30% Report

486 CAPSTONE PROJECT:
RYAN'S TRAIL ROAD REDESIGN IN COCONINO COUNTY, FLAGSTAFF, ARIZONA

College of Engineering, Forestry, and Natural Sciences

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Acknowledgements

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We would also like to thank Dr. Brendan Russo for his professional technical expertise on the preliminary and design phases of our road redesign project.

Lastly, we would like to thank the residents of Lockett Ranches for allowing us to design their improved access road and perform the necessary fieldwork in their development.

Without the assistance of these individuals, the road redesign would not have been possible.

1.0 Project Introduction

1.1 Project Purpose

The residents of Lockett Ranches have requested improvements for an existing private road. The Ryan's Trail Capstone team will be evaluating potential design options by completing the project "Ryan's Trail Road Redesign". The clients would like to enhance many elements of the road including: the ease of snow removal, the suitability for all vehicle types, the durability for regular use, insurance of proper drainage, and the cost effectiveness of road maintenance. The team will be expected to recommend designs that best satisfy all the said requests within the means of the clients. These designs will be dependent upon the team's thorough analysis both in the field and in the office. A renovation may include a change of material and a change in the road's structure.

1.2 Project Background

1.2.1 Road Location and Dimensions

Located in Coconino County, which is northeast of Flagstaff city limits, is a residential development "Lockett Ranches" (Figure 1). Within the community it is east off of Hattie Greene Road. Some of the utilities lie on N. Wildcat Trail, which is the road west of Ryan's Trail (Figure 2). The road itself is classified as a private road, and is a quarter-mile long and approximately 12 feet wide (Figure 3).

Figure 1: Location of Coconino County in Arizona [1]

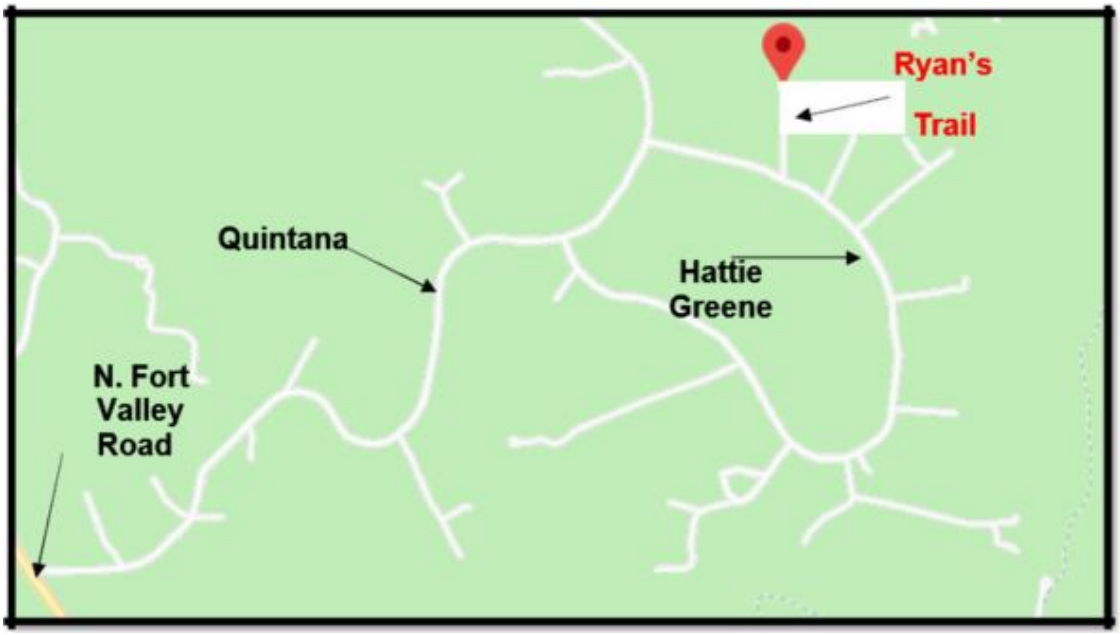

Figure 2: Lockett Ranches Site Map [1]

Photo By: McKenzie Moten

Figure 3:Private Road "Ryan's Trail" located in Lockett Ranches, AZ

1.2.2 Existing Material Conditions

The road currently consists of mostly dirt with a combination of crushed cinders and gravel on top. The maximum amount of gravel, cinders, or a combination of the two at any point on the trail is no more than six inches. There are five residential homes accessed by the use of Ryan's Trail paired with their individual driveways. The material of these driveways is necessary to consider because the newly designed road will need to mesh into the driveway material without complications. There are currently two gravel driveways, a dirt driveway, an asphalt driveway, and a driveway composed of cinders.

