Parma Park Sustainable Trail System Plan, Phase I

TRAIL EVALUATION, ASSESSMENT AND DESIGN REPORT

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Santa Barbara County Trails Council

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SANTA BARBARA COUNTY
Trails Council

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WHAT IS SUSTAINABILITY?

Sustainability of natural surface trail corridors is defined as the characteristic of a travel surface to support currently planned and future users with minimal impact to the natural systems of the area.

Sustainable trails have negligible soil loss or movement while allowing the naturally-occurring plant systems to inhabit the area, recognizing required pruning and eventual removal of certain plants will be needed over time.

Sustainable trails will not adversely affect the naturally occurring fauna. Sustainable trail design will accommodate existing and future uses while only allowing appropriate ones.

The sustainable trail will require little rerouting and minimal maintenance over extended periods of time.

— *National Park Service, Rocky Mountain Region, 1992*

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Executive Summary

In 1973 John and Harold Parma dedicated Parma Park to the City of Santa Barbara as a publically accessible open space. Harold Parma's bequest for the property was for it to remain in its "natural state" for the respectful enjoyment of others in the future. Over the next several decades a trail system has been developed for the Park that has grown to include nearly six miles of trail organized into four main systems: Ridge; Creek; Stanwood and Plateau trail systems along with one private easement that connects to Mountain Drive.

In 2003, responding to increased use of Parma Park and the need for a comprehensive review of its resources, the *Parma Park Open Space Resource Management Guide* was developed by Parks and Recreation to provide long-term management of the Park. The goal was to incorporate adaptive management tools to allow for changing conditions of the property and public use trends.

Since the adoption of the Guide in 2003, the Park has experienced increased use and a devastating wildfire (Tea Fire, November, 2008) that has had a long-term impact on the trail system at Parma Park. In Spring 2017 City Parks & Recreation commissioned a review of current trail conditions at Parma Park with the long-term goal of creating a sustainable trails plan for the Park Trails System.

In July 2017, the Parma trails were survey over a period of several weeks using GIS equipment capable of sub-meter accuracy. Data was collected for 231 separate segments that included data such as tread width, trail grade, entrenchment, outslope and current condition. In addition, data was collected for all trail signs, markers or other physical improvements such as tables, benches, hitching posts and the like.

The results of this survey have been organized into a "Trail Evaluation, Assessment and Design Report". The main focus of this report includes:

- Providing the City of Santa Barbara Parks & Recreation Department with an assessment of the current condition of the existing trails at Parma Park, including the main access road, the Park's physical resources (trail signs, kiosks, signage) and other improvements such as erosion control features;
- Assessing their suitability for meeting the Department's Trail Management Objectives (TMOs) and other sustainability guidelines;
- Providing an analysis of these conditions and prescriptions for the development of a sustainable trails system design for Parma Park.

Detailed Analysis

The report includes a thorough analysis of each of the major trail systems along with an overall review of each, a critique of the segments within the system, concerns identified by the survey and detailed recommendations for meeting Park TMOs and sustainability goals.

Concerns Identified

In analyzing the data collected during the survey, while it indicated that 50% of the trails were in reasonably good condition or close enough that minimal-to-moderate efforts can be used to

upgrade them to meet the Park's TMOs, more extensive restoration efforts will be needed for the other 50% of the trails if they are to meet Park standards.

This may include retiring some trail segments, performing more extensive restoration efforts to improve erosion control, eliminating entrenchment and restore outsloping, or when not possible, realigning others along routes that will better meet them.

- Excessive Grade. Approximately 60% of the trails have grades of 11% or more, including 16% with grades between 16-20%, 19% between 21-29% and 8% in excess of 30%. Steep grades are a primary cause of other problems such as entrenchment, loss of outslope and the inability of the erosion control features to get water off the trail.
- Entrenchment. Almost all of the trails have some degree of entrenchment (or gullying). This is both a result of steep grades and a cause of more serious erosion problems. Entrenched trails will only become more entrenched.
- Outslope. More than 50% of the trails are not properly outsloped. Much of this is a result of the entrenchment noted above. Tread restoration is needed to reduce the impacts of both.
- Lack of Erosion Control. Of the 162 erosion control features identified in the survey, 78% of them were rated as poor, meaning that they are ineffective in getting water off the trail. The majority of these features (128) are waterbars, almost all of which do not work and should be converted to more effective types such as knicks or rolling grade dips.
- Location. Many of these issues are concentrated in specific areas such as along Stanwood Drive and the eastern part of the Ridge Trail System where the topography provides few alternatives where the trails exceed standards for grade.
- Poor Routing. Some segments, such as in the Creek and Plateau systems, were poorly designed or may have followed existing social trails prior to the Park being created. Issues relating to these may be better resolved by re-routing them rather than attempting to restore them.

Conclusion

The report confirms the need for the development of a long-range trail design and restoration plan for each of the trail segments within the Ridge, Creek, Stanwood and Plateau trail systems and the Mountain Drive trail easement to:

- Identify areas that require minimal efforts to meet current Park trail standards and sustainability goals and provide planning goals to maintain them over time.
- Develop restoration plans for trail segments that require more extensive efforts (tread work, backsloping, erosion control improvements, trail armoring) to upgrade them to Park TMOs and sustainability guidelines.
- Provide recommendations for trail segments that should be retired along with segments that would better meet Park TMOs and sustainability guidelines if they were realigned along more suitable routes.

Parma Park Trail Assessment

PART 1. Overview

In 1973 John and Harold Parma dedicated Parma Park to the City of Santa Barbara as a publically accessible open space. "The community has been nice to us," Harold reminisced, "and we've been here so long. Every community should have some open space. I think it's precious, something we could do in return for the community."

Parma Park is a relatively unknown “jewel” set in the rugged Santa Ynez Mountain foothills in the northeast corner of Santa Barbara within the Sycamore Canyon Watershed. The property commands incredible mountain top views of the Santa Barbara Channel Islands and lower Sycamore Canyon.

The park was opened for public use with the provision “that the property shall be used solely, exclusively and forever for public park purposes; no buildings or other structures shall be permitted on the property except those incidental to its use; and the official name shall be Parma Park.” Harold Parma’s bequest for the property was for it to remain in its “natural state” for the respectful enjoyment of others in the future.

Purpose

The purpose of this report is to provide a detailed review of the Parma Park trail systems (Creek, Plateau, Ridge, Stanwood, Mountain Drive Easement) and each of the segments within those systems in light of the above concerns to assess their current conditions and to make recommendations for improvements to them.

The primary focus is support for development of a framework to achieve two important goals:

- Identifying trail maintenance and restoration efforts needed to meet the Trail Management Objectives (TMOs) identified for the Parma Park trails.
- Providing design recommendations that can be used to define the Park’s Sustainable Management Objectives (SMOs) and develop a Sustainable Trails Plan for Parma Park.

Planning Guide

During that planning process a majority of user groups noted a preference that Parma Park be kept in as natural a state as possible. They also wanted to see it continue to be used in a “relatively” unspoiled condition, with the understanding that improvements would be necessary to maintain safe multi-use of the trails, including erosion control measures, brushing and stabilization of the creek crossings and addition of some minimal user amenities such as benches, picnic tables and hitching posts for equestrians.

Specific conditions noted in the 2003 Planning Guide included:

- The ridge roadway trail used by heavy vehicles were creating large ruts, and erosion along the edge of trails when driven in wet conditions.
- Many of the trails lacked water bars.

- Where water bars had been constructed many of them were not done well.
- Additional brushing of the vertical corridors for continued and safe equestrian use was needed.
- More frequent brushing of the horizontal corridor to make it wide enough for the primary users – hikers and horse riders — but not so much that trails become too wide and cause runoff/erosion or visual scars on the landscape.
- Use of trails by hikers, bikes, horses and vehicles in wet conditions was increasing trail entrenchment and increasing erosion control.
- Trails most susceptible to damage during these conditions are the trails composed of sticky clays and siltstones, especially along the creeks and steep terrain (primarily the Creek and Ridge trail system).
- Trails should not be cut straight uphill (along the fall line) and switchbacks should be added to reduce erosion.

Tea Fire Impacts

While many of these suggestions were incorporated into the City Parks & Recreation planning process, in 2008 a wildfire that started in the hills almost immediately above Parma Park would cause major impacts to Parma Park. Known as the Tea Fire, though it burned less than 2,000 acres total, it destroyed 210 homes, and burned through most of Parma Park's vegetative cover.

In June, 2009, a report to the City Council by Assistant Parks and Recreation Director Jill Zachary noted that over 95 percent of the native riparian, oak woodland and grassland habitats within Parma Park had been destroyed by the fire. As a result, the park sustained a significant loss of vegetation, accelerated soil erosion and seriously damaged the hiking and equestrian trails and fire access roads.

As a result of these impacts Parks and Recreation was successful in applying for and receiving a $186,190 National Emergency Grant for Parma Park to support non-native exotics removal, habitat restoration, trail and defensible space maintenance, new signage, restoration of the olive grove, community outreach, volunteer programs, and project management.

Need for Additional Review

Despite the grant funding and an additional commitment by the Parma Park Trustee to support a 2.5-year restoration program for the park, the loss of vegetation during the Tea Fire has had a long-term impact on the trail system at Parma Park.

Many of the original trails, especially those on the western side of the park (upper Creek and Plateau trails systems) have experienced increased erosion due to their steep grades.

- A number of these west-side trails appear to have developed primarily as social trails. A social trail is a foot path created by park users or wildlife and not originally created as a park path. They are generally created out of convenience without thought to sustainable trail design, grade or impacts from increased erosion after the Tea Fire.

There is a need to review the current configuration of all of these trails to determine if they can meet sustainable standards.

- If not, these areas need to be reviewed to determine if a more sustainable trail network can be developed in these areas that better meets user needs as well as TMO and SMO objectives.
- The three (3) trailhead access points along Mountain Drive are steep, with slopes averaging in excess of 20%. All have experienced increased erosion and need to be reviewed for the potential to reduce the entry grade, remove entrenchment and stabilize the hillsides.
- The trails along the Stanwood Trail System (S1, S2 and S3 in particular) contour along steep hillsides and often include grades that far exceed typical trail standards. Each need to be reviewed to determine how to improve erosion control and, if possible, where portions of these trails either can be realigned or rerouted.
- The eastern portion of the Stanwood System that leads from Stanwood Drive north up to the Ridge Trail System far exceeds standards for grade. Many of the switchbacks are steep, averaging over 25%. There is a need to review how to improve erosion control, improve the switchbacks and determine where portions of these trails either can be realigned or rerouted.
- Along the eastern part of the Ridge Trail System a number of trails were developed to provide an opportunity for trail users to bypass the extremely steep portion of the Fire Access Road (R1c). Only one of these meets either TMO or SMO guidelines. These trails need to be reviewed to determine if there is a more sustainable way to provide a transition from the main part of the Fire Access Road (R1b) leading to McMullin Point and from there down to the lower end of the eastern Fire Access Road (R1c).
- A half-mile-long section of the Ridge Trail System (R7, R8, R9) provides an additional loop opportunity along a mid-slope part of the Coyote Creek drainage. This loop needs further study to determine whether the trail can be made more sustainable (particularly R8) and safety issues can be addressed along a steep hillside on R9.

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PART 2. Management Objectives

The Trail Management Objectives (TMOs) for Parma Park have been developed using the United States Forest Service standards for a range of trail classifications that include wilderness and non-wilderness trails, lightly developed and more heavily developed areas and various shared uses.

A. Trail Management Objectives (TMOs)

Trail Management Objectives (TMOs) developed by the United States Forest Service (USFS) also help define the design parameters used to manage the Parma Park trails. The guidelines for the Park focus on Trail Class 3 standards for Hikers and Trail Class 3 standards for Pack and Saddle as noted below.

Table 1. Parma Park — Trail Class 3 Hiker Trails and Pack and Saddle Design Parameters	
Surface	Native Soil
Width	Single Track - 36” from centerline; Double Lane - 36”-48”
Grade	5-10%; Short Pitch Maximum 15%; Maximum Pitch Density 10-20% of Trail
Outslope	5-10%; Maximum 15%
Vertical Clearance	12 feet overhead
Horizontal Clearance	6 feet to ground level on uphill side from center line of trail; 4.5 feet to ground level on downhill side
Design Turns	5 feet-8 feet

The TMOs for Parma Park provide overall guidance in assessing current conditions at Parma Park and what may be required to meet these standards. However, while the TMOs provide direction in how to manage the Parma trails and what users should expect when they use them, they do not define the specific methodology for doing so.

Along with the TMOs, understanding sustainable trail objectives and the techniques required to meet them is critical to the development of a long-term plan. The following section provides an overview of the key components of building a sustainable trails system and process of evaluating each of the trails for sustainability.

B. Sustainability Management Objectives (SMOs)

Sustainability of natural surface trail can be defined simply as the ability of a trail to support planned and future uses with minimal impact to the surrounding environment over time given the topographic, geologic, climatic and other factors. The SMOs identified below will provide a sound framework for future maintenance and more comprehensive restoration efforts to meet sustainability goals for the Parma Park trails system.

In large part the concept of sustainability has come to be based upon the premise that getting water off the trail as soon as possible is the key to minimizing erosion and its associated

impacts. Methods for doing this involve use of techniques to minimize the impacts of water, reduce erosion and keep sediments from migrating downhill. These include:

- Transitioning from use of waterbars to mini-dips (knicks) and longer, more gentle rolling grade dips.
- Removal of outside berms to allow for outsloped tread.
- Increasing the outslope of trails from 5-7% to 10% or more where the grade is too steep.
- Creating a curvilinear flow that makes use of the outside berm and the backslope to create short grade reversals (where the grade is not too steep).
- Use of trail armoring or rock step overs[1] where the grade is too steep to add dips.
- Use of trail construction techniques to minimize the impact that intensive shared use may cause, especially from equestrian and downhill mountain bike activity.

C. Key Characteristics of Sustainable Trails

Sustainable Design criteria suggest trails should contain frequent grade reversals and follow a curvilinear alignment. In other words, the trail should have "ups and downs" and curve around trees, rocks, etc. This design creates an interesting trail for trail users and provides excellent opportunities to manage water on the trail tread.

These design elements keep steeper sections of trail restricted to short distances and provide ample opportunities for “resting intervals” between each up and down, which are key elements of the proposed accessibility guidelines. Most folks would agree (whether you have a disability or not) that a trail with "ups and downs" is much better than a long, consistent uphill (or downhill) slog.[2]

D. Sustainable Trails Model

Using the above description of a sustainable trail, specific characteristics include:

1. Grade — 10% or less (8% is ideal)
2. Outslope — 5-7%
3. Trail Width — 36-48”
4. Frequent Grade Reversals
5. Use of rolling grade dips

[1] Use of rock embedded in the tread or along the outside edge of the trail serves to harden the surface of the trail in places where the soil erodes easily. This is known as a
“armoring” the trail. Larger rocks 10-12” in diameter may also be buried at an angle across the trail, with enough of the rock buried to anchor it in place. They serve a similar purpose as a waterbar does but because the upper part of the rock is exposed it helps to direct water off the trail, slows users down and lasts much longer.

[2] American Trails, http://www.americantrails.org/resources/trailbuilding/Favro-sustainable-trail-design.html

6. Waterbars converted to knicks[3]
7. Use of climbing turns rather than switchbacks
8. Dips or grade reversals above and below turns
9. Armoring of knicks, gullies and dips
10. Backsloping steep hillsides

What to Avoid

- Trails that are routed down the fall line (I.E. more or less straight downhill)
- Trails that travel through flat land (I.E. 0 grade with no potential to outslope or add dips)
- Hillside grades that are extremely steep (with difficulty to add reversals or dips, add turns or create safe shared use)

E. Transitioning to Sustainable Trails

While these characteristics provide an opportunity to conceptualize what a newly-constructed trail might include and what to avoid, transitioning an existing trail network to sustainable standards, such as at Parma Park, can be difficult at best.

This is especially true where a large portion of the trails do not meet TMOs or SMOs and where there are few options to realign or reroute poorly designed parts of the system.

Guidelines for Transitioning to Sustainability

The following is a step-by-step process for evaluating a trail segment to determine if it meets standards and if it is possible to transition it to more sustainable standards. It has been developed by the author of this report over more than a decade of trail maintenance, trail restoration and new trail construction in the Santa Barbara County area and review of sustainable trail practices employed by organizations such as Los Padres National Forest, IMBA and the American Trails Association.

1. **Grade** (10% or less rule). The goal is a trail system with few sections over 10% and those that are consisting of short steeper sections followed by sections with lower grades and locations to add erosion control features.
    - Is the grade over 10%?
        i. If so, has the grade caused trail deterioration?
        ii. Is the grade continuous or composed of short uphill sections up to 20% along with grades less than 10%?
        iii. Is it possible to add dips, reversals or knicks along the steeper sections?
    - Is the grade in excess of 20%?

[3] A knick might be called a mini-dip, usually less than 4 feet in length with additional outsloping at the upper end to get water flowing off the trail before reaching to lowest part of the dip, with the bottom edge set at a diagonal rather than straight across the trail to keep the water flowing off the trail. Knicks often have rock armoring where water flows onto the hillside to protect it from gullying.

i. If so, has the grade caused trail deterioration? How seriously?

ii. Is it possible to realign the trail to create a more curvilinear flow which may allow water to flow off the trail at periodic intervals?

iii. Is there an option for rerouting the trail in one or more places to reduce the grade?

iv. If not, is armoring the trail at periodic intervals (steps or step overs) either possible or acceptable?

2. **Outslope/Entrenchment**. The goal is 0 inches of entrenchment and outslope ranging from 5-7%.

- Is the route a single-track trail, roadway or roadway converted to single track?

  i. If single track, does the grade exceed 10%? If so, has it caused entrenchment? If yes, will outsloping the trail to as much as 10-12% help eliminate the entrenchment?

  ii. If roadway, is the primary cause of the entrenchment "dozer" insloping to channel water along the upper hillside?

  iii. If roadway, are the dips that channel water from the hillside across to the lower hillside working? If not, can they be improved? Can additional dips be added?

  iv. If an abandoned roadway (such as Mountain Drive 1), is the water being channeled into the upper hillside? If yes, can dips be added along the route to flow water off the trail?

  v. If an abandoned roadway, has this created a wide outside berm that makes it difficult to get water off the trail? If yes, is it possible to create a curvilinear flow that curves the trail onto the berms and then back onto the main part of the trail to create rises and falls?

- If not entrenched, is the outslope between 5-7%? If not, can it be regraded to this?
- Is the entrenchment between 1-5"? If so, can the outside berm be removed to remove the entrenchment and restore the outslope?
- If in excess of 5", is it appropriate to use fill material (such as ¾" cut stone) to remove the entrenchment? Is it possible to remove the berm to restore the outslope?
- Is the entrenchment caused primarily by equestrian use? Note: regular use of single track trails typically creates a channel 12-14" wide and 2-3" deep within the tread. If yes, would removing the outside berm or adding fill material solve the problem?
- If equestrian entrenchment, is it possible to add either knicks or dips to control the water flow if this type of entrenchment occurs in the future?

3. **Control Points**. Control points are trail features that focus on minimizing erosion, controlling user behavior or improving the trail experience. This might include pinch points where the trail corridor narrows (between rock outcroppings or between trees or heavy brush), adding twists or turns in the trail to slow users down, or creating a curving flow to the trail to create gentle rises and falls that can aid in getting water off the trail.

For sustainable trails, control points can play a major role in helping sheet water off the trail and reduce its impact on the environment. The key point is that water should never be allowed to flow down the trail for any distance before being forced off it.

- Waterbars. These are no longer considered appropriate for erosion control and wherever possible should be converted either to knicks or dips.
    i. If the trail has waterbars, can they be converted either to knicks or dips?
    ii. Have any of the dips (or knicks as well) caused tread issues or been so poorly constructed that they need to be removed?
- Knicks & Rolling Grade Dips. Both are appropriate for controlling the flow of water down the trail and sheeting it off. Knicks are much shorter and more appropriately used on steeper grades where it would be impossible to add longer dips.
    i. Are there natural spots, such as slight changes in grade, where addition of a knick or dip would be particularly effective?
    ii. If the grade is above 10%, are there spots above or below short steep sections to add a dip or knick?
    iii. If from 15-20%, is it possible to add a knick or step over to flow water off the trail? Is it possible to realign the trail slightly to take advantage of a curvilinear flow or the outside berm to get water off the trail?
    iv. If the grade exceeds 20%, are any of the above possible? If not, can the trail be rerouted to lessen the grade?
- Grade Reversals. Grade reversals are generally longer stretches of the trail where it has a rise and a fall, making it impossible for water to continue down the trail. Often longer sections of steeper trail may have benches or changes in grade where it may be possible to convert these into longer rolling dips or grade reversals.
    i. If the grade is in excess of 15%, and especially those over 20% are there any spots along the section that may be converted into dips or reversals?

4. **Switchbacks/Climbing Turns**. The current focus is on constructing climbing turns rather than switchbacks. These provide a gentle transition from one leg of the turn to the next and meet TMOs for shared use of the trail. To provide for sustainability, climbing turns should have erosion control points above and below them — either knicks, dips or reversals.
    - If the segment includes switchbacks or climbing turns, is the grade in excess of 10% above and below the turns?
    - If more than 10% (and especially grades over 20%), is it possible to extent the corners of the turn out further to extend the length and lower the grade?
    - If higher than 20%, can the trail be realigned to extend the corner out even further?
    - Are there dips, knicks or grade reversals above and below each turn to flow water off the trail? If not, is it possible to add them?
    - Where there are a series of turns that exceed 15-20% one after the other, is it possible to design a complete reroute of the section to lower the grade and improve the turns?

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PART 3. Geologic and Soil Impacts

As noted in the *Parma Open Space Resource Management Guide*[4], the Park is characterized by a number of marine and non-marine sedimentary rocks that have been uplifted and tilted, forming a series of resistant sand stone ridges and intervening gullies. See Geology and Soil maps of Parma Park on Pages 15-16 below.

These include:

- Quaternary Landslides materials. The landslides in the park are within siltstone members of the Sespe Formation. Additionally, numerous landslides are present to the south of the park in a large landslide complex on the north flank of Mission Ridge (Stanwood entrance). These landslides occur in soft siltstone, which is unstable on steeper slopes.
- Quaternary Fanglomerate. Fanglomerate deposits overlie bedrock in the western portion of Parma Park. These deposits consist of gravel, cobbles, and large boulders in a matrix of silty sand and clay that may have formed as part of an ancient alluvial fan that is 100,000 to 200,000 years old.
- Vaqueros Sandstone Formation. The Vaqueros Formation is generally a medium grained buff marine massive sandstone. It has occasional pebbles and fossil fragments. Fine-grained sandstone members within the Vaqueros commonly grade into massive to poorly bedded greenish-gray siltstone. It covers the lower 15% of the property and forms much of the steep cliffs along Stanwood Drive.
- Sespe Formation. The Sespe Formation covers an estimated three quarters of the property, and is relatively unstable. It is formed of non-marine interbedded fluvial sandstones, shales, and conglomerates, and is commonly reddish in color. It consists of material deposited on a floodplain by rivers, and includes extensive mottled silts and clays, as well as large sheet and channelized sand bodies.
- Rincon Shale. The Rincon Shale in this area consists of highly weathered weak massive claystone that is highly fractured and deformed in some areas. It is located beneath the Vaqueros Sandstone along the southern boundary of the park, and covers less than 10% of the property.

Parma Park Soils

There are three primary soil complexes at Parma Park (Todos-Lodo complex, Lodo-Sespe complex, and Gaviota-Rock Outcrop complex) derived from weathered sandstone and shales described above. Soil depths range from a thin mantle on bedrock outcrops of several inches, to 30 inches thick in flat areas.

- The Lodo-Sespe complex dominates most of the park, occurring in the central and northern portions. A primary characteristic of this soil type is its low permeability causing rapid runoff during winter storms and the potential for erosion, mudslides and trail damage along steep hillside slopes such as those in the Stanwood Trail System.

[4] City of Santa Barbara Parks & Recreation, February 2003, Pages 7-11.

