 61.79	5
Road Density	≤ 0.53	1
	0.53 - 1.08	2
	1.08 - 1.61	3
	1.61 - 2.36	4
	> 2.36	5
High Slopes (>15%)	≤ 0.85	1
	0.85 - 1.95	2
	1.95 - 4.33	3
	4.33 - 7.8	4
	> 7.8	5
Developed Land in Proximity to Water Resources (% of Subwatershed)	≤ 0.06	1
	0.06 - 0.19	2
	0.19 - 0.49	3
	0.49 - 0.92	4
	> 0.92	5



N

0 0.75 1.5 Miles

Subwatershed Priority Ranking
Mad River Watershed

WATERSHED CONSULTING ASSOCIATES, LLC

Map Produced: 01/03/2017