1.2.3 Existing Watershed Analysis

The team will perform an analysis using "GIS" (Geographic Information Systems) to determine the specific hydrological patterns of Ryan's Trail. The results can be found under the "Technical Considerations" section. The current research conducted regarding the hydrology of the area concluded

that the run off from the San Francisco Peaks drains primarily around our given site (Figure 4).

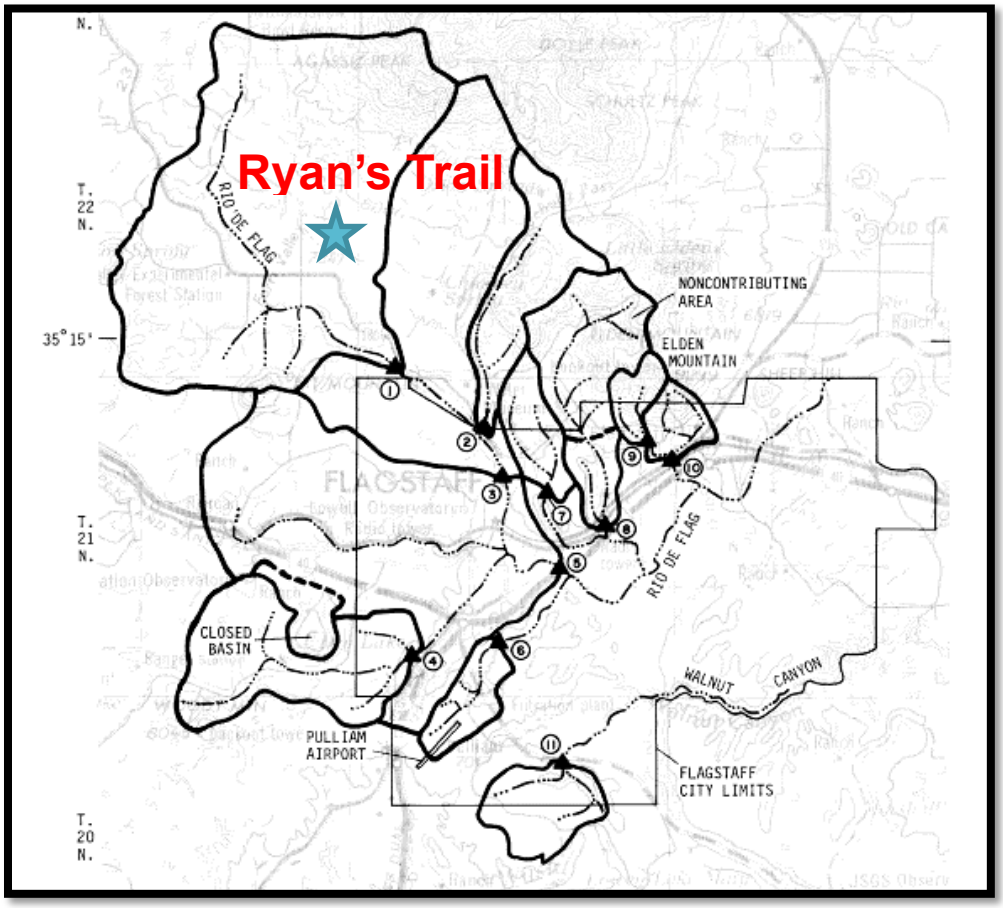

Figure 4: Watershed behavior in Coconino County [3]

1.2.4 Existing Utilities

The existing utilities (gas, water, electric, and cable) that are located under Ryan's Trail were to be identified to prevent damage during the road redesign. Blue Stake (a service used to mark existing utilities) was contracted to help prevent incidents such as gas leaks or the leakage of electricity during construction. The Blue Stake results can be seen in Figure 5.