- The Todos-Lodo complex occurs on the western portion of the park, and predominates in the Plateau Trail System. While the soil weathers to gentle slopes such as those on the upper Plateau area, the soils are generally shallow, with bedrock close to the surface, creating a potential for rapid runoff and hillside erosion on the slopes below.
- Gaviota-Rock Outcrop complex occurs along the lower flanks of the hills along Stanwood Drive. The Complex is formed from materials weathered from the underlying sandstone (Vaqueros, Sespe) along a series of steep hillsides immediately above and north of Stanwood Drive.

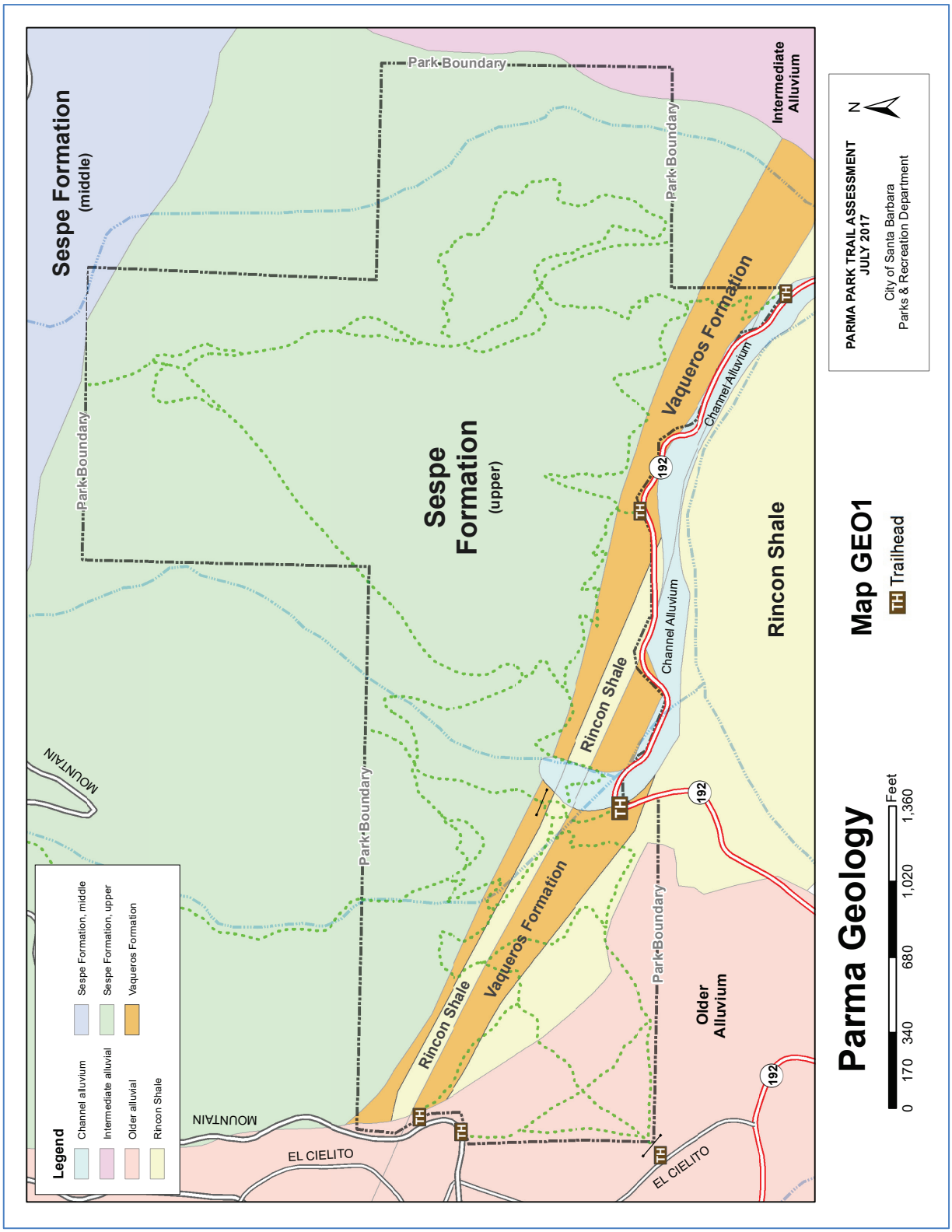
Conclusions

As noted in the Open Space Report, the primary concerns relating to these soil types are low permeability which can lead to excessively high runoff and the potential for serious erosion.

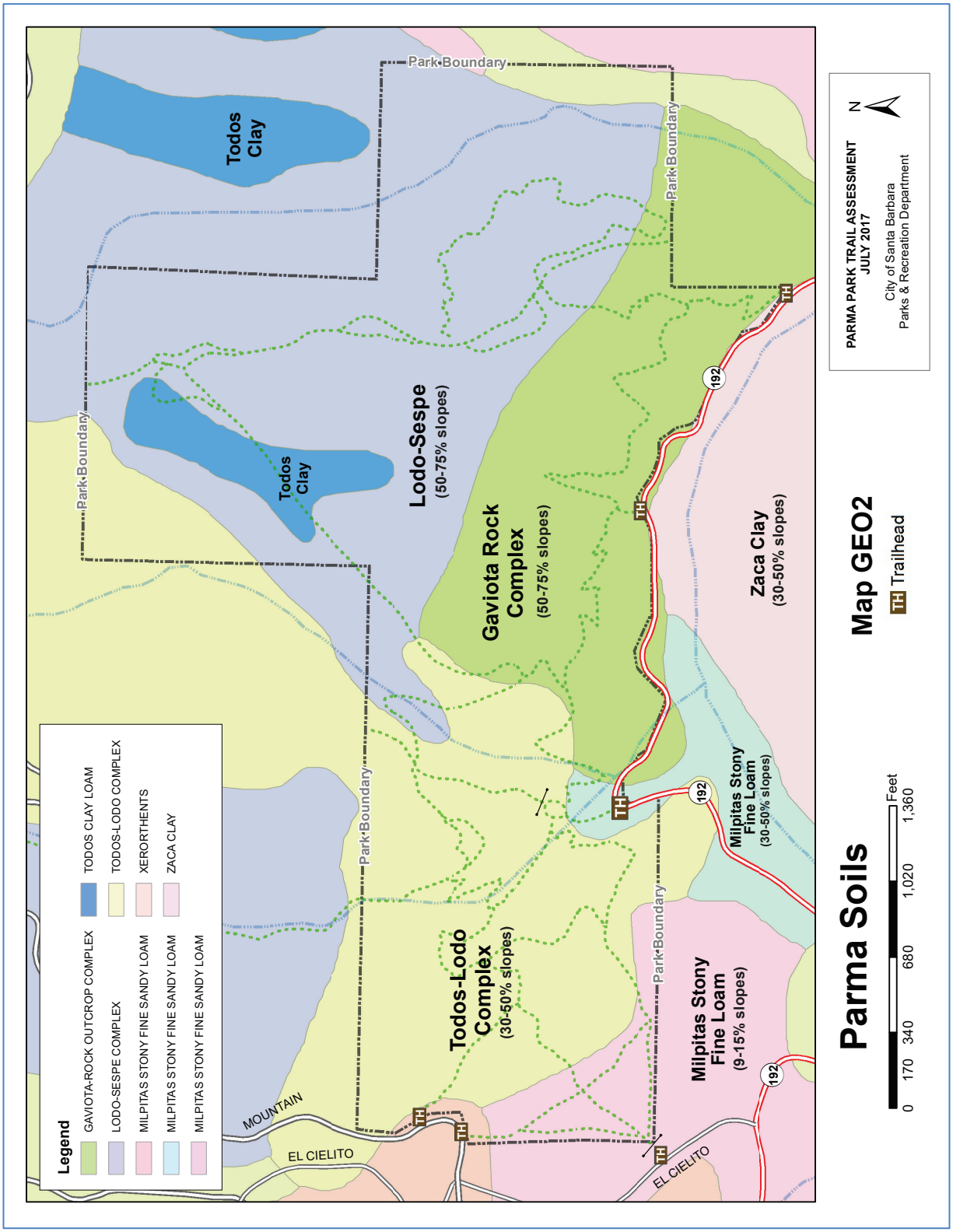
Parma Park is characterized by a complex geology that has resulted in an open space defined by its high ridges, deep gullies and steep hillsides. The soils are relatively impermeable, leading to higher than average runoff and the potential for serious erosion, especially during the intense winter rain storms that occur relatively often.

The Parma Park trails network has been seriously impacted by these conditions: trail grades are often steeper than ideal in locations where steep hillsides, dropoffs or other obstacles limit alternatives; easily eroded hillsides contribute to trail slump, larger slides may occur, blocking trail use or causing more serious trail damage; and trail maintenance costs can easily explode if our current drought conditions leads to higher-than-average wet years; or another wildfire similar to the Tea Fire should occur.

Now more than ever a sensible plan for restoration of the Parma trails should be envisioned that is built on the acknowledgement of the challenge that Parma Park's geologic conditions have posed and a focus on developing sustainable plans are designed to overcome them.



Map Geo 1. Underlying Parma Park Geology



Map Geo 2. Parma Park Soil Overlay

PART 4. Parma Trail Surveys and Initial Assessments

Parma Trails were reviewed to determine how well each of the larger trail systems met both the TMOs and SMOs as well as each of the segments within those systems. Following is a detail assessment of overall park conditions and individual trail conditions.

Methodology

The initial process of developing the data needed to provide an analysis of the Parma Trails network involved a three-stage effort:

- Breaking the each of the trail systems down into smaller segments that could be analyzed for various attributes such as trail grade, width, outslope, entrenchment and others that would provide us with the data needed to assess them.
- Conducting additional field surveys to collect the data for each of the segments.
- Analysis of the data using ArcGis software.

A. Identifying the segments

Ray Ford and Mark Wilkinson, Santa Barbara County Trails Council, performed surveys over a period of several weeks in early July 2017. A hand-held SX Blue II GPS data collector (http://www.sxbluegps.com) capable of sub meter quality and ArcGis Collector iPhone app linked wirelessly to the Blue II were used to collect trail data. Trail segments were walked and broken down into smaller segments for further analysis.

Generally, the beginning and ending points for each of these segments focused on changes in grade, entrenchment or other trail issues to be analyzed separately. Over the course of several site visits, the entire Parma trail system was divided into 231 separate segments as follows:

- Ridge System – 55 Segments
- Plateau System – 31 Segments
- Creek System – 61 Segments
- Stanwood System – 65 Segments
- Mountain Drive Trail Easement – 18 Segments

The data was imported into ArcMap and each of the segment lines were symbolized with a different color to make it easy to see where each began and ended.

To make it easier to identify the end points in the field, under low light conditions, a marker (small red dot) was added at each end point to highlight the break points. Once this was completed, the data was exported back to the iPhone app for use in the field.

B. Conducting Field Surveys

Follow-up site visits focused on collecting specific data for each of the 231 segments. Using SX Blue II and iPhone app, previous routes were followed and measurements were taken at each of the end points with the help of a 25’ tape measure and 4’ digital level.

Data Collected for each of the smaller segments included:

- Trail Type
  - Trail
  - Dirt roadway
  - Paved Road
  - Social Trail
- Tread Width (inches)
- Trail Grade (%)
- Outslope (%)
- Entrenchment (inches)
- Sideslope (%)
- Trail Condition
  - Poor
  - Fair
  - Good
  - Excellent

C. Assessing the Data

After conducting the field surveys, the data was imported into ArcMap and used to symbolize the trail conditions by various characteristics such as grade, entrenchment, outslope, trail width and overall trail conditions. The goal was to identify areas where the trails met TMO standards, areas where they did not. Concurrently, trails that met or did not meet SMO standards were identified along with specific locations that might require more serious restoration efforts. The initial review showed that:

- Approximately 50% of the trails are in reasonably good condition or close enough that minimal-to-moderate efforts will be required to transition them to sustainability.
- Close to one-third of the trail segments surveyed far exceed TMO and SMO standards.
- Many of the segments out of standard are concentrated in specific areas, with the Stanwood System having the most serious issues and being the most difficult to solve.
- Parts of the Creek and Plateau Systems also have serious issues relating to grade and entrenchment but have the potential of being resolved if re-routed along more sustainable lines.

1. Trail Grade

In order to develop a process for understanding what the data collected during the field surveys might indicate, we initially focused on "Trail Grade" given the area's wildly varying topography.

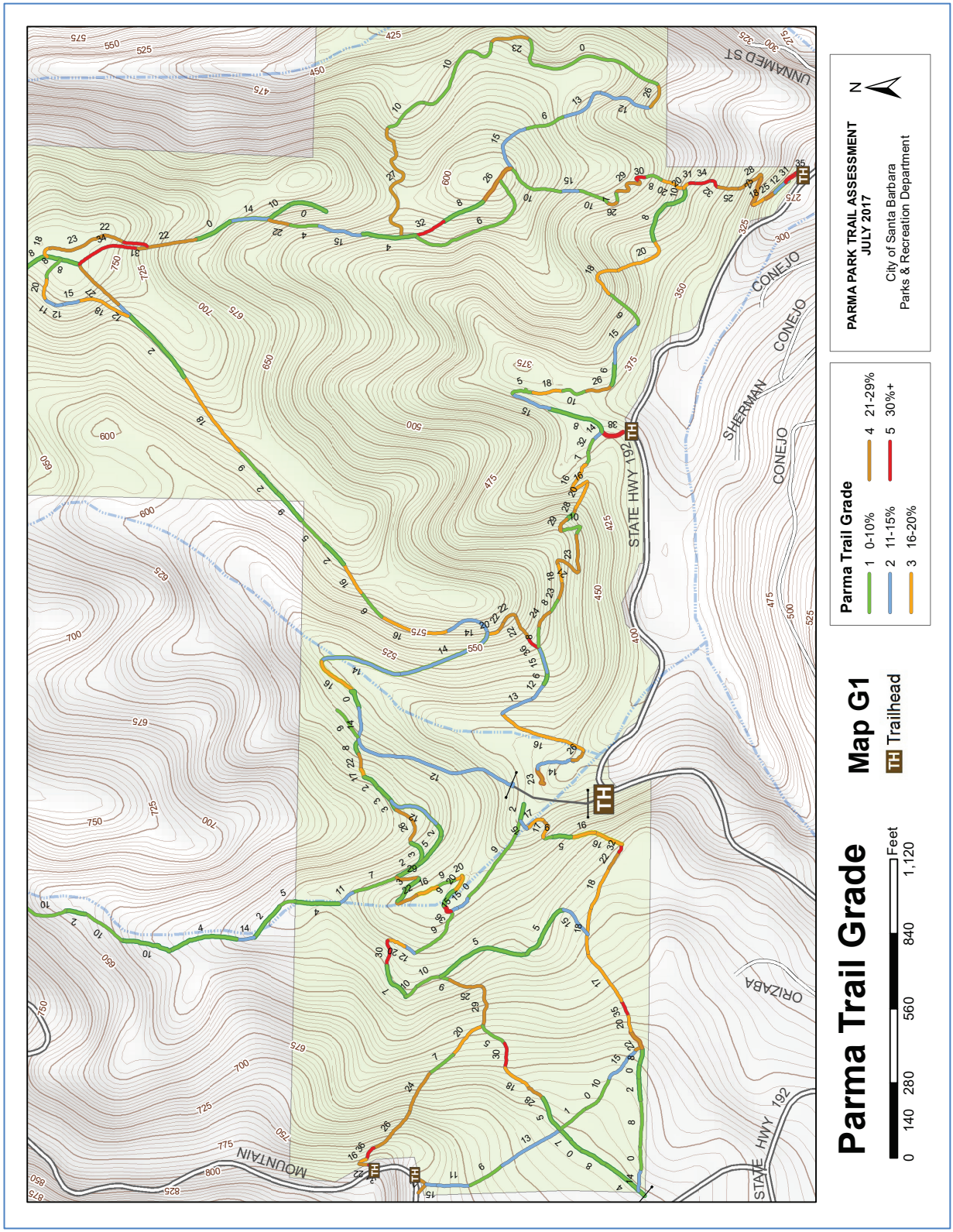
Table 2. Parma Trail Grade Data

Grade ID	Trail Grade % Range	No. of Segments	% of Total Segments	Notes
1	0-10	94	40.7	These Parma trails meet TMOs for trail grade.
2	11-15	37	16	These trails are slightly steeper than TMO grades and need moderate erosion control measures to meet TMOs and SMOs.
3	16-20	37	16	These trails are moderately steeper than TMO standards for grade and need more serious erosion control measures to meet TMOs and SMOs and/or adjustments to the trail alignment.
4	21-29	44	19	These trails are in extremely steep in relation to TMO grades and need serious restoration including trail realignments or rerouting to solve erosion control issues.
5	30+	19	8	There trails far exceed TMO grades and will likely require reroutes to meet TMOs and SMOs.

Of the 231 segments surveyed, just over 40% of these Park met TMOs for grade, with an additional 16% being slightly above grade, ranging from 11-15%. This indicated that over 50% of the Parma Trails were within TMO standards and potentially amenable to meeting SMO standards as well. However, approximately 43% of the Parma trails far exceeded TMOs for grade, with more than a quarter of the trail segments so steep as to be difficult to transition to sustainable standards.

See Map G1 on Page 20 for a more detailed view of areas with steeper grades. The grade is noted alongside each of the segments.

- Stanwood System – many of the Stanwood trails are well beyond grade, especially S1, S2 and S4-5 that climb steeply up from Stanwood Drive. Due to the steep topography, these will be the most challenging to deal with.
- The Ridge Trails constructed to bypass the eastern part of the roadway (R3) are partly out of grade and may be difficult to make more sustainable.
- Parts of the Creek System that lead up to the hang gliding area are well out of grade but it is possible to resolve these issues by adding several switchbacks.
- The Plateau System has several sections (P1, P4) that are extremely steep and in need of serious erosion control efforts or reroutes to follow alignments that bring the grade down to less than 10%.
- All of the trail access points leading off Mountain Drive need realignment due to steep initial grades.



Map G1. Parma Trail Grade

Figure 1. Impacts of steep trail grade.

Top. A short steep section along Stanwood Trail Segment C4. With frequent equestrian use the excessive grade has caused the trail to become entrenched, causing tread damage and making it difficult for the waterbar near the bottom of the grade to function.

There are a number of issues shown in this photograph. The slope above the tread is extremely steep and needs to be cut back to create a wider corridor and keep vegetation above the trail from hanging over it. The waterbar at the bottom is poorly constructed and is at the bottom of a steep grade, making it almost impossible for the water to flow off the trail.

Figure 2. Combination of steep trail grade and entrenchment

Looking down the same trail shown on the previous page shows the impact of grade, entrenchment and poor use of erosion control features such as the waterbar pictured here. The trail grade is 22%. Though the outsloping is adequate the entrenchment (10" wide and 2-3" deep) prevents water from sheeting off the trail.

2. Entrenchment

Entrenchment (or gullying) is a key indication that water is not being sheeted off the trail properly. Further, even on trails that would otherwise have proper outsloping, gullying within the outslope not only prevents it from moving water off the trail, but if not dealt with, will cause enough entrenchments to make it difficult to restore the outsloping.

In short, entrenchment is one of the main threats to maintaining a sustainable trails system and needs to be addressed as soon as possible.

More than 50% of the Parma trails showed some level of entrenchment, with 52.4% characterized by gullying at least two inches 2" deep; almost 30% of the trails showing more

serious erosion, with entrenchment of 5” or more; and an additional 13.4% with gullying ranging from 10” to 24” deep.

The most important conclusion to be drawn from this data is that is that the large majority of the trails at Parma Park have some level of entrenchment that prevents them from draining water off the trails properly. This creates a number of issues:

- Water cannot sheet off the trail
- Instead it flows down the trail, adding to the entrenchment during periods of high intensity rainfall.
- Along some portions of the more level trails, where you would not expect much entrenchment, equestrian use has created channels ranging from 2-3” deep and 16-18” wide. These channels tend to be longer, but because they aren’t too deep, they may be easy to repair.

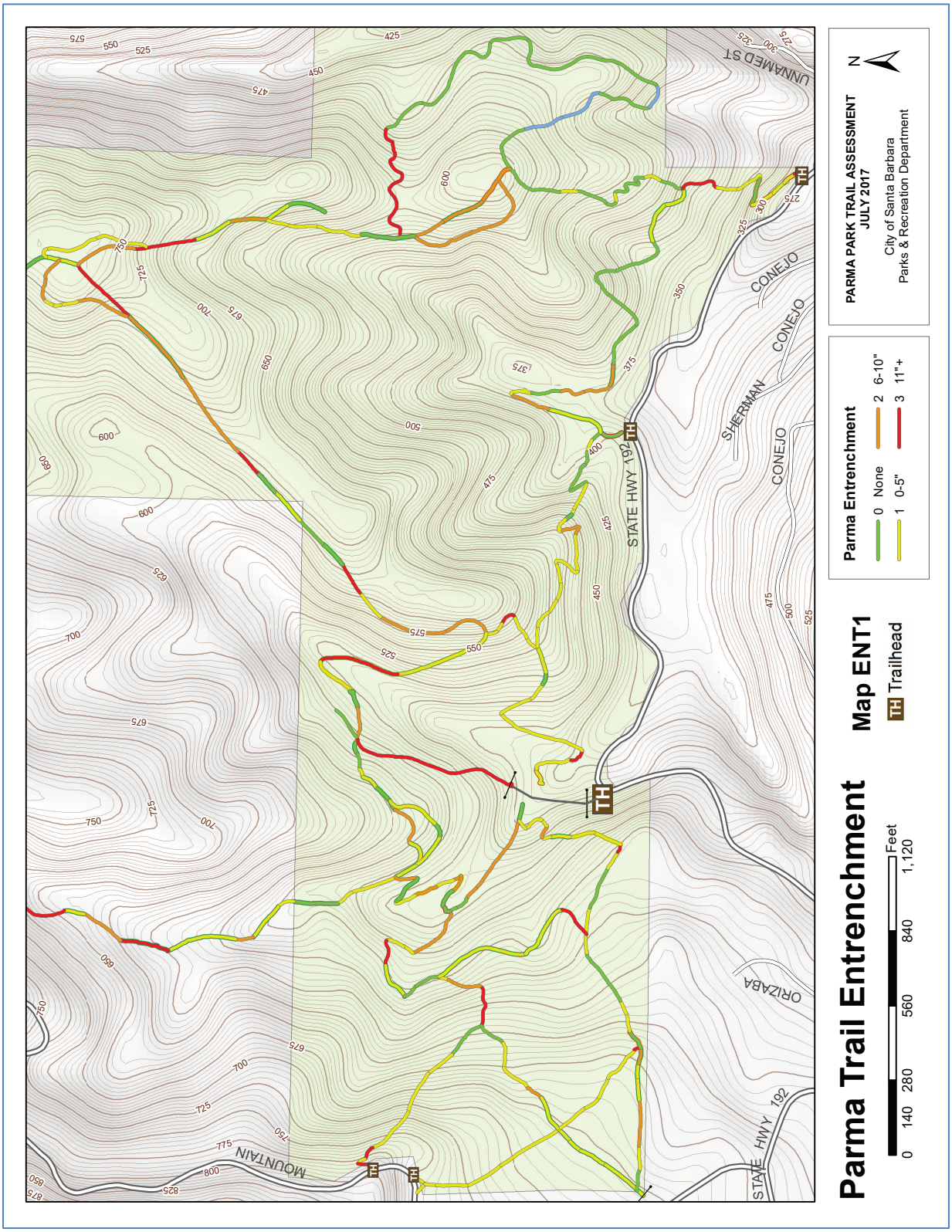
Table 3. Amount of Entrenchment

Range of Entrenchment	No. of Segments Entrenched	% Total Segments Entrenched	Notes
2” or more	121	52.4%	A large percentage of the Parma trails do not meet the TMOs or SMOs due lack of outsloping and gullying. Many of these are less than 5” and can be restored fairly easily.
5” or more	68	29.4%	Moderate entrenchment that will require adding dips so the water does not channel down the gullies for any length or removing enough of the outside berm to restore outsloping.
8” or more	38	16.5%	More serious entrenchment may require slight adjustments of the trail to create a curvilinear flow that gets water off the trail every 20 yards or so.
10” or more	31	13.4%	Serious entrenchment often characteristic of abandoned roadways or jeepways that have poor drainage. May require some trail realignment on top of the berm in places where it is too wide to completely remove.

The most serious entrenchment occurs along many of the roadway segments, where insloping of the road and lack of maintenance has created some of the deeper gullies (see Map ENT1). Note areas in green that show entrenchment between 0-5%. Even the smallest amount can turn into a serious issue if not corrected.

Figure 3. Entrenched section of Stanwood Trail System

Section along Stanwood S5 heads straight downhill (along the fall line) at a grade in excess of 20%. Trail is deeply entrenched, further channeling water straight down it. Berms on both sides make it difficult to realign the trail.



Map ENT 1. Parma Trail Entrenchment

3. Outslope

Outsloping single track trails is one of the most common prescriptions for sheeting water off the trail. An outsloped trail is higher on the inside and lower on the outside tread. Typically, an outslope of between 5-7% is recommended for trails with grades less than 10% and slightly more for steeper trails. As noted below, more than half the Parma trails are entrenched enough that there is no outsloping at all.

Table 4. Percentage of Outslope

Grade ID	Outslope % Range	No. of Segments	% of Total Segments	Notes
0	Gullied (no outslope)	118	51%	More than half the Parma trails have some level of entrenchment so that there is no outsloping. Water is flowing down trail and not sheeting off it.
1	1-4%	44	19%	These trails have a small amount of outsloping but not quite enough to do a good job of sheeting water off the trail.
2	5-8%	39	17%	These trails have the appropriate amount of outsloping and meet TMO and SMO standards.
3	9-12%	19	8%	A small amount of the trails has slightly more outsloping and are within TMO and SMO levels of being acceptable.
4	13+	11	5%	A very small amount of the trails has enough hillside slumping or other issues that have created an outslope that needs to be corrected.

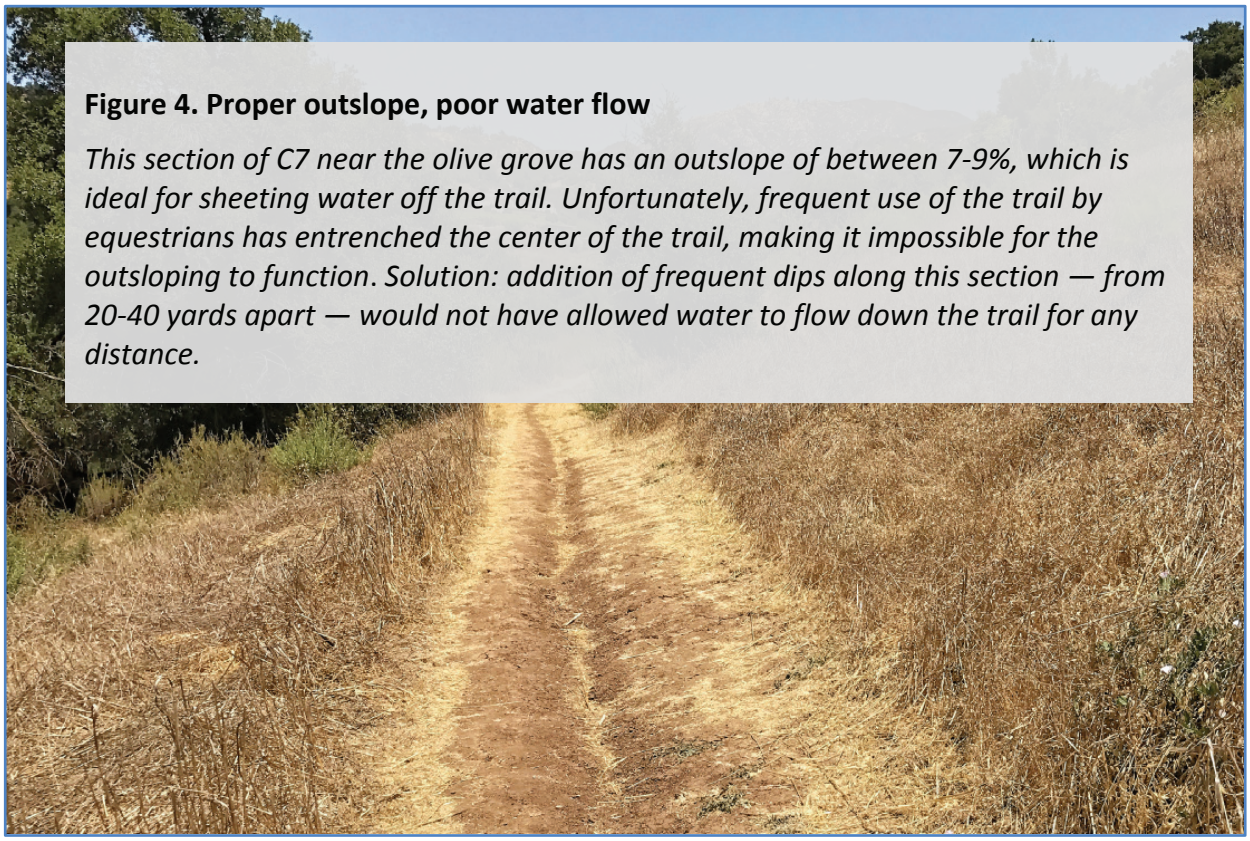
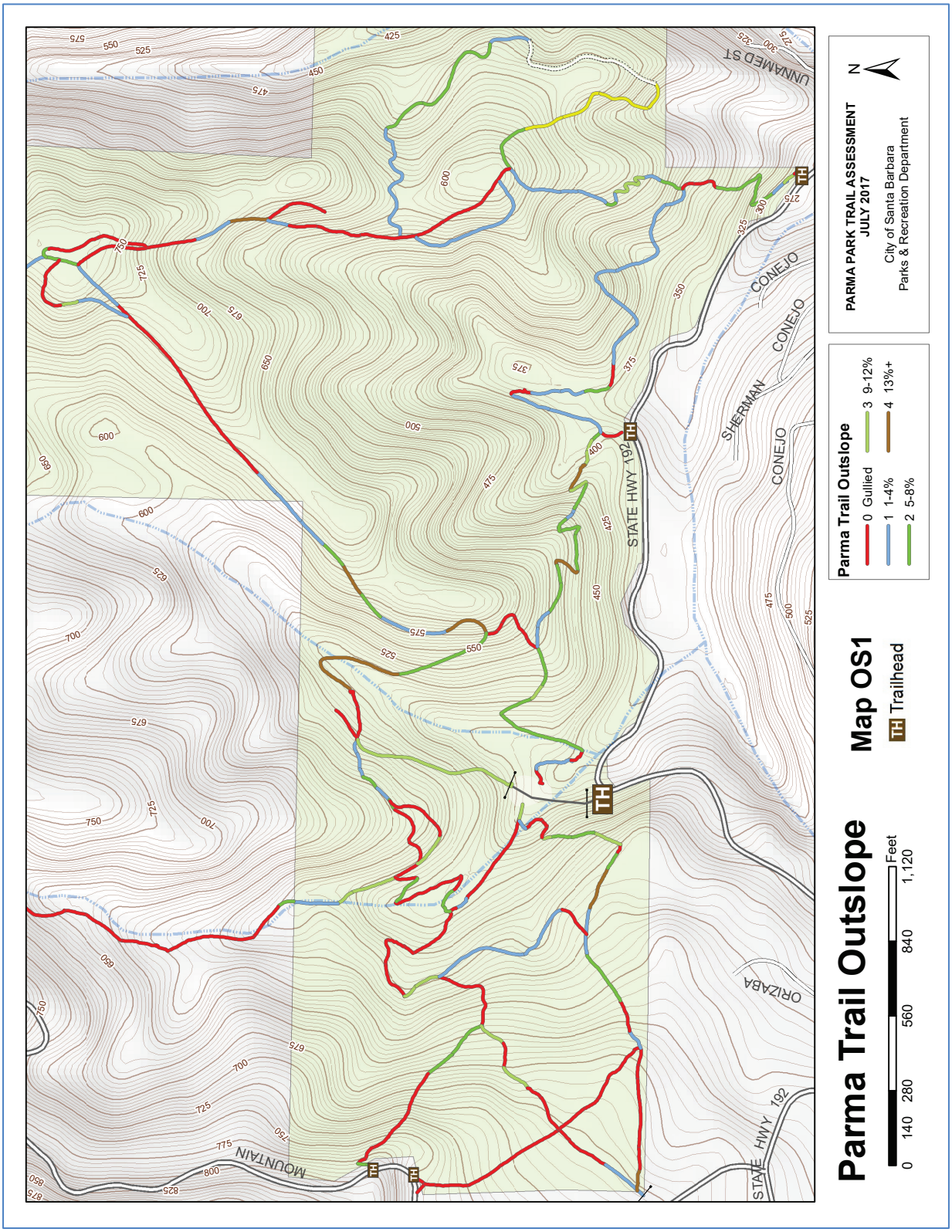


Figure 4. Proper outslope, poor water flow

This section of C7 near the olive grove has an outslope of between 7-9%, which is ideal for sheeting water off the trail. Unfortunately, frequent use of the trail by equestrians has entrenched the center of the trail, making it impossible for the outsloping to function. Solution: addition of frequent dips along this section — from 20-40 yards apart — would not have allowed water to flow down the trail for any distance.



Map OS1. Parma Trail Outslope

COUNTERACTING POOR OUTSLOPE

While an important characteristic of a sustainable trail, outsloping a trail to allow water to sheet off it and maintaining that outslope over time is difficult at best. Trails tend to get "worn in", with small amounts of entrenchment occurring as foot traffic removes small amounts of soil with passing time. This is especially true of trails that are regularly used by equestrians. The heavy weight and sharp edges of the horse (or mule) hooves tend to create 12-15" wide depressions in the trail, often deep enough to create gullied channels within the wider tread. Equestrian use during and after rain events results in even greater depressions and trail damage.

Note the trail segments symbolized in red on Map OS1, on the page above. These indicate areas where the entrenchment is enough that the outslope is ineffective in getting water off the trail. Quite a few of these are located within the Creek and Plateau systems, which are more frequently used by equestrians.

To counteract this effect, the development of well-designed knicks, dips — and where possible grade reversals — is critical to getting water off the trail at regular intervals, even when entrenchment occurs between those intervals.

4. Erosion Control Efforts

During the field surveys conducted in July 2017, 162 erosion control features were identified that had been constructed at some time in the past. A number of these appeared to have been added recently. These consisted of 128 waterbars, 29 knicks and 5 rolling grade dips. Rolling grade dips were developed as part of a volunteer trail training event.

They were concentrated heavily along the Stanwood Trail System, sections of the Ridge Trail System, a part of the Creek System leading up to the hang glide area, and segments P1 and P4 of the Plateau System as shown in Map WB1.

Table 5. Parma Park Erosion Control Features

Condition Range	No. of Segments	% of Total Segments	Notes
Poor	127	78%	More than ¾ of the erosion control features were judged as not being effective in getting water off the trail.
Fair	29	18%	Less than 1/5 of the features were slightly effective in getting water of the trail. These were located mostly along the Stanwood trails.
Good	5	3%	All of those rated as good were rolling grade type dips.
Excellent	1	>1%	The one feature rated as excellent was a rolling grade dip.

By their nature, waterbars do not function well for getting water off trails where the grade exceeds 15%. They fill with sediment easily and are so narrow that water tends to flow over them rather than being channeled down them and off the trail. Therefore, despite their concentration in areas where the trail grades far exceeded TMO standards, we have rated them as being in poor condition.

Of the 29 knicks that were surveyed, 24 of them were judged as being in a poor condition. Most of these were not situated so that they would work and not constructed in a way that they would be effective in getting water off the trail. See Map WB1 on the following page for details regarding feature locations and conditions.

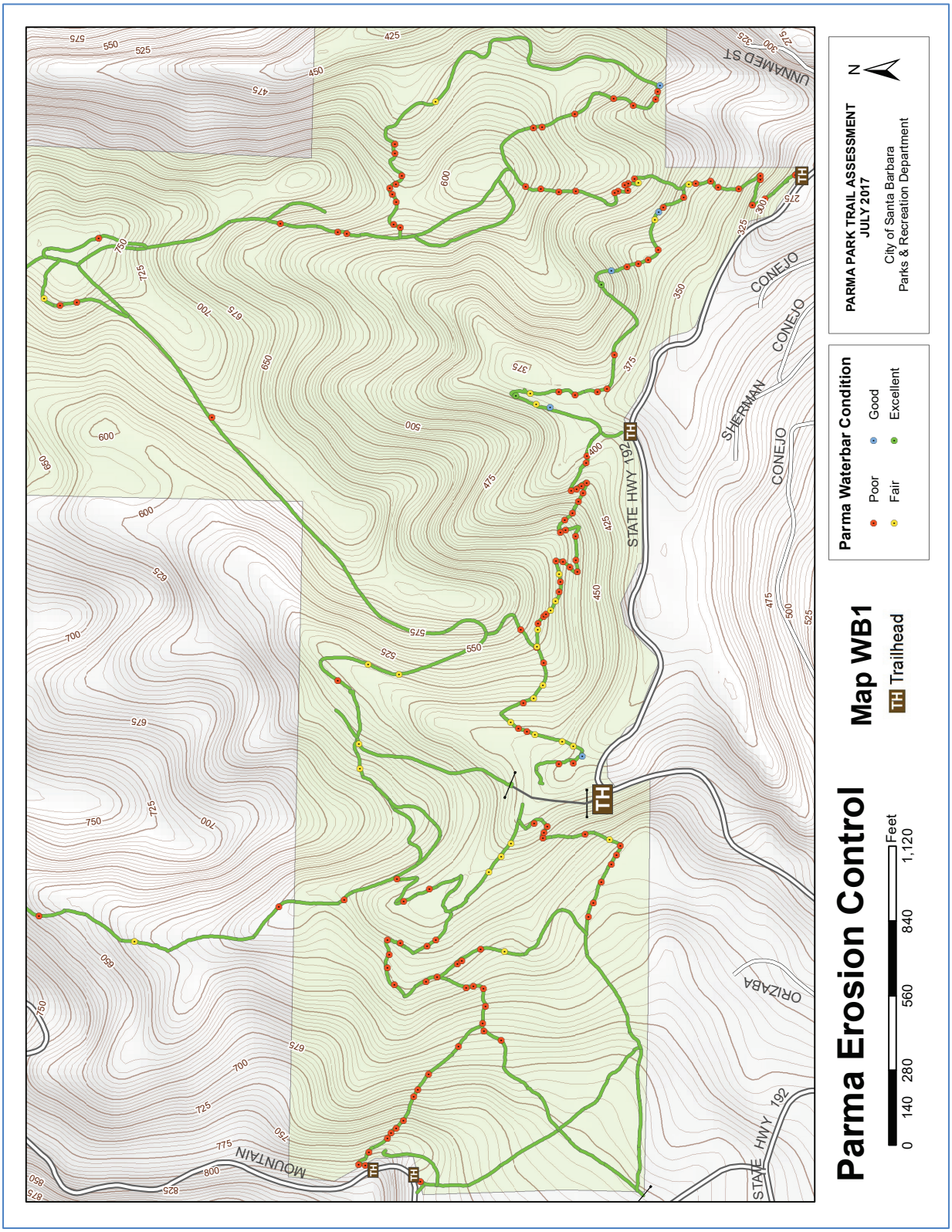
The key issue with most of the waterbars surveyed during the assessment was poor location and poor design. There are two key components to a well-designed water control feature:

- Locating them at points where the trail changes direction. Moving water wants to keep moving in a straight line. When the trail turns the water wants to keep going straight off the trail rather than curing around and following the trail. Use that to your advantage.
- Water needs to begin moving off the trail before it reaches the water control feature. That means outsloping the trail 10-12% at least 6-10 feet above the feature so it is sheeting off well before it reaches it.

Unfortunately, most of the water control features constructed on the Parma trails were entrenched above them and made it almost impossible for water to sheet off the trail.

Key Points:

- The erosion control features at Parma are generally located in areas (Stanwood, Plateau, Ridge) where they are needed but poor design has hampered their ability to function.
- Most of the features are waterbars, which are ineffective, require yearly maintenance and should be replaced with knicks or dips were appropriate.
- Almost no erosion control features were added in locations where equestrian traffic has created depressions within the main tread. Knicks or dips should be added in these locations as well, even though the grade may not be that steep.
- A follow up survey will be done in the second phase of this project to identify the most appropriate locations for erosion control features throughout the Park and the appropriate type for each location. The information gathered during the survey will be incorporated in the final trail design and will include recommendations of locations where erosion control features should be added and where existing features should be improved or converted to rolling grade dips or knicks.



Map WB1. Parma Erosion Control

Figure 5. Improper placement of waterbars

Note placement of waterbar at very bottom of a steep part of P1 where the trail makes the final climb (32%) to Mountain Drive. There is no outslope above it to get water moving off the trail before it reaches the waterbar, it is extremely shallow and there is no berm on the lower side to force water off the trail.

5. Trail Width

Tread width is often one of the most controversial aspects of establishing TMOs for a trail system. Some want the trails to be as minimal as possible to help maintain a more natural feeling; others appreciate wider trails that allow users to socialize as they walk or ride.

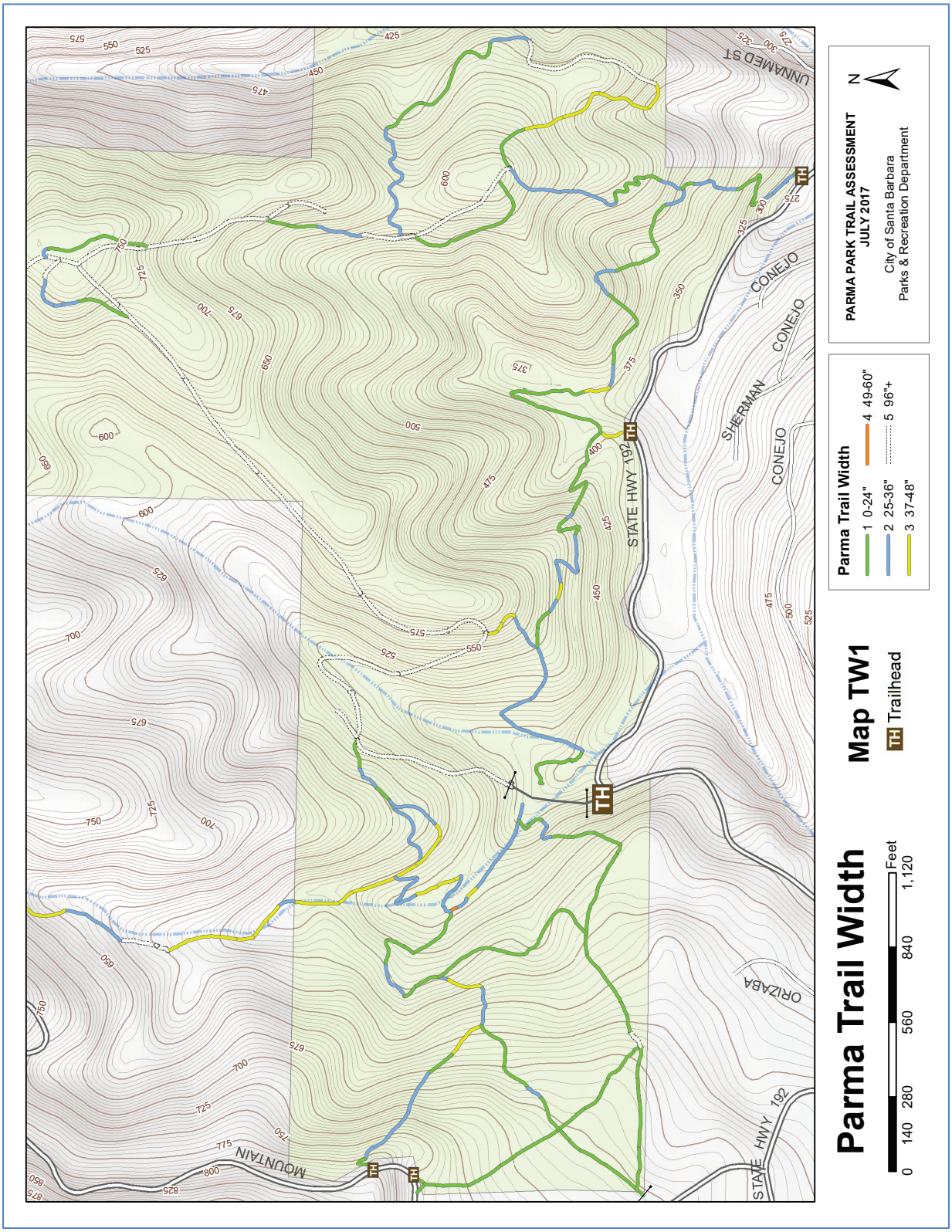
The trail design parameter established by the USFS for Trail Class 3 Hiker and Equestrian trails varies in range, depending on conditions such as grade, sideslope, safety issues and the like but in general, for the purposes of this assessment, we have identified a trail width of 36" as the prevailing standard for Parma Park.

Of the 4.58 miles of single track trail within the Park (including 0.43 miles along the Mountain Drive Trail easement and excluding the dirt roads), more than 50% have a tread width 24" or less, with quite a bit of that closer to 16-18" wide. Just over 30% are between 25-36" wide, meaning that close to 80% of these trails do not meet the Park TMO for width.

In areas where both grade and side slopes are gentle, especially where users can step off the trail as others pass, a narrower tread may be acceptable. However, narrow trails tend to become entrenched easier, and in the winter and spring months they tend to become overgrown by the grassy hillsides. Narrow trails also may promote parallel social trails when the main trail becomes entrenched.

Table 6. Trail Width (Excludes Paved Entry Road and Fire Roads)

Trail Width Range	No. of Segments	% of Total Segments	Notes
0-24"	99	51%	Almost half of the Parma trails are less than 24" in width and many of these less than 18"-20".
25-36"	64	32%	Another ¼ of the trails are close to the Class 3 TMO width of 36", but in areas with steep sideslopes, and should probably be widened.
37-48"	30	16%	Only 16% of the trails either meet TMOs or may be wider than needed.
49-60"	2	1%	Just 1% of the trails exceed standards for width.



Map TW1. Parma Trail Width

Figure 6. Hillside slumping narrows trail

This section of the S4 segment along the Stanwood System is less than 15" wide. Partly this is due to hillside slumping as material from above migrated down onto the trail. The trail is also steep and crowded by brush. Had the trail been cut a bit wider and the backslope cut back properly (note how steep it is) there would have been less slumping and the brush would not be crowding the trail. This section does not allow users to pass one another, especially equestrians.

6. Trail Condition

Whether a trail segment can be rated as “Poor, Fair or Good” is dependent on a number of factors. These include grade, the amount of entrenchment, if any, whether it is outsloped or not, and if there is a potential for erosion and how has it been protected against it.

Safety issues are also a factor. A trail that is safe for hikers may not be for equestrians. Steep grade and sharp dropoffs that haven’t been dealt with, narrow trails in locations where there is a lot of use, or switchbacks that are too steep may all contribute to rating a trail as being in poor condition.

Of the 231 trail segments that were measured during the survey, 78 of these (33.8% of the total) were rated as being in poor condition with an additional 36.4% rated as being in fair condition.

Figure 7. Trail rated in poor condition

There are a number of reasons why this section of trail would be rated as being in poor condition (width, entrenchment, brush, backsloping). But the majority of the Parma Park trails (close to 2/3 of them) like this can be transitioned to meet both TMO and SMO standards. However, the remaining 1/3 will require much more extensive efforts — and in a number of cases, re-alignment or re-routing — to do so.