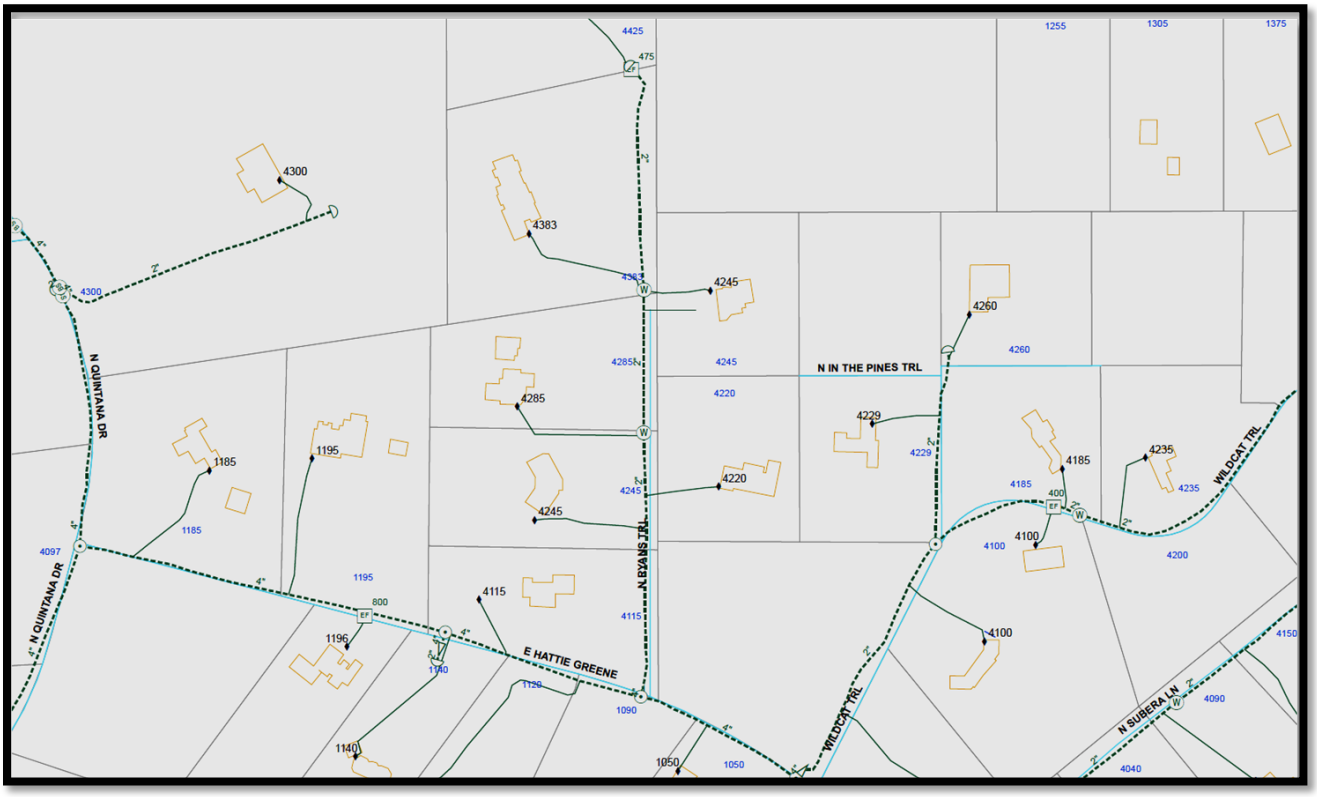

Figure 5: Utilities Located in Lockett Ranches Indicated by Blue Stake Services

1.2.5 Constraints and Limitations

The potential challenges the team predicts they will have to overcome in the preliminary design phases include financial constraints and locating affordable materials. During the construction phase the access, utilities, codes, and weather are all of concern to the team. Lastly, evaluating the maintenance and success of the project will be difficult to measure with benefits such as “comfortablility” or “aesthetics”.

1.2.6 Scope of Project

While there are many components of this project the tasks that the team is responsible for are to be specified clearly and systematically. The engineering team is accountable for administering background research, preforming a site investigation, developing a topographic map, analyzing the current design and it’s hydrology, suggesting alternatives, and performing a life cycle cost analysis on the final designs. A detailed description of each of these tasks, and the subtasks that they include can be found in section 2.0 “Technical Considerations”.

2.0 Technical Considerations

2.1 Site Investigation

2.1.1 Site Visit

2.1.2 Blue Stake

2.1.3 Field Surveying

2.2 Site Map

2.3 Conceptual Design

2.3.1 30% Report

2.3.2 Existing Design Analysis

2.3.3 Material Concepts

2.4 Hydrology

2.4.1 Watershed Analysis

2.4.2 Culvert Design

2.4.3 Improved Road Design Alternatives

2.5 Life Cycle Cost Analysis

2.5.1 Feasibility Report

2.6 Final Design Recommendations

2.7 Project Management

2.7.1 Meetings and Consultations

2.7.2 Website

2.8 Summary of Engineering Work

4.0 References

[1] Google LLC, "Google Maps," Google LLC, 2017. [Online]. Available: https://www.google.com/maps. [Accessed November 2017].

[2] U.S. Geological Survey, G. W. Hill, and B. N. Aldridge, *Flood Hydrology Near Flagstaff, Arizona*. Tucson, AZ, 1988.

Appendix A