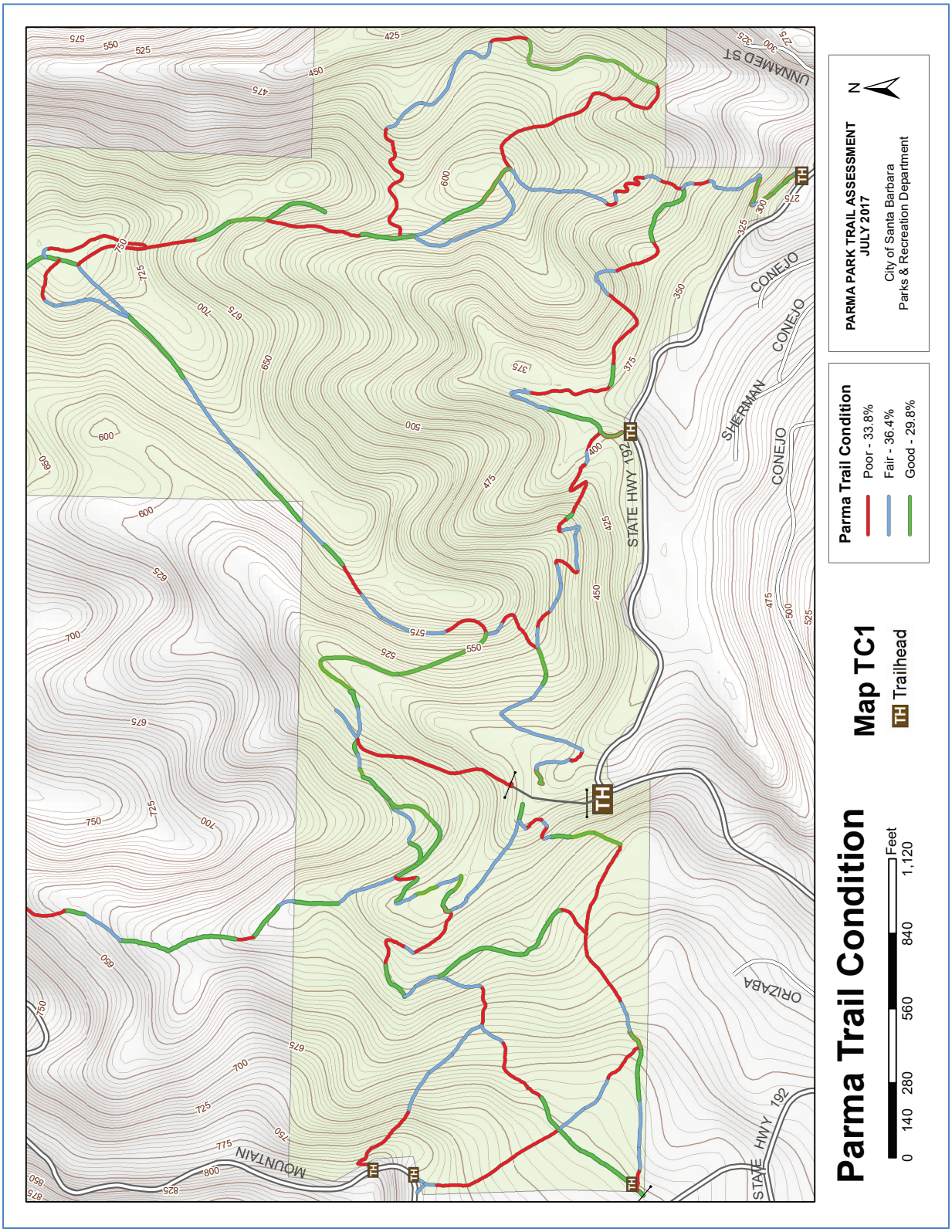
Table 7. Trail Condition Ratings			
Trail Condition	**No. of Segments**	**% of Total Segments**	**Notes**
Poor	78	33.8%	Many of these trails have excessive grade, switchbacks that create erosion and safety issues and poorly designed waterbars. These will create the major challenges for transitioning to sustainability.
Fair	84	36.4%	Quite a few of these trails have poorly designed waterbars and minor entrenchment. These trails will require work to make sustainable but can be fixed fairly easily.
Good	69	29.8%	Just under 30% of the trails are in reasonably good condition but contain low functioning waterbars, nicks or entrenchment. They require converting to knicks or dips and removing small amounts of entrenchment to restore the outslope.

See Map TR1 on the following page for a more detailed view of the specific areas of concern, which are symbolized in red. These include the eastern part of the Ridge System. A large part of the Stanwood System, part of the Creek System in the vicinity of the hang gliding area and parts of the Plateau System.

The main factors causing a segment to be rated as “Poor” include:

- Excessive grade in association with entrenchment or trail damage.
- Steep side slopes in conjunction the above and trails that are too narrow, creating a user safety concern.
- Poorly designed or maintained erosion control features.
- Poorly designed switchbacks.
- Brushing issues.
- Hillside slumping that has narrowed the segment.

It should be noted that even trail segments rated as “Fair” or “Good” still require some level of restoration to meet all or most of the Park’s TMOs; however, the better the rating the more easily they can be upgraded and the lower the rating the more challenging to do so, especially when it comes to meeting the Parks sustainability guidelines.



Map TC1. Parma Trail Condition Ratings

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PART 5. Review of Existing Individual Trail Systems and Future Design Considerations

The Parma Park trail system consists of 5.4 miles of hiking and equestrian trails that includes both single track and fire access roads and limited mountain biking on the fire access road. The network is comprised of four main trail systems and one private easement along West Parma Creek.

Based on the field surveys and review of the individual trail segments that make up each of the systems, the following provides an analysis of each of them — both from the perspective of the systems as a whole and from their individual components.

As the initial field surveys were done it became clear that the trail segment designations for some of the Trail Systems depicted in the March 2002 Trail Inventory Map for Parma Park either were out of date or were not labeled in a way that was easy to follow. For example, the Creek System, as shown on the 2002 Map does not align with the current trail placements in some cases and the numbering system is somewhat confusing.

For the purpose of clarity and to reflect the current trail alignments, this assessment has revised the segment designations in the Creek and Stanwood systems. The Plateau, Ridge and Private easement (Mountain Drive 1) designations remain the same.

See the chart below for a list of current and revised trail segment designations:

Table 8. Creek System Segment Designations

New ID	Previous ID	Notes
C1	C4	C4 not shown accurately on the map.
C2	C1c, C1d	Not shown accurately, confusing to have 2 designations
C3	C5, c1f	Better assessed as one longer segment
C4	C6	Olive Grove segment; C4 fits better in the sequence
C5	C1c	Better fit sequentially
C6	C1b	Better fit sequentially
C7	C2	Better fit sequentially
C8	C3	Better fit sequentially
C9	C1a	Better fit sequentially; might consider removing this from the Creek System and including it in the Plateau System

Table 9. Stanwood System Segment Designations

New ID	Previous ID	Notes
S1	S1	No change but segment ends at S2 intersection
S2	S2	No change
S3	S1	Better assessed by breaking this part of S1 into two segments
S4	S1	Better assessed by breaking this part of S1 into two segments
S5	S3	Better assessed by breaking this part of S3 into two segments
S6	S3	Better assessed by breaking this part of S3 into two segments

A. Ridge Trail System

The Ridge System consists of a combination of dirt roads (1.1 miles total) and single-track trails (1.0 miles) that provide some of the most strenuous climbing and spacious views in the park. The backbone of the Ridge System is a long fire access road that leads from the lower picnic area near the main entry point into Parma Park for 0.75 miles to McMullin Point, at slightly over 800 feet, the highest spot in the Park.

The ridge walk is one of the most popular in the Park and the fire access road along the ridge is the only route open for mountain bikers. There is a hitching post at the top of the point, picnic table and boulder with a plaque dedicating the spot to long-time park supporter Rowe McMullin.

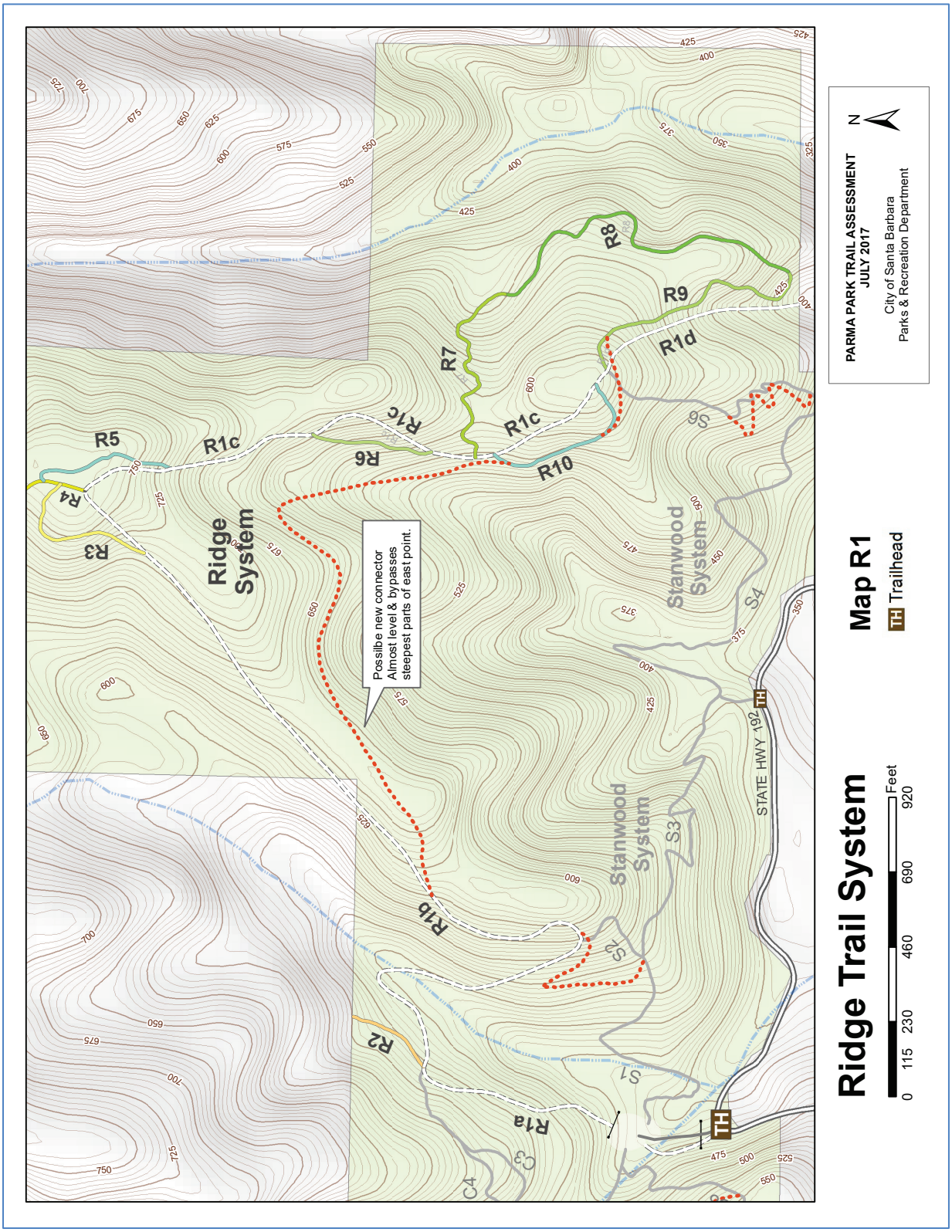
While many hikers and equestrians return back down the same route, the fire access road (R1c) turns to the right and descends steeply downhill and connects with the eastern part of the Stanwood Trail System. The fire access road (not shown on map due to overgrown condition) continues straight downhill past the turnoff to the Stanwood trails.

Due to the steepness of the grade and loose, rocky conditions of this part of the fire access road, a number of years ago four short single track routes (R3, R5, R6 and R10) were added to the trail system to provide an alternative route to the worst parts of R1c. In addition to these short segments, three additional segments (R7, R8 and R9) on the east side of the ridge loop down into the midslope area of the Coyote Creek drainage then curves back and re-connects with the fire access road at the point where the eastern end of Stanwood Trail System takes off. Eventually these connect to the Stanwood Trail System.

Existing Concerns and Recommendations for Improvement

The Ridge System is unique in that it consists of one long fire access road leading to a t-intersection on the east end of Parma Park at its highest point and a clustering of trail segments along the intersecting fire access road that drops steeply down towards Stanwood Drive.

- Main Fire Access Road — While easy to walk, and requiring little maintenance, or at least maintenance that would be done with a road grader or bull dozer and not the typical tools used for trail maintenance. Some of the largest amounts of entrenchment within the Park system occur along R1a and R1b and are contributing to erosion along many parts of the road. This maintenance may be beyond the scope of what might be expected for a trail crew to handle, but is needed to reduce the impact of the gullying that is occurring now.
- The eastern portion of the fire access road (R1c) that turns and drops sharply downhill to its intersection with the Stanwood System is entrenched, composed of loose soils and rock and is so steep that it is potentially dangerous for all trail users. Restoration of this part of the fire access road system is also well beyond the scope of a trail maintenance crew's ability to handle.



Map R1. Ridge Trail System

- As a potential loop route, it would be much better if an additional segment could be added to the Ridge System that would connect R1b to R1c in a way that that trail users could bypass the steepest parts of the current route. See Map R1 for a possible solution.
- Several of the short bypass trails (R5 and R10 specifically) along R1c are too steep and need much improved erosion control features added.
- The short loop that drops down into the Coyote Creek drainage leads to a beautiful section of trail but the route down to it (R7) averages a grade in excess of 27%. If possible this section should be realigned to include switchbacks that extend the length and lower the grade. The erosion control features along this section are poorly constructed and need improvement.
- Though picturesque, the trail along R8, especially where it approaches the Edison tower, has an extremely steep upper sideslope (80-90%) and drop off that is almost vertical below the trail. It is likely too narrow for Equestrian use in its current condition. This part of the trail needs to be widened to a minimum of 4 feet and more if possible to make it safe for equestrian use.
- The last part of this loop (R9) climbs back uphill along a broad ridge where it intersects with the fire access road and beginning of the Stanwood trails. The grade is excessive (18%+) and is entrenched. The trail should be realigned slightly to add more of a curvilinear flow and allow water to sheet off on both sides of the ridge.

R1a — 733'/0.14 miles/Overall Grade 8.5%

Potential to meet standards: Excellent

R1a leads from the gravel turn around northeast along the East Fork of Parma Creek to its intersection with C3. The grade is moderate and though the fire access road is plenty wide, it is steeply insloped into the hill in several places, creating gullied sections. Main concern: poorly maintained dips.

Recommendations

- Improve dips meant to divert water off the road to keep the inside edge of the road from becoming even more gullied.

R1b — 3,218'/0.6 miles/Overall Grade 7.7%

Potential to meet standards: Excellent

R1b is a long section of fire access road that crosses the creek, climbs steeply up onto the Park's central ridge and then follows the ridge up and down over a series of knolls to the east end of the Park. Main concern: poorly maintained dips that have created a long stretch of entrenched road that is several hundred yards long.

Recommendations

- Improve dips meant to divert water off the road and possibly add several more.

R1c — 1,802'/0.34 miles/Overall Grade 10.5%

Potential to meet standards: Poor

R1c appears to have a reasonable grade over its 600-yard length but rather than descending gradually downhill to its intersection with the Stanwood trails, it is composed of three very steep drops, short sections of very steep hills (with grades of 22%, 32% and 26% respectively) short level sections and slight uphills. Each of the uphills is steep, rocky and entrenched enough to require 4x4 travel to get up them.

Main Concerns:

- The loose soil, rocks that are easy to displace and steep grades creates a safety hazard for all user groups — whether traveling uphill or downhill.

  R1c leads straight down a narrow ridgeline with dropoff on either side. Improvements to the road would require improvements beyond the scope of this project and be extremely expensive.

Recommendations

- Improve the short bypass trail so that trail users do not have to go up or down the steepest hills.
- Consider adding a new trail (ID as R11) that diagonals across the main ridge from R1b to R1c that bypasses the steep parts of both. See Part 5: Proposed Trail Realignments

R1d — 641'/Overall Grade 27.8%

Potential to meet standards: Dead ends at private residence. No access through.

R1d is a steep overgrown part of the fire access road that once connected to Stanwood Road, but was/is not a part of Parma Park. However, a private residence was constructed below that has cut off access to Stanwood. Currently what remains of the roadway is deeply entrenched and overgrown.

Concern: R1d is not signed to tell users that it dead ends and is not passable. Accidentally going down the road will make for a difficult climb back up when you realize you can't go through.

Recommendation: Better signage.

R2 — 278'/0.05 miles

Potential to meet standards: Not Applicable

R2 is a short section of trail that begins near the intersection of the R1a fire access road and C3. It dead ends at a locked gate marking the park boundary.

Recommendation: A sign should be placed at the beginning of R2 noting that it is a dead-end trail-

R3 — 513'/0.1 miles/Overall Grade 12.3%

Potential to meet standards: Excellent

R3 is a bypass trail that allows users to avoid going up the last steep part of the R1b fire access road to reach McMullin Point. Though the segment is slightly above grade, the trail is well constructed and can easily meet both TMO and SMO standards.

Recommendation:

- Convert waterbars to knicks
- Remove small outside berm to reestablish outslope
- Brush lightly

R4 — 453'/0.09 miles/Overall Grade 5%

Potential to meet standards: Excellent

R4 is a short extension of the N-S roadway (R1c) that drops down to the Stanwood trails. It leads north towards Mountain Drive for several hundred feet to a point where it comes to fenced private property.

Recommendation: None. Road is in excellent shape.

R5 — 434'/0.08 miles/Overall Grade 21.9%

Potential to meet standards: Fair, the lower part of the segment is steep

R5 begins along the short R4 portion of the N-S fire access road. It offers trail users an opportunity to bypass the extremely steep top part of R1c. While the tread is in reasonably good condition, it is slightly entrenched and the one waterbar along the segment needs improvement. Though the trail begins at a sustainable grade the lower third of R5 is extremely steep.

Recommendations:

- Convert waterbar to a knick and add additional knicks along the trail.
- Consider armoring the lower section with rock step overs to get water off the trail in places too steep for knicks.
- Remove outer berm and restore outslope.
- Cut backslope back and remove brush along top of backslope.

R6 — 377'/0.07 miles/Overall Grade 11.9%

Potential to meet standards: Fair, lower part of the segment is steep

R6 is somewhat similar to R5. It serves as a bypass for anther steep section of R1c. It also begins at a sustainable grade but quickly begins to get steeper and steeper, especially at the lower end of the segment.

Recommendations:

- Add 3-4 knicks to get water off the trail.

- Consider armoring the lower section with rock step overs to get water off the trail in places too steep for knicks.
- Remove outer berm and restore outslope.
- Cut backslope back and remove brush along top of backslope.

R7 — 722'/0.14 miles/Overall Grade 12.3% (upper half 25%+)

Potential to meet standards: Poor if not realigned

R7, R8 and R9 combine to provide an extended ½-mile long trail around another steep part of R1c. The route drops steeply down to the midslope point in the Coyote Creek drainage then levels off and continues south to its intersection with an abandoned trail that once led down to the bottom of Coyote Creek.

The first 200 yards of the trail goes almost straight downhill (grade ranging from 20-27%) with a slight curvilinear flow that does little to make the segment sustainable. Mainly that is because the trail is deeply entrenched and there is no place water can get off the trail. The trail is also very overgrown with lush chaparral and riparian vegetation that creates a beautiful ambience but needs serious brushing for regular use. All of the waterbars along this section are in very poor condition and are basically non-functional.

Concern: This segment cannot be made sustainable without extending each of the curves to create more in the way of switchbacks that help lengthen it and reduce the grade substantially. Unfortunately, this will require quite a bit of vegetation to be removed given its thickness.

Recommendations:

- Extend each of the curves as far as possible on either side to create real switchbacks instead of slight steep curves.
- Remove overgrown vegetation and restore corridor width to Parma TMO standards (see Table 1, page 7).
- Remove outside berm and restore outslope.
- Add knicks or dips where possible.

R8 — 1,154'/0.22 miles/Overall Grade 7.8%

Potential to meet standards: Good

R8 follows the midslope of the Coyote drainage south, first along a very lush and shaded section of trail and then a longer section of Edison jeepway to the point where the trail comes to a locked gate. The grade is well within standards though there have been a few washouts on the Edison jeepway that have been covered with plastic that need to be avoided.

Concerns:

- The trail overgrown and needs heavy brushing.
- Both the hillside above and below the trail is extremely steep, with a 30-40 foot dropoff below one section that is almost close to being vertical.

Recommendations:

- Brush heavily.
- Remove outside berm in places
- Add several knicks
- Widen the trail as close to 5’ where the dropoff is large (not easy given the steep hillsides).

R9 — 822’/0.16 miles/Overall Grade 22.3%

Potential to meet standards: Good if realigned

The lower end of R9 begins just to the west (right) of the locked gate then meanders up a long and relatively broad ridge for almost 300 yards to the point where it intersects with the fire access road (R1c) and the beginning of the Stanwood trails. The trail is narrow with thigh-high brush on either side that creates and even narrower feeling. It is also slightly entrenched, mainly the result of a grade in excess of 20%.

Concern: It is not clear how easy it will be to make the trail sustainable without realigning it so that it includes a more curvilinear flow and switchbacks in places.

Recommendations:

- Realign the trail.
- Create a curvilinear flow that extends the curves as far as possible on either side of the tread and where possible far enough to characterize them as switchbacks rather than curves.
- Convert the waterbars (all in poor condition) to dips or knicks.

R10 — 548’/0.1 miles/Overall Grade 2.7%

Potential to meet standards: Excellent

R10 is the last of the trail segments that bypass the fire access road. The trail is overgrown but otherwise in great condition with only minor maintenance required.

Recommendations:

- Brush the trail. Remove as much of the star thistle as possible.
- Remove slight amount of entrenchment in places and restore the outslope.
- Add two dips to ensure water will not go down the trail if it becomes entrenched due to equestrian use.
- Create a curvilinear flow that extends the curves as far as possible on either side of the tread and creates slight rises and falls to sheet water off the trail.

B. Creek Trail System

The Creek Trails System begins at the west side of the open area located near the picnic area and continues west along the West Fork of Parma Creek. Much of the Creek system is shaded with riparian cover and oak woodland, making these trails pleasant in all parts of the year.

Within a few yards, one of the Creek trails (C8) crosses West Parma Creek and climbs directly up to the hang gliding meadow and eventually connects to the Plateau trails and several community trailheads.

Continuing several hundred yards upstream along C1, the trail branches at a point where the canyon is too narrow and steep for it to continue along the creek. The left fork crosses the creek and then climbs out of the canyon and circles back around to the hang gliding area via C5, C6 and C7 to create a short, picturesque loop opportunity. This fork also intersects with P1 of the Plateau system and eventually provides access to Mountain Drive.

The right fork climbs steadily up a short set of switchbacks (C2) where it intersects with several other trails, including a long section of Parma Creek, the historic olive grove and a link to the main Ridge fire access road.

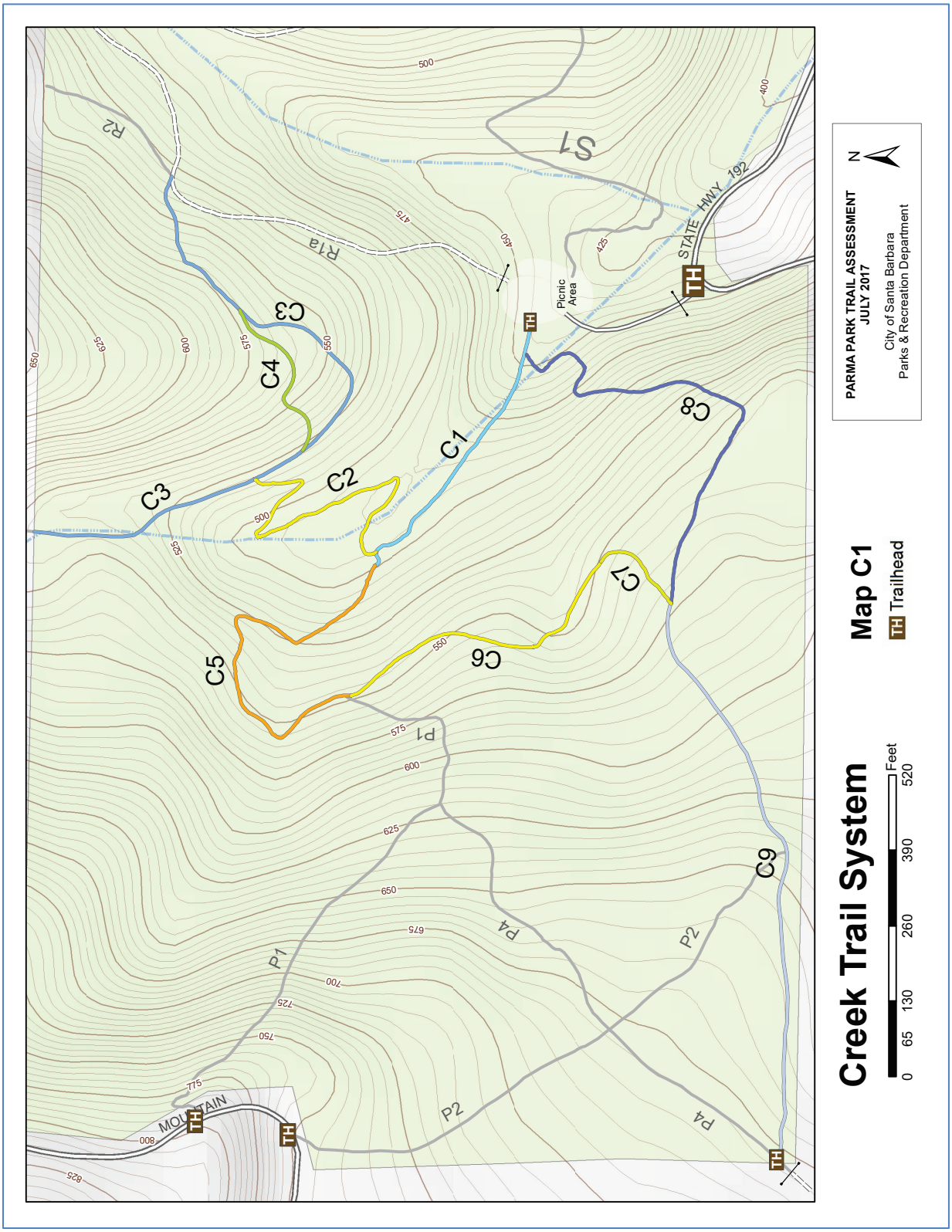
Overall Concerns - Existing System and Design Recommendations

- The main creek section of C1 is moderately entrenched but can be easily restored by creating a more curvilinear flow. A bench is nicely situated along this section but needs to be “reset” as the cement foundation is unstable.
- There are three creek crossings along C1, one at its intersection with C8 and two at the upper end of C1 where C2 and C5 begin. The C8 crossing is problematic due to the steep drop and uneven location of the boulders in the creekbed. The upper crossings along C1 are less of a concern but the soft sand and rocky bottoms can be a challenge to cross.
- The lower part of C8 is extremely entrenched and the tread is very rocky and uneven. The upper part of C8 is narrow (12-14”), slightly entrenched (1-3”) and far too steep (15-20%).
- The short section of trail (C4) that meanders through the olive grove is too close to the trees and the lower end is far too steep.

<u>C1 — 525’/0.1 miles/Overall Grade 1%</u>

Potential to meet standards: Excellent

C1 is a short beautiful section of trail that leads west along the edge of Parma Creek to a point where the canyon narrows and the segment ends. The section is entrenched from 6-8” in places and could benefit from a more curvilinear flow. At the upper end of C1, there are two short creek crossings. It might be possible to eliminate the first of these by staying on the right side rather than crossing and then almost immediately re-crossing. If possible from an environmental standpoint, armoring the creekbed with nearby rock to stabilize the crossing would be helpful.



Map C1. Creek Trail System

Recommendations

- Create a more curvilinear flow to deal with the entrenchment, add 3-4 dips that channel water to the creek, reset the bench, analyze the crossings to see if any of them can be bypassed and if possible to armor the creek crossing with rock. It is noted that work within the creek will require biologist review and possible permitting.

C2 — 661'/0.13 miles/Overall Grade 10.4%

Potential to meet standards: Good

C2 climbs very sharply out of Parma Creek and then switches back and forth to connect with the several other trails on the upper hillsides where the historic olive grove is located. This section contains a number of level sections and steep climbs. There are several sections that have grade reversals that are helpful in getting water off the trail. There is some entrenchment caused by frequent use of the trail by equestrians of from 2-5" that could be mitigated by addition of more knicks or dips.

- See if it is possible to lower the grade at the spot where C2 leaves the creek.
- Widen to 36" where needed and remove outside berms to restore the outslope.
- Cut the backslope along the trail to remove overhanging brush and create a more open feeling.
- Add 3-4 more erosion control features.
- Realign the last part of the trail where it intersects with C3 to lower the grade.

C3 — 1,188'/0.23 miles/Overall Grade 4.3%

Potential to meet standards: Excellent

C3 is a long almost flat section of trail that connects the private Mountain Drive Trail easement to the Ridge fire access road. It is in reasonably good condition with some entrenchment created by equestrian use.

Recommendations

- Remove outside berm, add additional dips to improve water control.
- Widen to 36" as needed.

C4 — 312'/0.06 miles/Overall Grade 8%; Steepest Section 12.9%

Potential to meet standards: Poor, should be removed or realigned as a shorter interpretive loop.

C4 is a short section of trail that meanders through the olive grove. Once past the grove the trail drops steeply downhill to intersect with C3. This trail it is redundant and is not needed but has value to many who enjoy walking through the grove. Unfortunately, it goes through the grove at a point where it is too close to the trees.

Recommendations

- Consider completely removing the trail and restoring it to a more natural state.
- As an alternative for those who like walking through the grove, remove the existing section close to the trees and the steep downhill section and realign the trail so it becomes a short interpretive loop off of C3 that curves through the grove with a minimum of 10' tree clearance and a grade of less than 8% and then returns back to C3.

C5 — 714'/0.14 miles/Overall Grade 7.6%

Potential to meet standards: Good, with work needed to mitigate steep grade and entrenchment where trail leaves the creek.

C5 begins at the end of C1 where continues along the West Fork of Parma Creek for a short distance and then climbs up out of the canyon to intersect with C6. The lower part of the trail is very narrow and entrenched. Where it climbs out of the canyon the grade is reaches 20-30% in places and is also entrenched. Above this the trail levels out and is in reasonably good condition.

Recommendations

- Widen lower part of the trail along the creek, remove entrenchment and clean out a small gully crossing
- Where the grade reaches its steepest as it climbs out of the canyon, re-align the trail in a more curvilinear fashion to widen the turns and make it easier to get water off the trail.
- Improve existing erosion control features and add 3-4 dips or knicks.
- Widen to 36" as needed.

C6 — 552'/0.1 miles/Overall Grade 1%

Potential to meet standards: Excellent

C6 is a beautiful almost level section of trail that connects the canyon section of the system to the hang gliding area. The trail has slight ups and downs that serve to minimize erosion and is in good condition.

Recommendations

- Improve existing erosion control features.
- Clean out several small gullies along the trail and armor the lower ends with nearby rock to prevent gullying.
- Widen to 36" as needed.

C7 — 173'/0.03 miles/Overall Grade 16.2%

Potential to meet standards: Challenging, trail should be removed.

C7 is a short steep section of trail that connects C6 to C8 just below the hang gliding area. This trail should be removed as a part of developing a more sustainable alignment that includes several switchbacks.

C8 — 869'/0.16 miles/Overall Grade 14.1%

Potential to meet standards: Challenging.

C8 branches off C1 within a few yards of the gravel turn around, crosses Parma Creek and then climbs up onto the lower part of the grassy slopes that connect to the hang gliding area. The trail has serious issues that need to be addressed to make it sustainable.

- The creek crossing is difficult for all users. The trail drops steeply down over a number of uneven boulders to the creek. The crossing itself is washed out enough that it is difficult to get good footing for horses and hikers.
- There are several switchbacks coming out of the crossing that are rocky, has uneven tread and loose rock that is uncomfortable to walk on and is both steep and severely entrenched.
- Above this the trail levels to a really nice grade but at the end of this section the trail has a steep, gullied and seriously eroded switchback that climbs at a grade in excess of 35%
- Once past the switchback the trail is narrow (12-14" wide), slightly entrenched and steep.

Recommendations

- Remove boulders leading into the crossing to improve footing
- Stabilize the creekbed if environmentally appropriate.
- Remove outside berm and extend switchbacks as far as possible to lessen the grade.
- Realign the upper part of the trail along a more sustainable grade.

C9 — 1,029'/0.19 miles/Overall Grade 10.7%

Potential to meet standards: Poor, lower part of the trail should be realigned to a more sustainable flow; upper part, excellent.

The Lower half of C9 is a long more or less straight section of trail that diagonals across the hang gliding area at a relatively steep grade. The trail is slightly entrenched (1-3"), exceeds grade (16-20%) and should be realigned to flow that is sustainable. See section below relating to proposed realignments.

The upper half of C9 above the hang gliding area is actually located on the upper Plateau flats. This section needs light maintenance to meet standards.

Recommendations

- Realign lower part of the trail.
- Consider including the upper half of C9 in the Plateau Trails System.

C. Stanwood Trail System

The Stanwood Trails System begins along the east side of the open area located near the picnic area and parallels Stanwood Drive for just over a half mile to the east end of the Park where it intersects with a secondary part of the system (S5 and S6) that leads from lower Stanwood Drive up to the Ridge Trail System.

The Stanwood trails are characterized by steep climbs and drops, many of them averaging grades in excess of 15-20%, steep hillsides and long dropoffs. Though just over 1.1 miles in length, the six segments that make up the system have the most varied topography in the Park and perhaps will be the most challenging to develop into a sustainable system.

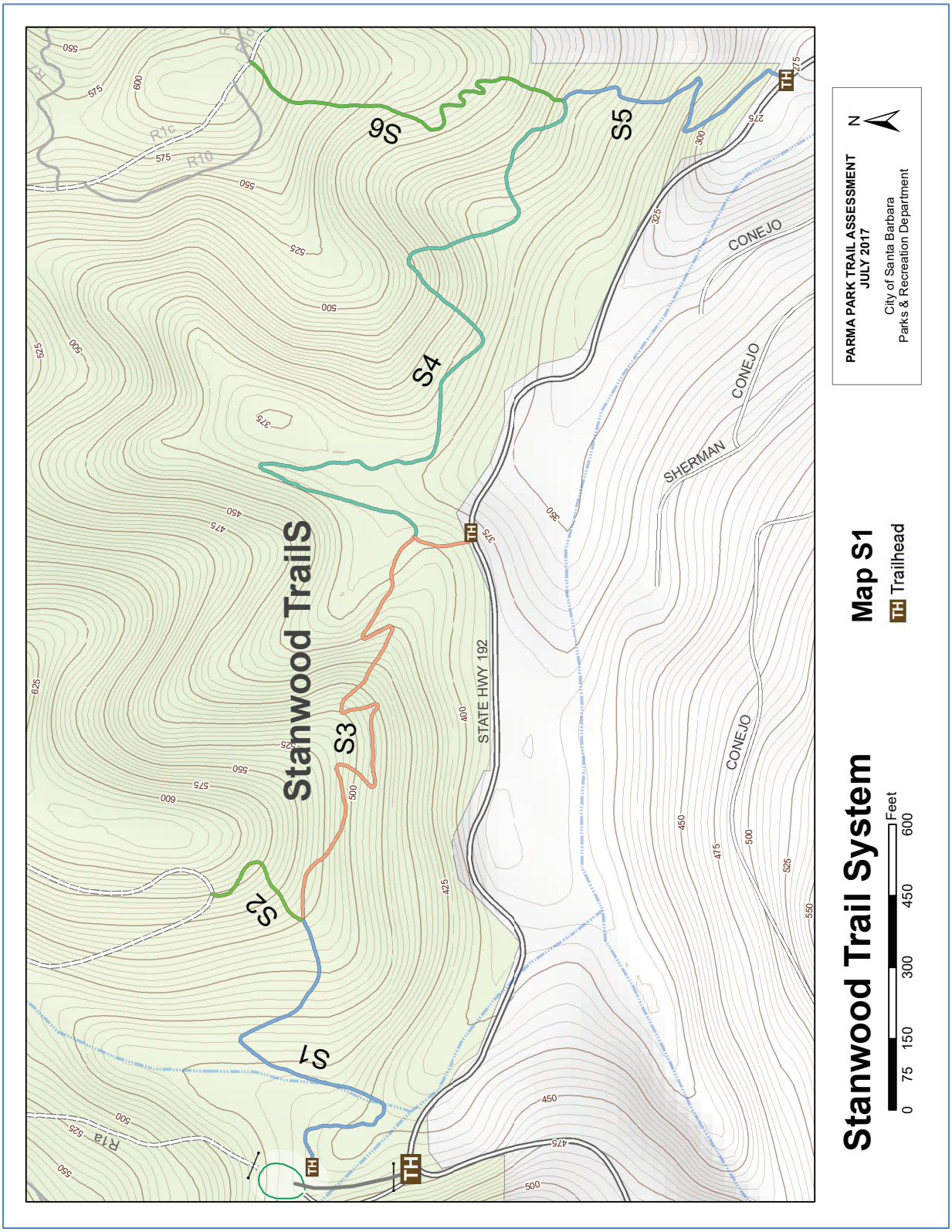
Overall Concerns with the Existing System and Design Recommendations

- Grade. Many of the trails within the Stanwood System far exceed standards for grade.
- Steep hillsides. The hillside slopes average 70-90% both above and below the trails in many locations.
- Entrenchment. Segments S3, S4, S5 and S6 have sections with steep grades (in excess of 15%). As a result, they are gullied to the extent that it is difficult to get water off the trail.
- Backslope Issues. Given the steepness of the hillsides, many of the trails were not cut back enough, leaving them steeper than they should be. As a result, the brush and other vegetation crowd the uphill sides of the trails and in some cases, hang over them.
- Poorly designed waterbars.
- Poorly designed switchbacks or climbing turns. The corners are extremely steep and create a safety issue, especially for equestrians going downhill.
- General safety concerns due to above, along with narrow tread and poor tread condition.

<u>S1 — 956'/0.18 miles/Overall Grade 11.1%</u>

Potential to meet standards: Good, with the exception of the corner leading out of the canyon, which has deteriorated badly.

S1 crosses the East Fork of Parma Creek almost immediately after leaving the picnic area. The trail diagonals gradually out of the lower canyon and around a corner (which is in extremely poor condition) that opens into a large triangular-shaped hillside covered in grass. From this point, the trail climbs around the west and north edges of the area to a point where it intersects with S2 or continues on as S3.



Map S1. Stanwood Trail System

Concerns:

- The creek crossing is narrow but deep enough to be difficult to cross. If possible, the creekbed should be armored with rock to make the crossing easier and rocks removed on either side leading into or out of the crossing that could be hazardous.
- The section leading up to the plateau above the creek has a grade of 26% and the corner itself is even steeper. There are large boulders near the corner that could roll down onto Stanwood Drive if dislodged.
- Most of the segments are less than 24" wide and entrenched slightly.
- Many of the waterbars are ineffective.

Recommendations

- Remove outside berm, widen trail to 36", restore outslope and convert existing waterbars to dips.
- Repair corner area by widening it, add rock reinforcement on the outside edge and remove boulders that might be a safety issue relating to Stanwood Drive.

S2 — 293'/0.06 miles/Overall Grade 16.7%.

Potential to meet standards: Poor if existing route stays; excellent if the trail is realigned.

S2 is a short set of very steep switchbacks that connect the main Stanwood trails to the Ridge fire access road. The grade averages more than 20%.

Recommendations

- Re-align the trail to create a more sustainable route with one switchback and grade less than 9%.

S3 — 1,252'/0.24 miles/Overall Grade 17.3%

Potential to meet standards: Challenging at best

East of the S2 connector trail, the next section of the Stanwood System (S3) drops sharply downhill to a small reservoir where a secondary access trail connects with Stanwood. There are two switchbacks along this section, both in poor shape, numerous spots where the grade exceeds 20% and narrow, extremely degraded tread in spots. This section will be a challenge to improve to anything close to sustainable standards and may need crib wall[5] reinforcement in places, armored step overs and other techniques to deal with parts of the trail that are too steep or unstable to add dips or knicks.

[5] A crib wall is constructed of rock, wood or metal that serve to reinforce the outside edge of a trail in a location where the soil is unstable or a washout has occurred. Typically, metal posts are driven into the ground and wood planks are fastened to them to hold the trail tread in place. In areas where large rock is available (12"-24" in diameter) as a source of material, they can be stacked on top of one another to create a more natural looking wall.

Recommendations:

- Widen tread to 36". In areas where not possible, provide pull out areas for passing, especially for equestrians.
- Cut backslope to a lesser angle to improve the corridor and remove brush hanging over the trail.
- Add dips/ knicks where possible.
- Extend corners of switchbacks wherever possible to lower trail and corner grades.
- Reinforce switchbacks with crib wall in places where the soil is unstable enough that the outside edge of the trail may be compromised.
- Add step overs where the grade is too steep for knicks or dips.
- Add crib wall to protect the reservoir fencing near the bottom of this section.

S4 — 1,846'/0.35 miles/Overall Grade 4.6%.

Potential to meet standards: Good, but a fair amount of reasonably easy restoration will be needed to create a sustainable segment.

S4 has a number of gentle sections with grades 8% or less, short steep sections that reach 18-20% and a number of ups and downs that serve well as grade reversals. There is a fair amount of entrenchment though most of it is relatively minor and can easily be dealt with by removing the outside berms. Almost all of the waterbars are in poor condition and the backslope needs to be cut back so that the brush does not hang over the trail.

Recommendations:

- Widen tread to 36" as needed.
- Remove outside berm and outslope. Convert waterbars to knicks and add additional dips/knicks.
- Cut back the soil on the uphill side of the trail (the backslope) to lessen the angle and removing overhanging brush.

S5 — 697'/0.13 miles/Overall Grade 20.8%

Potential to meet standards: Very challenging.

S5 connects a little used trailhead along lower Stanwood Drive to the main Stanwood System. Located in a very steep part of the hillside, the section is composed of short switchbacks and one long section near the top that goes almost straight up the hill. Several parts of the trail exceed a 30% grade, more than 3 times the normal amount.

Recommendations:

- Widen tread to 36" minimum where possible to create safe passage for trail users.
- Cut backslope to a lesser angle to improve the corridor and remove brush hanging over the trail.

- Extend corners of switchbacks wherever possible to lower trail and corner grades.
- Reinforce switchbacks with crib wall in places where the soil is unstable.
- Add step overs where the grade is too steep for knicks or dips.
- Add crib wall to protect the outside edge of the trail where needed.

S6 — 867'/0.16 miles/Overall Grade 18.5%

Potential to meet standards: Very challenging along one set of switchbacks; less so in other parts.

S6 continues more or less straight uphill to connect the Stanwood trails to the Ridge System. Though not quite as steep as S5, the average grade is still far beyond sustainable standards, especially along the lower part of the section where the trail goes through a series of very short, steep switchbacks ranging from 28-30%.

Recommendations:

- Consider realigning the lower part of the trail to create a series of longer switchbacks to make the trail safer and lower the grade. See Trail realignment proposal in Part 5 C.
- Widen tread to 36" minimum where possible.
- Cut backslope soil to a lesser angle to improve the corridor and remove brush hanging over the trail.
- Extend corners of switchbacks wherever possible to lower trail and corner grades.
- Convert waterbars to knicks and new dips/knicks where possible.
- Realign the top part of S6 where it intersects with Ridge trails R9 and R10 to create a more sustainable flow and grade less than 10%.

D. Plateau Trail System

The Plateau System is located in the upper western corner of Parma Park, with primarily flat terrain and a mixture of grassland and coastal sage scrub and scattered oaks that give way to steeper terrain and the topography flows down into the Parma and Sycamore Canyon drainages.

The Plateau system serves as entry points to Parma Park in three locations: one a short fire access lane located along El Cielito Drive; and two other spots along Mountain Drive. These trailheads provide access for the nearby neighborhoods and some limited parking along Mountain Drive for others.

They are designated as hiker/equestrian only entry points and are not open to mountain bikers.

The total mileage within the Plateau system is minimal: there are four designated trails (P1, P2, P3 and P4) within the area that total just under .6 miles of trail. Of the four, P3 appears to have disappeared due to lack of use and was not inventoried for this report.

Lack of Erosion Control

Note in Map P1 above the location of the waterbars along P1 and parts of P4 shown with color coded circles. Though sufficient in quantity, all of them were rated as “Poor” in quality, either due to poor construction techniques, poor location or lack of maintenance.

A Scenic Section

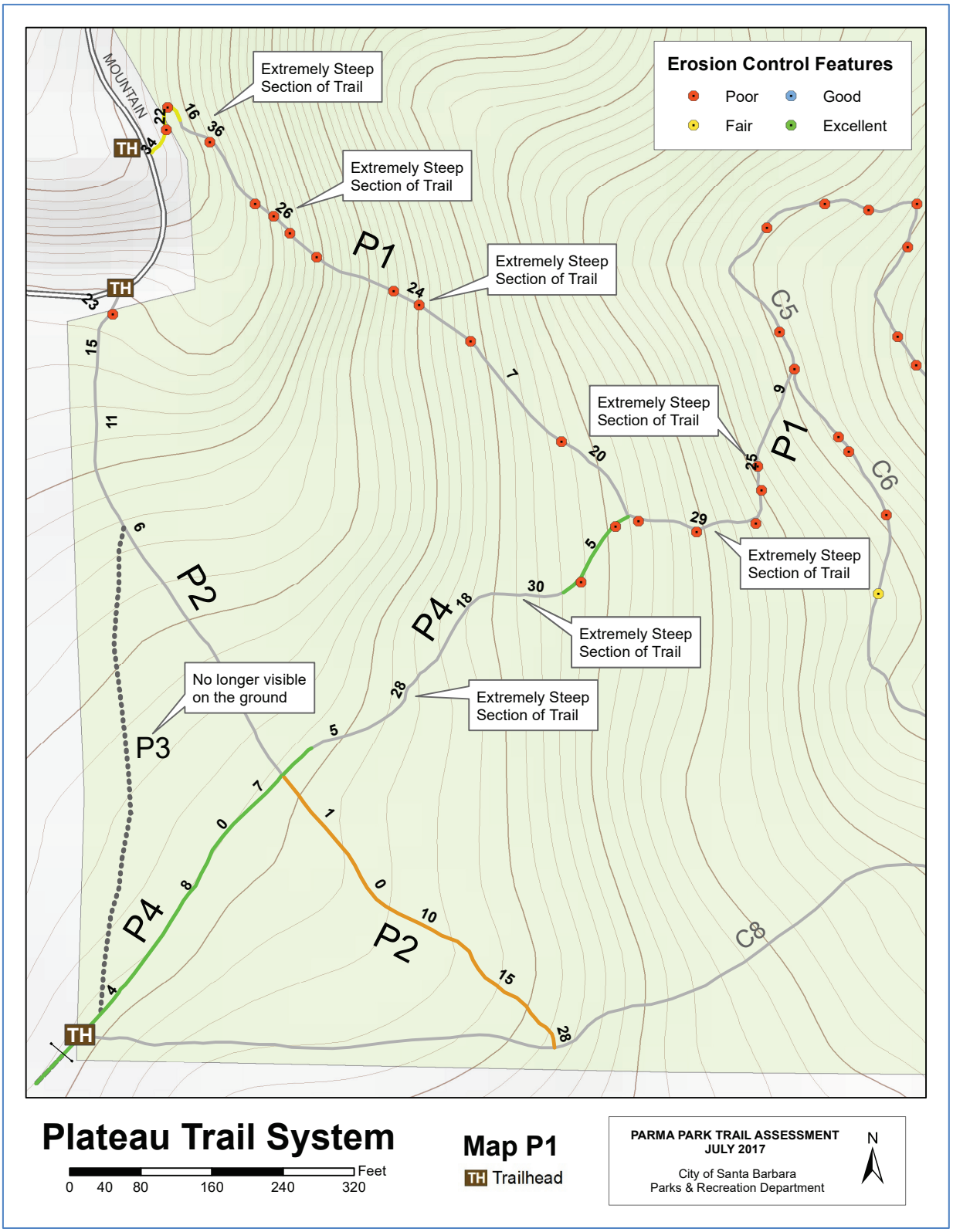
The Plateau area is one of the most scenic in the park, with wide open vistas, open meadow, scattered oaks and a designated hang glider landing area that offers a unique opportunity to watch them soaring in the wind.

The scenery is dramatic and this area is often used by adjacent neighbors. It may not be used as often by other park visitors, partly due to the steepness of the access. Though almost flat along the top part of the Plateau, the land begins to drop off quite steeply as it drops down into the Parma drainages. As a result, other than Trail Segment P2, other Plateau trails (P1, part of P4) are extremely steep with grades averaging from 20-30% and have fairly serious erosion issues.

In addition to the steep grades, the system lacks a circulation pattern that provides opportunities for loop hikes or any means for varying one’s hike from time to time. Basically, what the Plateau system offers currently is two steep Park entry-and-exit points.

Overall Concerns with the Existing System and Design Recommendations:

- Grade. All of P1 and the north-eastern part of P4 are in extremely poor condition due to grades that average over 20% for most of these segments. This has translated into entrenched trails with poor tread conditions and trails that are not enjoyable to use.
- Width. All of P2 and the southwest part of P4 average a trail width of less than 16”. Though grade for both of these segments is within standards, they have become entrenched due to frequent equestrian use. Along large parts of P2 parallel social trails are developing due to the difficulty in using the main tread. This trail follows the middle of the Plateau flats more or less down the fall line and will be difficult to restore given the flat land.



Map P1. Plateau Trail System

Entry points. There are three Park entry points within the Plateau System: one along El Cielito (in excellent condition) and two on Mountain Drive that need improvement. The P1 trailhead is in extremely poor condition due to the step grade (34%) and sharp switchback not too far below the top.

- Lack of variety. The Plateau System basically offers access in and out of the Park from El Cielito and Mountain Drive with no loop options and steep trails that aren't fun to use. At one point, P3 offered the possibility of a short loop in the upper flats but it is no longer visible given its lack of use.
- Need for realignment. There are numerous opportunities for creating a more sustainable trail system in the Plateau area that might also create new, exciting loop opportunities. During public outreach, several comments were received requesting new loop opportunities.

P1 – 1,102'/0.21 miles/Overall Grade 18.9% (upper half 25+%)
Potential to meet standards: Very challenging unless realigned along a more sustainable route

P1 is a steep segment that connects Mountain Drive to the Creek System trails. The grades range from 25-29% on the lower part of the trail to as high as 36% as it nears Mountain Drive. The trail is severely entrenched as well and though there are numerous water bars along the way, they have been poorly constructed and do little to keep water from going straight down the trail.

Recommendations:

- Realign the first 200' of P1 from Mountain Drive to establish a more sustainable grade. The upper entry point from Mountain Drive has one of the steepest grades in the Park, averaging 22-36% over the first two hundred feet immediately below the trailhead.
- Remove the rest of P1, restore to a natural state and re-route the trail along a more sustainable grade, links to other parts of the Plateau and Creek systems to loop new connections. See Map P2 for more details.

P2 — 1051'/0.2 miles/Overall Grade 10%

Potential to meet standards: Excellent

P2 also provides trailhead access from Mountain Drive. The trail drops steeply downhill from the road to the open flatland that characterizes the upper part of the Plateau. The grade is reasonably gentle, averaging from 11-13" as it crosses the flats and connects to the El Cielito trailhead on the southwest. It also provides a connection downhill via P4 to the upper Creek System as well as the hang glider area via the far part of the Creek System.

However, P2 has also been entrenched to a depth of 2-4" and a width of 12-16", creating a channel for water to flow directly down the trail. Currently users are walking outside the entrenched trail and creating a new parallel trail. Because the route follows the fall line on a relatively flat section there is little potential for erosion control techniques to be used.

Recommendation:

- Consider removing existing entrenched trail and realigning along a route slightly to the east with better views, more potential for erosion control and loop potential.

P3 Not Assessed

Does not show on the ground. May have disappeared from disuse over time. Does not follow a route as shown on the March 2002 Trail Inventory Map for Parma Park.

Recommendation:

- Add new trail alignment to replace the lost trail that combines with a newly realigned P2 route to create a short loop within the flats area.

P4 — 967'/0.18 miles/Overall Grade 8.6%

Potential to meet standards: Excellent for the upper half; lower half needs to be removed

P4 consists of one 967' foot segment that is better separated into two parts. The first diagonals across the flats from the El Cielito trailhead to connect with P2. It has a gentle rise and fall with a grade of less than 8%. Though narrow (16-18" wide) the trail is in good condition. The second part of P4 continues east past P2 and then drops steeply off the hillside at a grade of between 25-29% where it connects with P1. This part of P4 should be removed from the system and restored to a natural state.

Recommendations:

- Remove the section of P4 to the east of P2 and restore to a natural state.
- Connect remaining part of P4 to a new trail alignment leading down along a sustainable route to P1, creating larger loop possibilities.

E. Mountain Drive Trail Easement

The Mountain Drive Trail Easement consists of a long 2,263-foot (0.43 mile) easement, 20 feet wide, that begins at the Parma Park boundary where C3 ends and continues along the West Fork of Parma Creek to its exit at Mountain Drive to the north. This is a private easement and is not located on Parma Park property.

The trail easement is for pedestrian and equestrian purposes only, per the grant of easement. Mountain bikes are prohibited on the easement. The trail follows an old ranch road for the most part along the east bank of the creek through some of the nicest riparian vegetation in the Park. The potential to meet TMO and SMO standards is excellent but the trail does need some improvements and quite a bit of basic trail maintenance.

There are numerous rises and falls along the way, creating excellent grade reversals and a number of waterbars, many of which are in better condition than other parts of the Park. However, given that the road was insloped to the hillside when it was originally constructed, there is a good deal of entrenchment along the bottom of the hillside and many places the entrenchment is deep enough to have created a 12”-18” high berm on the creek side of the trail. These berms range from a few feet to 6-8 feet wide, requiring quite a bit of excavation to cut drainages through them.

Figure 8. Overgrown section of the Mountain Drive Easement

While much of the tread is in good condition, the trail could use additional erosion control features added and brushing to restore the corridor width.

One option is to create a more curvilinear flow that curves the trail such that it creates small grade reversals as it goes over the top of the berms then back down onto the existing trail.

As mentioned above, the Mountain Drive Trail Easement provides one of the nicest riparian environments in the Park but it comes at a cost: the thick, lush vegetation is extremely overgrown along most of the segment and needs extensive brushing to meet Park TMOs.

As is true of the other Mountain Drive access points, the last several hundred feet of trail leading up to the road is extremely steep and needs improvement to meet either TMO or SMO standards.

Recommendations:

- Brush the trail to meet TMOs.
- Convert existing waterbars to dips or knicks.
- Use a curvilinear flow that takes advantage of the berms.
- Extend the corner of the switchback just below the Mountain Drive trailhead to lessen its grade and create a wider climbing turn so the lower part of the switchback is slightly further downhill where it can be widened.
- Any work will need to stay within the 20-foot easement boundaries.
- Advance written notice to the surrounding property owner will be required at least seven days prior to trail easement work.

PART 6. Proposed Trail Realignments

Though many of the issues relating to meeting TMOs and SMOs can be dealt with using basic trail maintenance practices (some of which will require using mechanized equipment) there are a number of locations within the Park that create very challenging obstacles to doing so. These challenges are focused in two main parts of the Park:

- The western part of the Park that includes a number of the Plateau Trails and the part of the Creek System that leads from the first creek crossing along C8 to the hang gliding area.

  Many of these trails were most likely developed as social trails providing community access to Parma without much thought regarding trail design or sustainable concepts. The result is a network of trails that are far too steep.

- Most of the Stanwood Trail System and a number of the Ridge trails along the eastern edge of the Park.

  These trails were constructed in more recent years to provide users with additional trail opportunities and to solve the concerns many had regarding the quality of the eastern fire access road (R1c). Though constructed using more appropriate trail design techniques and erosion control methods, the steep topography and sharp dropoffs found along Stanwood Drive and the west side of the Coyote Creek drainage made it difficult to construct them to TMO and SMO standards or to maintain them over time.

One means for resolving concerns, such as those described above, is to realign the existing trails along more sustainable routes that will meet the Parma trail objectives. Along with surveying current trail conditions, this assessment has also focused on identifying opportunities where existing trails can be realigned in a way that removes erosion control issues, minimizes the need for maintenance over time and creates new user opportunities.

A. Ridge Trail System

Building, maintaining and restoring sustainable trails in the eastern part of the Park along the ridge is extremely difficult due to the steep topography.

1. Add New Ridge Single Track Trail

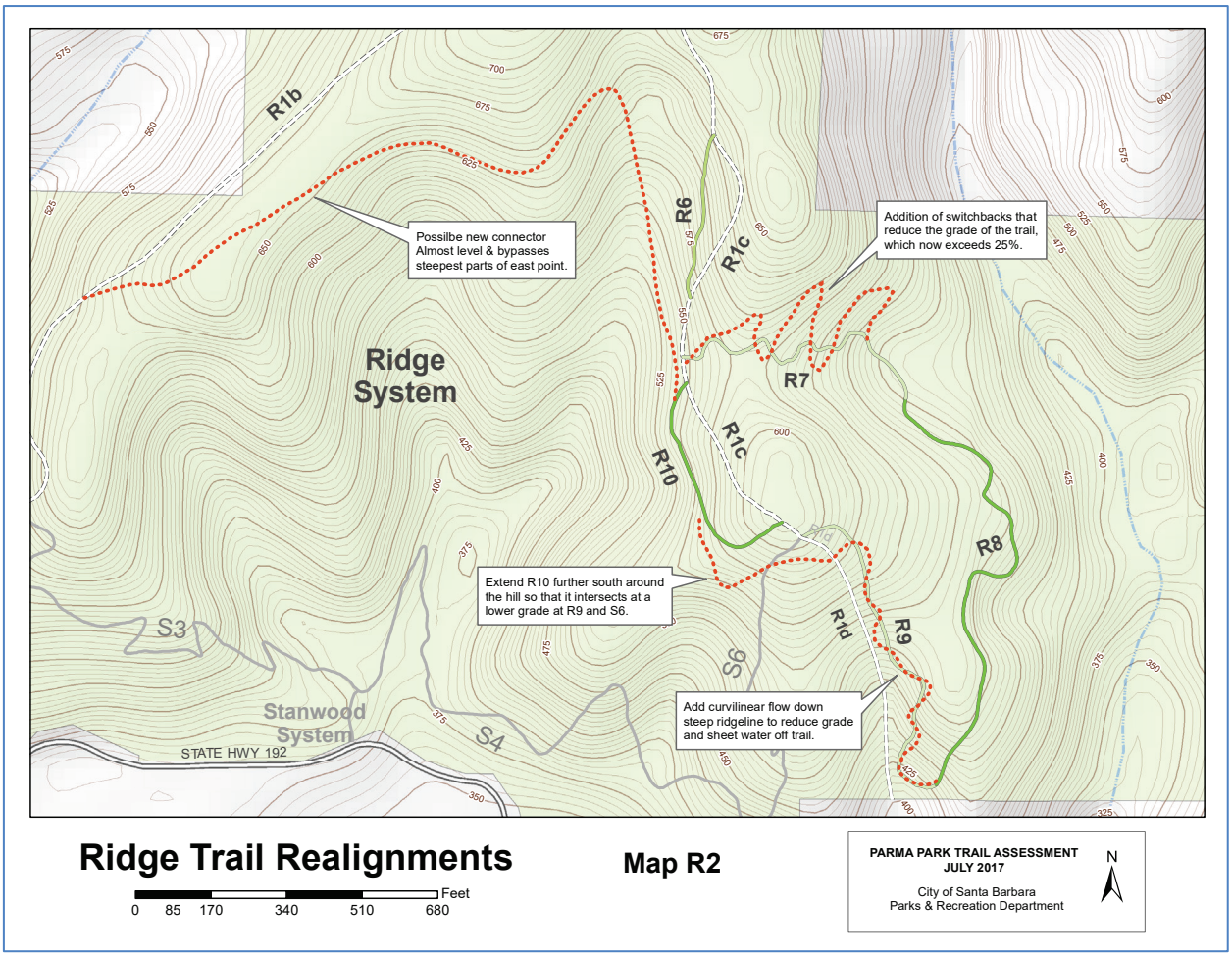
See Map R2 on the following page. Adding a new connector trail from the R1b fire access road around the upper part of watershed that leads down to Stanwood near small reservoir at the intersection of C3 and C4 would provide 2,100 feet of new trail and bypass some of the worst parts of the fire access roads (R1b and R1c).

While the hike or ride up to McMillan Point is popular with many of the Park trail users, due to the steepness of the fire road leading south down to the Stanwood trails, most users return back via R1b because of the poor condition of R1c. The proposed new trail addition would provide more user-friendly access to the east Stanwood part of the trail system. Average grade for the new route would be less than 6% given the entry point on R1c is approximately at the 650-foot level and the exit onto R1c is at the 540 level.

2. Make Adjustment to R9, R10 and Upper S6 to Reduce Grade

The point at which the Ridge fire access road (R1c) intersects with S6 and R9 on the east side of the road is poorly laid out. R10 ends on the fire access road at a point where users are required to head down a steep hill to reach S6 and the Stanwood trails. Further, on the east side of the road, R9 loops around into the Coyote drainage in a spot where users are required to go steeply downhill if they want to take that route.

Realigning the R10 trail so it meets S6 further down the ridge bypasses the steep hill and diagonals across the fire access road at a much better location if heading to the R9 loop.



Map R2. Adjustments to Ridge Trail System

3. Add switchbacks to R7 to Reduce Grade

R7 leads from the R1c fire road east almost straight downhill for several hundred yards to a point where it turns south and contours along the mid-slope of Coyote Creek. The trail is extremely steep (averaging over 20% with grades exceeding 30%) and entrenched.

There is sufficient open areas on either side of the trail to add 3-4 switchbacks that extend 20-30 yards out which could reduce the grade to no more than 12% and reduce impacts. However, the area consists of heavy brush (mainly ceanothus) that would need to be removed to create a more sustainable route.

4. Realign R10 to Intersect with S6 and R9 to Reduce Grade & Align Trails

Currently, R10 curves around the west side of the ridge and intersects R1c. At that point R1c drops steeply downhill to a point where it joins S6 and R9. This causes two main concerns: this part of the route requires users to go up (or down) a steep part of the fire road; and the trail across the fire road and down R9 exceeds 18%. Both create erosion issues and will lead to future maintenance costs.

By routing R10 further west and south along the ridge, a more sustainable route is possible that would intersect S6 before it reaches the fire road and would diagonal east across the fire road at a lower point, lessening the grade at the top of R9.

B. Creek Trail System

The area of concern is along C8 (Map C2), from the creek crossing up into the open grassland that climbs steeply up to the hang gliding area and though it to the beginning of the Plateau System. Map C2 depicts how C8 and C9 might be realigned to create a sustainable trail system though the open grassland areas on the south and west parts of the Creek and Plateau areas.

1. Realign C8 to Reduce Grade

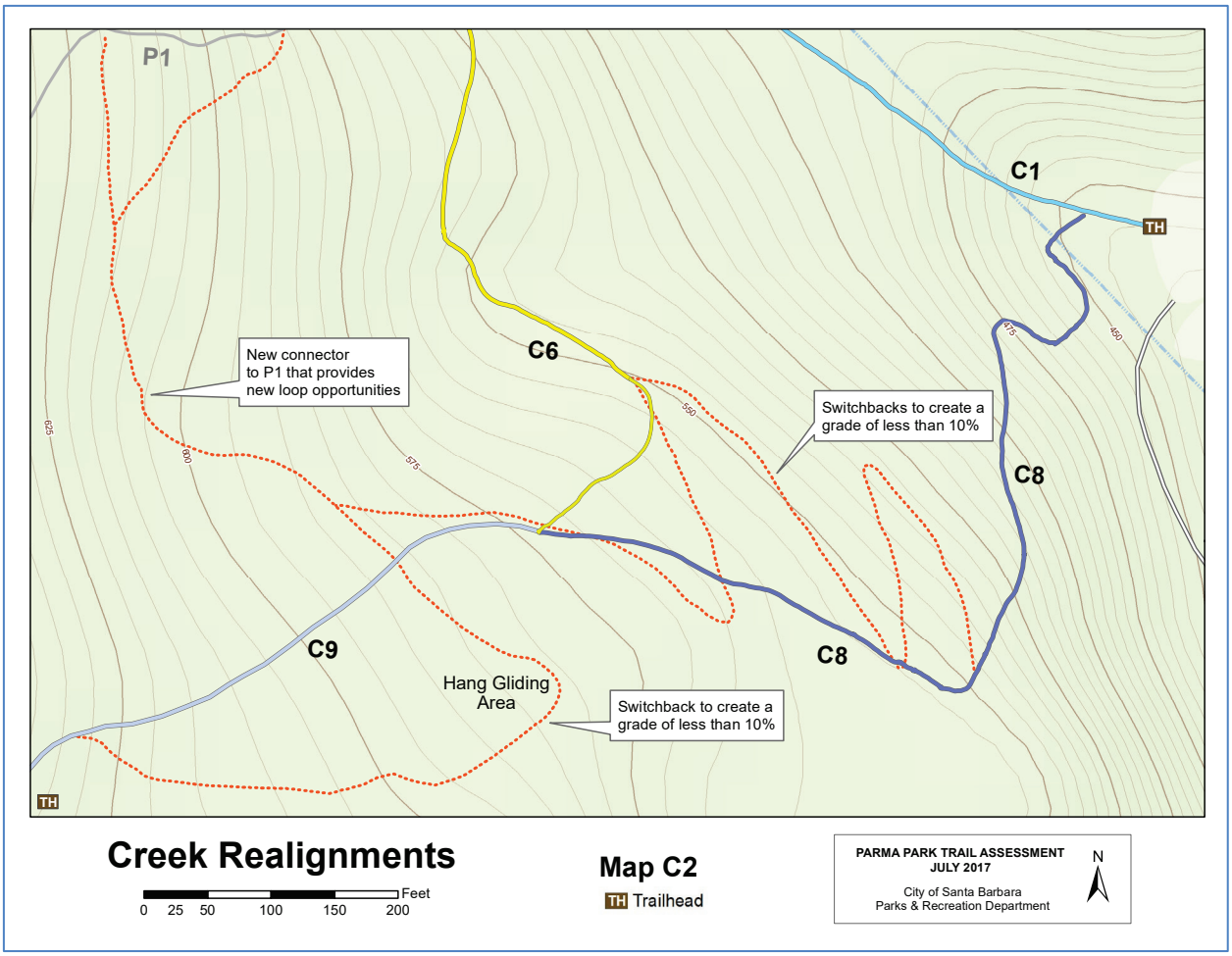
Once C8 climbs out of the West Fork of Parma Creek drainage, it levels out before turning west and climbing steeply along the upper side of an open grassland area to the hang gliding area. The current trail is narrow and steep, averaging 20%. The open grassland provides an excellent opportunity to add two switchbacks that bypass a badly eroded spot and reduce the grade to less than 10%. This would connect directly to C6 to form a nice shorter loop then switchback up to the gliding area.

2. Realign C9 to Reduce Grade

This realignment would continue the lower realignment where C9 ends, switching back around the gliding area at a grade less than 10% and then continue west to El Cielito trailhead.

3. Add Connector to P1 to Create New Loops

Midway between the C8 and C9 realignments, there is a potential for crossing a small gully and connecting to the P1 areas of the Plateau trails. The route drops slightly to an opening where it would cross the gully then would climb at an angle less than 5% to connect with a new proposed alignment of P1. This would add several additional loop possibilities.



Map C2. Creek Trail System Realignments

4. Realign C8 Trailhead to Improve Safety

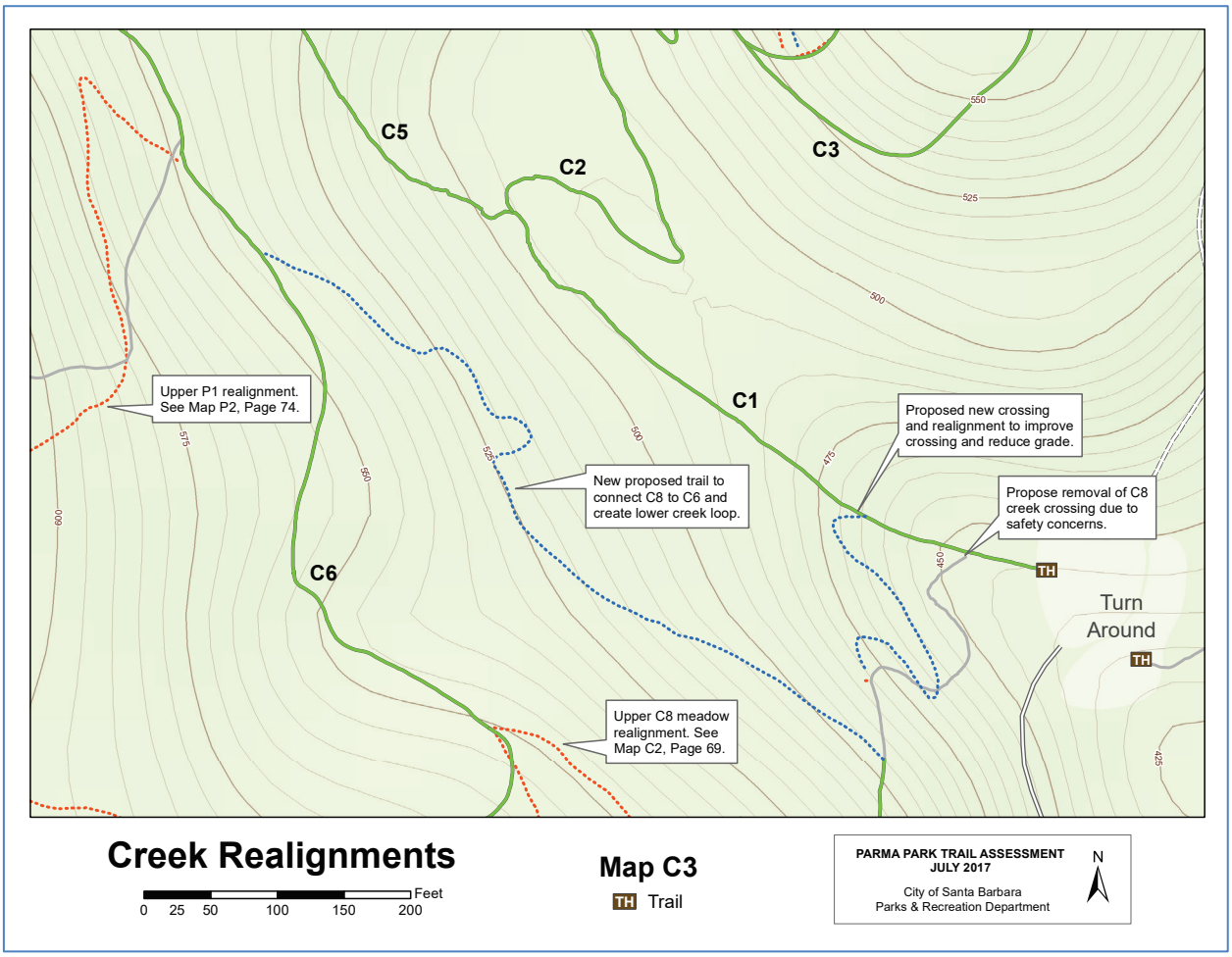
See Map C3 on the following page. As the creek crossing near the intersection of C1 and the lower end of C8 has become more gullied, it has become more difficult for equestrians and many hikers to negotiate the boulders. In addition, once across the creek, the trail turns east and continues along the edge of the creek bank for approximately 40 feet along a precipitous 5 foot dropoff.

An alternative alignment has been identified 100 feet upstream that has more gentle banks on both sides of the creek and a smooth, sandy bed that could serve as a much safer crossing. By routing the trail across at this point and then diagonally up the hillside to a point where it intersects with C8, it will provide a much more sustainable route.

5. Add New Lower West Connector Trail to Improve User Experience

Features: Mostly shaded canopy, views out over Parma Creek and across to the Olive Grove area, short half-mile loop accessible to users of all levels, kid friendly. See map C3 on the following page.

As a part of the assessment of the Parma Park Trails System, one of the goals was to identify additional trail opportunities, especially those which provide shaded cover and tree canopy. The Lower West Creek Trail would meander through oak forest for approximately 700 feet, linking C8 to a point along C6 where it would loop back via C5 and C1 to the picnic area. The route provides plenty of shade and almost level walking along the south bank of the creek.



Map C3. Proposed New Creek Crossing and Trail Addition.

C. Stanwood Trail System

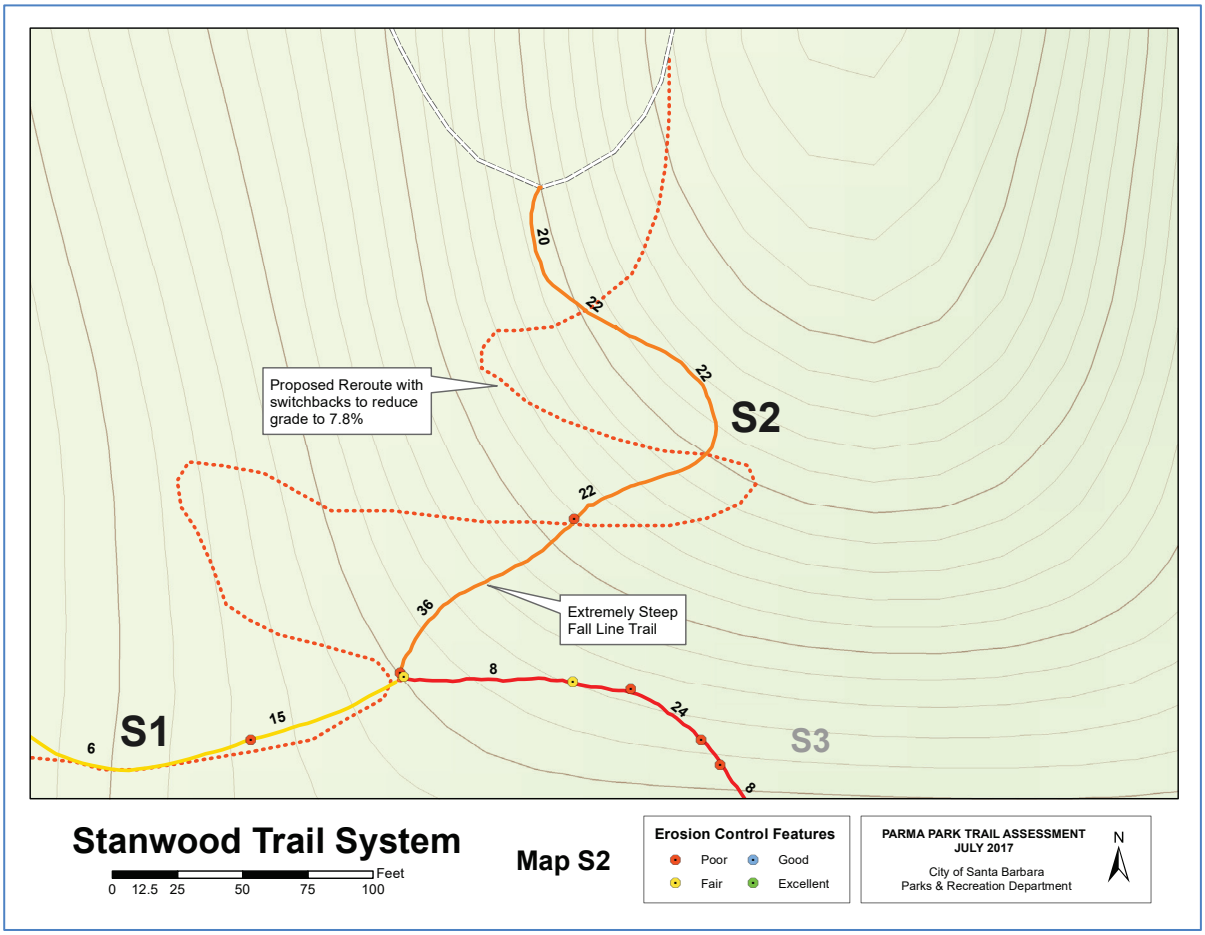
Building, maintaining and restoring sustainable trails in the eastern part of the Park along Stanwood Drive is extremely difficult due to the steep topography. All have extremely steep grades, degraded tread, poorly designed switchbacks and numerous safety concerns.

In some cases, the focus will need to be on use of various techniques to armor the trails (crib walls, step overs, armored dips) where the grade is extremely steep and there are no opportunities to realign the trail. During this review, several possible trail realignments have also been identified that could help reduce the grade and minimize both safety and trail damage concerns.

1. Realign S2 to Reduce Grade

S2 is a short steep trail that connects the Stanwood Trails to the Ridge fire access road almost immediately above it. Average grade is 22% and the one waterbar located along it does not work properly. Though the trail has several very slight curves to it there is little possibility of designing structures that would work to get water off it.

It is possible to realign the trail by adding several switchbacks that would lead out into an open grassy area and back uphill to the fire access road at a grade of 8%. See Map S2 below.



Map S2. Reroute of Steep S2 Trail Segment

2. Add New East Parma Creek Connector to Improve User Experience

Features: Provides an additional .2 miles of trail along a shaded oak canopy route with views out over the East Fork of Parma Creek and creates a short half-mile loop back to the Main Gate or longer loops via the Creek Trail System. See map S3 on the following page.

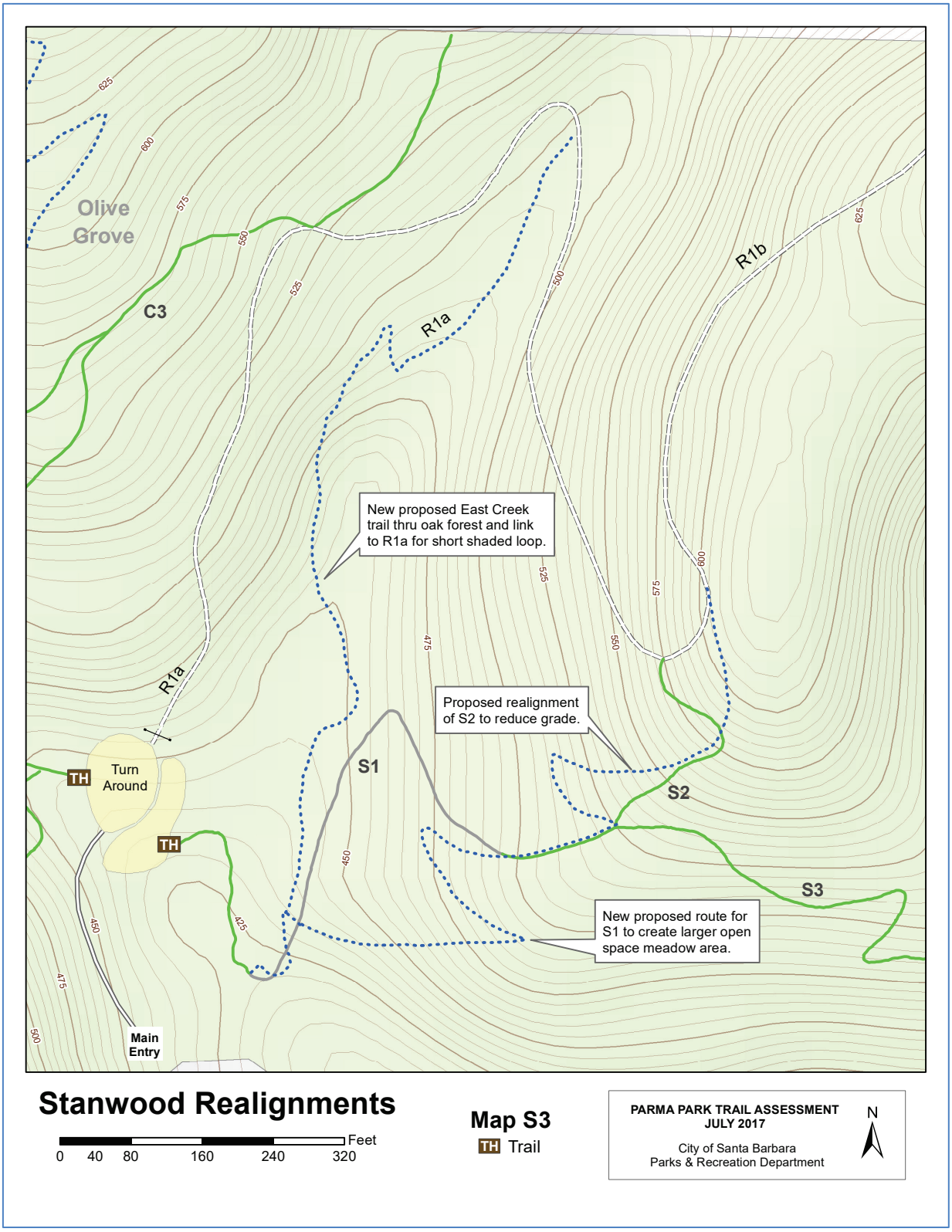
The new connector would lead from S1 near the point where S1 climbs out of the canyon then follow the east side of this fork of Park Creek, meandering in and out of an oak canopy, dropping down into a small meadow area then climbing back up to a point where it switches back and then continues north to intersect with the Fire Road (R1b).

3. Consider Realignment of S1 to Bypass the Meadow Area

See map on following page. The steep hillside meadow to the right (east) side of the East Fork of Parma Creek has been the subject of an ongoing effort to restore the area to a native grassland habitat. Currently the meadow is divided in half by the current S1 trail route and has created difficulties in restoring the area.

The proposed realignment of S1 would remove the part of S1 shown in gray on the following page and route the trail to the east at the lower edge of the meadow out onto slopes vegetated by soft chaparral vegetation, avoiding the open meadow area entirely and leaving enough of a buffer to discourage trail users to cut through the meadow.

Note: this realignment would maintain the overall average grade of the trail at approximately 11.8% but provide an alternative route that avoids going through the meadow. It also could be combined with a realignment of S1 and the upper west part of S3, which is extremely steep, to create a more sustainable route for the western part of the Stanwood System. See map below for possible routing.

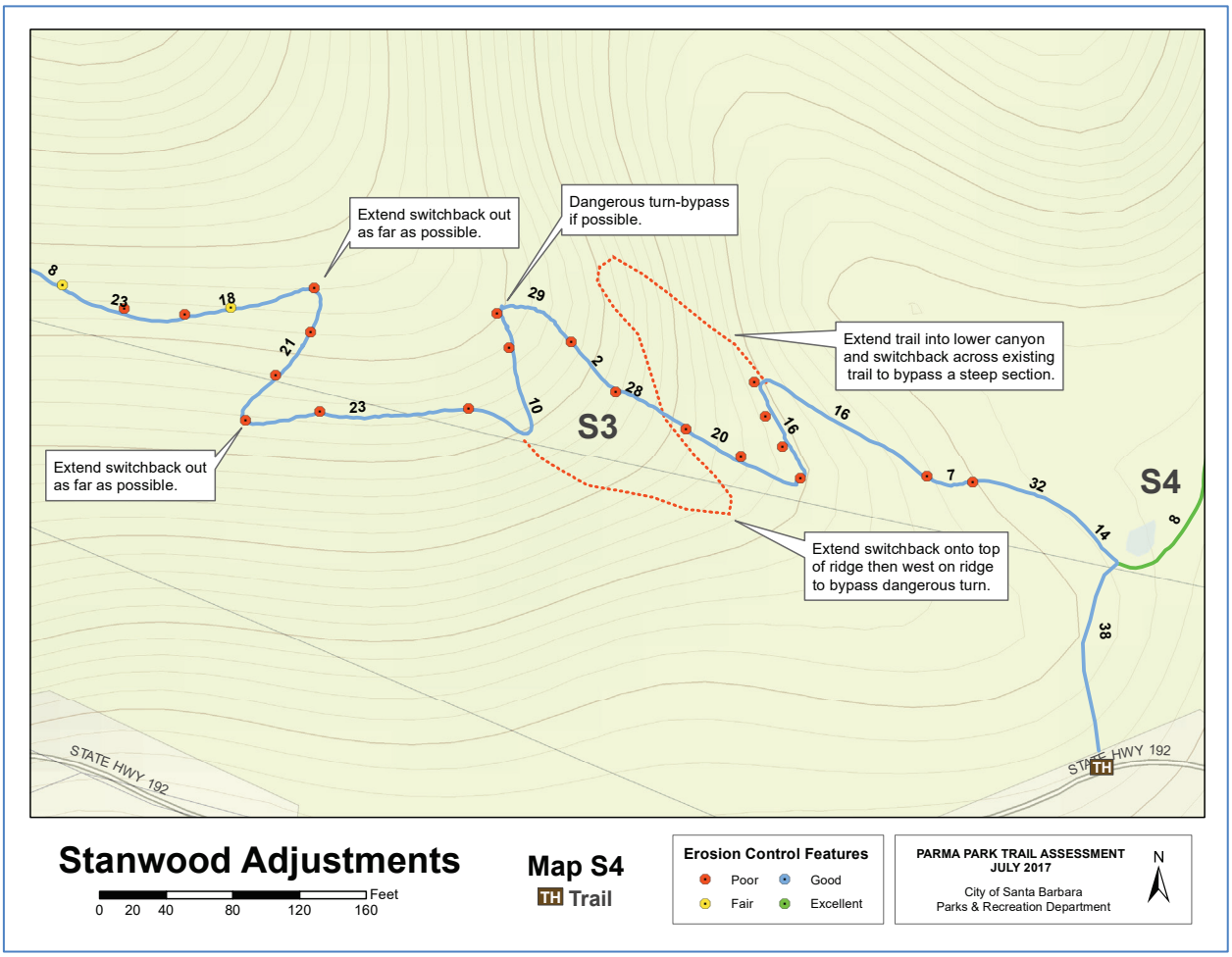


Map S3. New East Side Trail Connector – Realignment of S1

4. Realign S3 Switchbacks to Reduce Grade & Improve Safety

S3 drops steeply downhill to the east from S2, paralleling Stanwood Drive along a steep hillside that leads down to a small reservoir (dry much of the year) and trail access point near the road. The Stanwood trails are heavily impacted by their underlying geologic formations. Underlying S3 and areas north of the trail, the Vaqueros and Sespe Formations predominate, their more resistant sandstone and denser marine formations creating the high, narrow ridgelines while below the more erosive Rincon shales have weathered to create hillsides prone to erosion and deep canyons such as the West Fork of Sycamore Creek.

The result is a trail system (S1, S2 and S3) that contours along the junction of these more resistant and more erosive formations. As a result, the steep topography provides few options for realigning the trail in the sections that exceed sustainable grades or have switchbacks that are too steep.

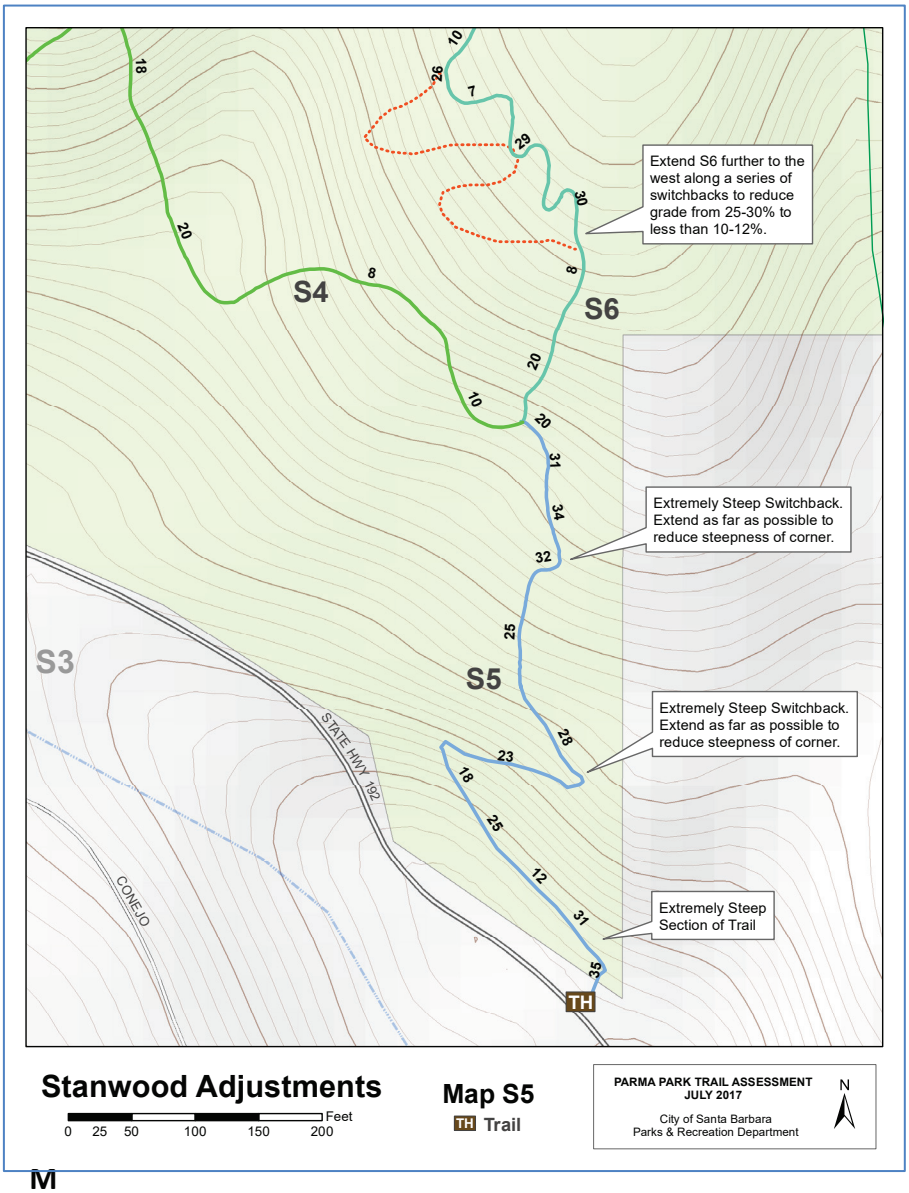


Map S4. Potential Realignment of Trail Segment S3

Map S2 above outlines one potential spot where the it may be possible to route the trail further up a small side canyon below the trail and then back across it to avoid a part of the existing trail that is too steep. However, further exploration will be required to determine if the route is feasible or not. At this time both the thick brush and abundant poison oak makes it difficult to explore the area further.

5. Realign S6 Switchbacks to Reduce Grade & Improve Safety

S6 continues uphill along a steep ridgeline that connects to the lower part of the R1c fire access road and the R9 single track. In the middle of S6 there are several switchbacks that climb the steepest part of this segment. They are short, poorly designed and are unsafe. It is possible to realign the segment as shown above so that the switchbacks are extended further to the west, avoid the worst of the corners of two of the switchbacks and reduce the overall grade from 20% down to as close to 10% as possible. See Map S5 on the right.



Map S5. Adjustments to Segments S5 and S6

D. Plateau Trail System

Along with improvements to the Creek System and addition of a new connector trail that would connect the hang gliding area to the P1 part of the Plateau System, several realignments within the Plateau area could resolve serious issues with transitioning P1 and part of P4 to sustainability and add new loop possibilities while doing so. See Map P2 on the next page.

1. Realign P1 to Reduce Grade & Improve Safety

When P1 was added to the trail system, there was no real design to it: rather, it was cut almost straight downhill to the point where it intersected with P4 and then continued on an even steeper grade downhill to join the Creek trails network. Near the top the grade averages almost 30%, levels out to 7% then returns to an average grade over 25% for the last third of the trail. There are a number of knicks and waterbars along it, all of them characterized as being in poor condition, and none of them capable of supporting a sustainable system.

There is, however, the potential for routing the trail along a series of switchbacks just below the Plateau flats, that would connect down to the lower part of P4 use a part of that segment and then continue to switchback downhill to intersect with C6 in the Creek System at a grade averaging 7-10%. The route meanders through open grassland, oaks and rock outcroppings, proving both sustainability and a picturesque experience. This is a potential area for the placement of a new bench.

2. Consider Removal of the P1 Trailhead

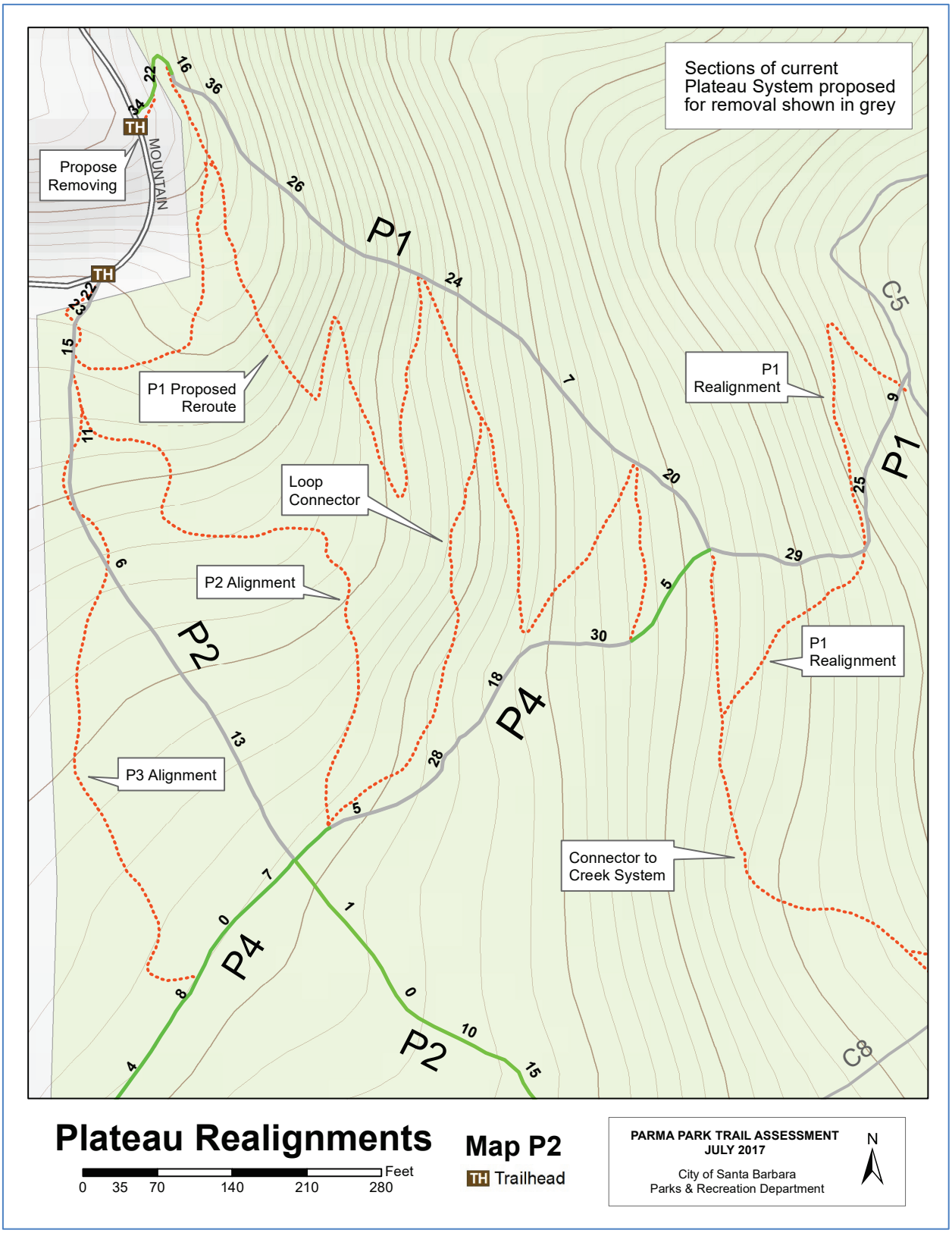
The trailhead at the top of P2 is less than 50 yards from the top of the P1 trailhead. The trailhead is somewhat redundant and has significant issues relating to grade, safety and potential costs for maintenance over time.

The P1 trailhead is extremely steep (34%) and leads down to a switchback that has a grade of 22% above it and 16% below it. The top of the trail is entrenched and could require extensive use of crib wall, steps and other reinforcement to stabilize.

As shown on the Map P2 on the next page, it is possible to connect to P1 at a point below the steep sections noted above from the P2 trailhead without seriously impacting the user experience. This would require several hundred yards of additional hiking but would avoid the steepest parts pf P1 and lead into the trail realignment proposed on the map.

3. Realign P2 to Improve Grade & Add New Loop

Currently P2 heads straight down through the Plateau Flats and intersects with the upper part of C9. The trail is narrow and entrenched and cannot be maintained over time for sustainability. A more sustainable alignment of P2 is possible by routing it slightly further to the east along the edge of the flats where there is enough sideslope to sheet water off the trail and the views overlooking the lower part of the park are dramatic.



Map P2. Plateau Realignments

4. Restore P3 to Improve User Experience & Add New Loop

See Map previous page. P3 has disappeared through disuse. It is possible to reestablish P3 along a route that is more sustainable. By designing it so that it can be combined with P2 to create a route that loop around the Plateau Flats.

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PART 7. Proposed New Bench Locations

Three new locations for park benches have been identified for addition to the Parma Park system. Each is slightly off the trail, providing a bit of solitude for those who might use them and all have expansive views of different parts of the Park and upper Sycamore Canyon area.

Bench 1

Upper Plateau Flats area. The proposed bench would be located a few yards off at the bottom edge of a massive sandstone boulder set beneath a large oak tree. It is located not too far from the El Cielito entrance and could provide a nice spot for the community to enjoy the sunset views. It has late afternoon and evening shade.

Bench 2

Is located about 150 yards below the west Mountain Drive trailhead, It would be located just off a realigned P2 trail. The location is near the east edge of the Plateau Flats at a point where the topography drops off, providing a panoramic view of the Sycamore Canyon area.

Bench 3

Is located along the edge of the open meadows leading to the Hang Gliding area. It would be tucked under a large oak canopy, providing midday to evening shade and views of the West Parma Creek watershed and Olive Grove.

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PART 8. Conclusions

The field surveys conducted in July, 2017 indicate there is a need for the development of a long-range restoration plan for the Parma Park trails system. While many of the trails are passable by most trail users, almost all require some degree of restoration to meet current TMOs and the objective of making them as sustainable as possible.

Based on the data derived from the trail surveys conducted in July 2016, each of the twenty-eight (28) trail segments within the overall network were rated for their ability to meet Park trail management standards and sustainability objectives. Each of the trail segments was rated as Fair, Good and Excellent on the more positive side and either Poor or Challenging on the negative side.

Map TR1 on the following page displays each of the trail segments color coded by rating. The areas of greatest concern were located in the Plateau and Stanwood systems where steep grades, poor erosion control features and excessive entrenchment will require more extensive restoration than in most other parts of the network.

This report recommends that the Phase 2 Trail Design & Rehabilitation Plan focus on three key things:

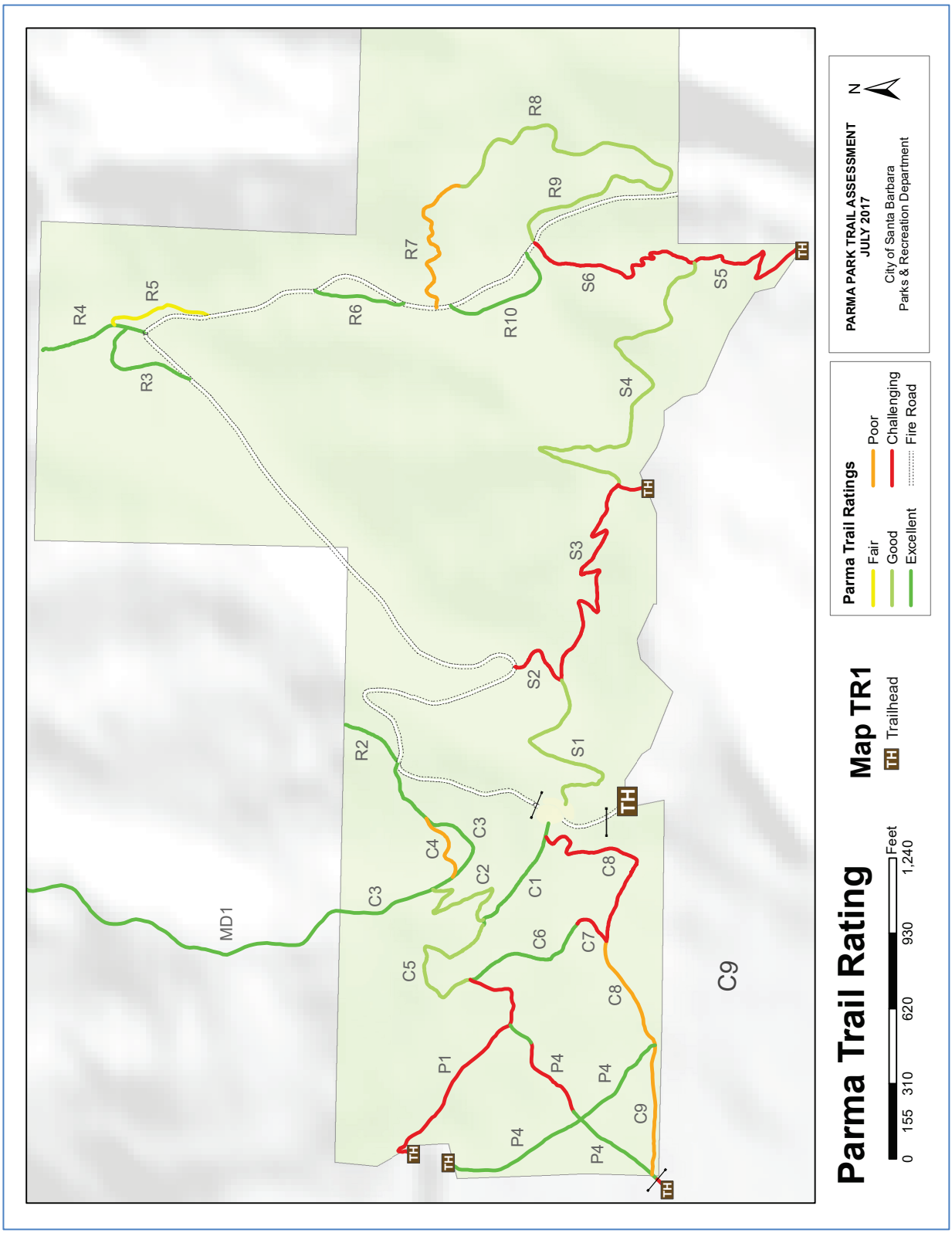
1) Performing basic preventative maintenance to minimize the potential for what are now minor issues that nevertheless impact meeting TMOs and trail sustainability. Seventeen (16) of the single-track trails within the Parma trail system, totaling were rated as having either a good or excellent restoration potential and one (1) as fair.

   These trails do not meet the standards but could easily be retrofitted to meet standards including things such as:

   a. Backsloping to create to lessen the grade of the slope above the trail. Slopes above many of the trails are far too steep. This contributes to slumping, narrowing of the trails and vegetation hanging over the trail.
   b. Brushing, especially the uphill side of the trails.
   c. Removal of the outside berms and restoring outslope.
   d. Converting waterbars (currently not effective) and replacing with knicks.
   e. Adding new knicks or dips in other locations.

2) Realignment many of the segments rated as “poor” or “challenging”, specifically those which would otherwise be difficult to restore or convert to TMO and SMO standards. These include P1-P2 within the Plateau System, C8-9 in the Creek System, S2 in the Stanwood System and R7 and R9 in the Ridge System.

   Many of the issues that caused these trails to be rated as “Poor” may be difficult to resolve if the current routes continue to be used. All of them can transitioned to meet standards if realigned along different routes. This would not only provide a more enjoyable trail experience, reduce erosion and minimize maintenance needs, but provide additional loop opportunities.



Map TR1. Trail Segment Ratings

Table 10. Trail mileages and acreage.

Lists each of the 28 existing trail segments within the overall Parma Park trail network by trail system and includes trail lengths, square footage and acreage

System	Segment	Length (Miles)	Length (Ft)	Area (Sq Ft)	Acreage	Rating
Ridge	R2	0.05	278	2,919	0.07	Excellent
	R3	0.10	513	5,387	0.12	Excellent
	R4	0.09	453	4,757	0.11	Excellent
	R5	0.08	434	4,557	0.10	Fair
	R6	0.07	377	3,959	0.09	Excellent
	R7	0.14	722	7,581	0.17	Poor
	R8	0.22	1,154	12,117	0.28	Good
	R9	0.16	822	8,631	0.20	Good
	R10	0.10	548	5,754	0.13	Excellent
		1.01	5,301	55,661	1.28	
Creek	C1	0.10	525	5,513	0.13	Excellent
	C2	0.13	661	6,941	0.16	Good
	C3	0.23	1,188	12,474	0.29	Excellent
	C4	0.06	312	3,276	0.08	Poor
	C5	0.14	714	7,497	0.17	Good
	C6	0.10	552	5,796	0.13	Excellent
	C7	0.03	173	1,817	0.04	Challenging
	C8	0.16	869	9,125	0.21	Challenging
	C9	0.19	1,029	10,805	0.25	Poor
		1.14	6,023	63,242	1.45	
Stanwood	S1	0.18	956	10,038	0.23	Good
	S2	0.06	293	3,077	0.07	Challenging
	S3	0.24	1,252	13,146	0.30	Challenging
	S4	0.35	1,846	19,383	0.44	Good
	S5	0.13	697	7,319	0.17	Challenging
	S6	0.16	867	9,104	0.21	Challenging
		1.12	5,911	62,066	1.42	
Plateau	P1	0.21	1,102	11,571	0.27	Challenging
	P2	0.20	1,051	11,036	0.25	Excellent
	P3	NA	NA			Trail Abandoned
	P4	0.18	967	10,154	0.23	Challenging
		0.59	3,120	32,760	0.75	
Mtn Drive	MD1	0.43	2,280	23,940	0.55	Excellent
TOTALS		**4.29**	**22,635**	**237,668**	**5.44**	

3) Use of more aggressive techniques to make a number of the trails rated as "Challenging", which cannot be realigned due to steep topography or other issues. The challenges include excessively steep grades, large amounts of entrenchment, unsafe switchbacks and poor tread conditions.

   Trail segments that fit into this category include S3, S5 and S6 within the Stanwood System where alternative alignments do not exist or would be difficult to construct. Use of more aggressive techniques to make trails rated as "Challenging" as safe and sustainable as possible include:

   a. Widening the tread to a minimum of four (4) feet, with wider step outs placed along locations where users (especially equestrians) may have difficulty passing one another.

   b. Use of crib walls to shore up locations with steep side slopes.

   a. Widening and extending switchbacks wherever possible to reduce the grade at the turning points and stabilize the outside edges (rock armoring or crib walls) to prevent loss of the tread.

   b. Use of a curvilinear flow where possible to allow the trail to extend outside areas with deeper entrenchment.

   c. Use of step overs (rock or wood) to get water off the trail where it is too steep for dips or knicks.

PART 9. APPENDICES

1. Trail Data Tables

2. Segment Conversion Chart

3. Trail Segment Data

APPENDIX 1. Trail Data Tables

Trail Grade				
Grade ID	**Range**	**# Seg**	**% Total**	**Notes**
1	0-10	94	40.7	Less than half of the Parma trails meet TMOs for trail grade.
2	11-15	37	16	16% need moderate erosion control measures to meet TMOs and SMOs.
3	16-20	37	16	16% need more serious erosion control measures to meet TMOs and SMOs or some adjustments to trail alignment.
4	21-29	44	19	19% of trails need serious restoration including trail realignments or rerouting to solve erosion control issues.
5	30+	19	8	8% of trails almost for sure require reroutes to meet TMOs and SMOs.

Entrenchment			
Range	**# Seg**	**% Total**	**Notes**
2” or more	121	52.4%	A large percentage of the Parma trails do not meet the TMOs or SMOs due lack of offsloping and gullying. Many of these are less than 5” and can be restored fairly easily.
5” or more	68	29.4%	Moderate entrenchment that will require adding dips so the water does not channel down the gullies for any length or removing enough of the outside berm to restore outsloping.
8” or more	38	16.5%	More serious entrenchment may require slight adjustments of the trail to create a curvilinear flow that gets water off the trail every 20 yards or so.
10” or more	31	13.4%	Serious entrenchment often characteristic of abandoned jeepways or jeepways that have poor drainage. May require some trail realignment on top of the berm in places where it is too wide to completely remove.

Offslope				
Grade ID	**Range**	**# Seg**	**% Total**	**Notes**
0	Gullied	118	51%	More than half the Parma trails have some level of entrenchment so that there is no outsloping. Water is flowing down trail and not sheeting off it.
1	1-4	44	19%	Just under 1/5 of the trails have a small amount of offsloping but not quite enough to do a good job of sheeting water off the trail.
2	5-8	39	17%	Less than 1/5 of the trails have the appropriate amount of offsloping.
3	9-12	19	8%	A small amount of the trails has slightly more offsloping and is within the level of being acceptable.
4	13+	11	5%	A very small amount of the trails has enough hillside slumping or other issues that have created an offslope that needs to be corrected.

Erosion Control			
Range	**# Seg**	**% Total**	**Notes**
Poor	127	78%	More than ¾ of the erosion control features were judged as not being effective in getting water off the trail.
Fair	29	18%	Less than 1/5 of the features were effective at all in getting water of the trail. These were located mostly along the Stanwood trails.
Good	5	3%	All of those rated as good were rolling grade type dips.
Excellent	1	>1%	The one feature rated as excellent was a rolling grade dip.

Trail Width (Excludes Jeepways and Paved Road)			
Range	**# Seg**	**% Total**	**Notes**
0-24	99	51%	Almost half of the Parma trails are less than 24” in width and many of these less than 18”-20”.
25-36	64	32%	Another ¼ of the trails are close to the Class 3 TMO width of 36” but in areas with steep sideslopes should probably be widened.
37-48	30	16%	12% of the trails either meet TMOs or may be wider than needed.
49-60	2	1%	19% of trails need serious restoration including trail realignments or rerouting to solve erosion control issues.

Trail Condition			
Condition	**# Seg**	**% Total**	**Notes**
Poor	78	33.8%	Many of these trails have excessive grade, switchbacks that create erosion and safety issues and poorly designed waterbars. These will create the major challenges for transitioning to sustainability.
Fair	84	36.4%	Quite a few of these trails have poorly designed waterbars and minor entrenchment. These trails will require more work to make sustainable but can be fixed fairly easily.
Good	69	29.8%	Just under 30% of the trails are in reasonably good condition and require converting exiting waterbars to kicks or dips and removing small amounts of entrenchment to restore the outslope.

APPENDIX 2. Segment Conversion Chart

CREEK SYSTEM		
New	Previous	Notes
C1	C4	C4 not shown accurately on the map.
C2	C1c, C1d	Not shown accurately, confusing to have 2 designations
C3	C5, c1f	Better assessed as one longer segment
C4	C6	Olive Grove segment; C4 fits better in the sequence
C5	C1c	Better fit sequentially
C6	C1b	Better fit sequentially
C7	C2	Better fit sequentially
C8	C3	Better fit sequentially
C9	C1a	Better fit sequentially; might consider removing this from the Creek System and including it in the Plateau System

STANWOOD SYSTEM		
New	Previous	Notes
S1	S1	No change but segment ends at S2 intersection
S2	S2	No change
S3	S1	Better assessed by breaking this part of S1 into two segments
S4	S1	Better assessed by breaking this part of S1 into two segments
S5	S3	Better assessed by breaking this part of S3 into two segments
S6	S3	Better assessed by breaking this part of S3 into two segments

APPENDIX 3. Trail Segment Data

#	System	Segment	Type	Grade	Width	Offslope	Entrench	Sideslope	Condition	Length-Ft
1	Creek	C4	Trail	2	28	10	0	0	Good	57.56
2	Creek	C4	Trail	9	32	0	6	0	Fair	309.38
3	Creek	C4	Trail	0	48	0	8	0	Fair	49.26
4	Creek	C4	Trail	15	28	2	0	0	Fair	55.41
5	Creek	C4	Trail	15	60	0	0	30	Fair	35.30
6	Creek	C5	Trail	9	16	0	9	55	Poor	217.44
7	Creek	C5	Trail	12	16	0	4	40	Fair	45.36
9	Creek	C5	Trail	20	18	0	4	20	Poor	71.47
10	Creek	C5	Trail	30	16	0	18	0	Poor	100.94
12	Creek	C5	Trail	7	30	0	2	20	Good	147.89
13	Creek	C5	Trail	10	14	12	0	25	Fair	59.53
14	Creek	C5	Trail	10	14	12	0	25	Fair	95.22
15	Creek	C6	Trail	5	24	3	2	25	Good	359.23
16	Creek	C6	Trail	5	24	3	2	25	Good	223.69
17	Creek	C7	Trail	15	12	0	15	0	Poor	135.87
18	Creek	C9	Trail	14	24	20	0	20	Poor	80.89
19	Creek	C9	Trail	0	15	0	4	18	Fair	85.63
20	Creek	C9	Trail	8	18	0	6	22	Fair	172.49
21	Creek	C9	Trail	2	16	0	2	25	Good	82.14
22	Creek	C9	Trail	0	18	0	2	40	Good	47.42
23	Creek	C9	Trail	8	18	0	6	40	Good	56.76
24	Creek	C9	Trail	22	120	2	0	0	Good	77.99
25	Creek	C9	Trail	20	15	0	2	20	Fair	64.65
26	Creek	C9	Trail	35	14	0	1	30	Fair	50.05
27	Creek	C9	Trail	17	15	8	0	30	Poor	220.36
28	Creek	C8	Trail	18	12	3	1	23	Poor	172.39
29	Creek	C8	Trail	18	12	14	0	20	Poor	160.54
30	Creek	C8	Trail	22	15	7	1	25	Poor	68.06
31	Creek	C8	Trail	32	24	0	36	48	Poor	28.76
32	Creek	C8	Trail	16	24	12	1	26	Good	111.21
33	Creek	C8	Trail	16	24	7	2	54	Good	87.92
34	Creek	C8	Trail	5	24	7	1	20	Good	72.20
35	Creek	C8	Trail	6	36	12	2	19	Fair	31.10
36	Creek	C8	Trail	17	30	0	7	28	Poor	48.32
37	Creek	C8	Trail	24	28	0	3	30	Fair	29.96
38	Creek	C8	Trail	17	24	0	4	29	Poor	72.09
39	Creek	C8	Trail	15	24	4	2	20	Fair	38.59
40	Creek	C2	Trail	36	32	8	0	0	Good	38.21
41	Creek	C2	Trail	9	26	7	0	50	Good	74.41
42	Creek	C2	Trail	20	36	0	6	45	Good	59.53
43	Creek	C2	Trail	20	40	0	8	40	Fair	33.12
44	Creek	C2	Trail	9	42	0	4	40	Fair	70.15
45	Creek	C2	Trail	16	42	0	6	40	Good	85.82
46	Creek	C2	Trail	22	36	0	5	40	Fair	82.44
47	Creek	C2	Trail	3	28	5	0	45	Good	120.57
48	Creek	C2	Trail	29	30	0	8	50	Poor	86.07
49	Creek	C3	Trail	7	38	12	2	30	Fair	174.96

#	System	Segment	Type	Grade	Width	Offslope	Entrench	Sideslope	Condition	Length-Ft
50	Creek	C3	Trail	11	42	9	4	65	Fair	65.72
51	Creek	C3	Trail	4	42	2	0	35	Good	165.58
52	Creek	C3	Trail	2	42	0	1	35	Good	94.21
53	Creek	C3	Trail	5	42	9	3	70	Good	141.25
54	Creek	C3	Trail	2	40	0	0	30	Good	52.83
55	Creek	C3	Trail	12	36	0	5	55	Good	201.51
56	Creek	C4	Trail	3	28	0	2	20	Good	100.24
57	Creek	C4	Trail	26	36	0	6	55	Fair	162.42
58	Creek	C4	Trail	3	24	5	0	35	Good	42.48
59	Creek	C3	Trail	3	24	1	0	35	Good	62.71
60	Creek	C3	Trail	2	32	5	2	35	Good	69.43
61	Creek	C3	Trail	17	28	4	2	35	Good	31.93
62	Creek	C3	Trail	22	20	4	0	35	Fair	66.94
63	Creek	C3	Trail	8	22	4	0	25	Good	51.89
100	Private	P	Trail	5	36	6	2	64	Fair	63.52
101	Private	P	Trail	2	42	0	1	60	Good	149.51
102	Private	P	Trail	14	38	0	10	28	Poor	66.70
103	Private	P	Trail	4	48	0	4	60	Good	257.67
104	Private	P	Trail	10	72	0	12	52	Good	206.35
105	Private	P	Trail	10	32	0	8	68	Fair	168.87
106	Private	P	Trail	2	28	0	2	62	Good	75.41
107	Private	Pr	Trail	10	40	0	12	20	Poor	195.66
108	Private	Pr	Trail	12	48	0	24	35	Poor	141.45
109	Private	Pr	Trail	7	48	0	15	65	Fair	157.98
110	Private	Pr	Trail	8	60	0	14	0	Fair	221.36
111	Private	Pr	Trail	3	32	0	12	43	Fair	95.62
112	Private	Pr	Trail	18	15	15	24	90	Poor	101.39
113	Private	Pr	Trail	2	28	0	0	0	Good	112.48
114	Private	Pr	Trail	16	42	0	12	38	Poor	58.18
115	Private	Pr	Trail	10	42	0	2	35	Good	96.17
116	Private	Pr	Trail	22	34	22	0	77	Poor	96.36
117	Private	Pr	Trail	30	24	0	4	77	Poor	30.71
136	Ridge	R2	Trail	9	100	0	0	20	Fair	129.79
200	Plateau	P1	Trail	9	36	0	4	0	Fair	33.14
201	Plateau	P1	Trail	25	40	0	6	0	Fair	134.42
202	Plateau	P1	Trail	29	36	0	14	0	Poor	144.78
203	Plateau	P1	Trail	20	40	6	0	15	Fair	159.92
204	Plateau	P1	Trail	7	24	5	2	15	Fair	110.52
205	Plateau	P1	Trail	24	32	0	4	20	Fair	165.67
206	Plateau	P1	Trail	26	32	0	4	20	Poor	194.18
207	Plateau	P1	Trail	36	32	0	12	30	Poor	52.32
208	Plateau	P1	Trail	16	16	0	2	55	Poor	30.42
209	Plateau	P1	Trail	22	16	7	12	75	Poor	35.58
210	Plateau	P4	Trail	34	16	7	24	80	Poor	32.20
211	Plateau	P4	Trail	5	24	12	0	25	Fair	106.91
212	Plateau	P4	Trail	30	24	0	4	0	Poor	88.21
213	Plateau	P4	Trail	18	18	12	4	30	Poor	117.10

#	System	Segment	Type	Grade	Width	Offslope	Entrench	Sideslope	Condition	Length-Ft
214	Plateau	P4	Trail	28	36	0	10	45	Poor	67.69
215	Plateau	P4	Trail	5	12	0	2	10	Good	134.67
216	Plateau	P4	Trail	7	12	0	3	10	Good	59.34
217	Plateau	P4	Trail	0	12	0	2	10	Good	52.63
218	Plateau	P4	Trail	8	15	0	4	10	Good	107.11
219	Plateau	P4	Trail	4	15	2	2	10	Good	183.56
220	Plateau	P4	Trail	22	15	0	2	0	Fair	41.07
221	Plateau	P4	Trail	23	14	0	2	0	Fair	43.79
222	Plateau	P4	Trail	15	24	0	4	0	Fair	43.70
223	Plateau	P4	Trail	11	14	0	4	0	Poor	119.86
224	Plateau	P4	Trail	6	12	0	3	0	Poor	141.91
225	Plateau	P4	Trail	13	12	0	3	0	Poor	252.73
226	Plateau	P4	Trail	1	12	0	2	0	Fair	128.12
227	Plateau	P4	Trail	0	12	0	2	0	Fair	61.45
228	Plateau	P4	Trail	10	15	0	2	0	Fair	81.03
229	Plateau	P4	Trail	15	15	0	3	0	Poor	148.17
230	Plateau	P4	Trail	28	18	0	18	0	Poor	21.47
300	Stanwood	S1	Trail	23	24	0	2	29	Good	70.54
301	Stanwood	S1	Trail	14	18	3	2	48	Fair	157.44
302	Stanwood	S1	Trail	26	24	0	18	30	Poor	62.87
303	Stanwood	S1	Trail	16	36	7	2	40	Fair	342.58
304	Stanwood	S1	Trail	13	30	5	2	30	Fair	127.74
305	Stanwood	S1	Trail	12	36	12	2	27	Fair	63.07
306	Stanwood	S1	Trail	6	30	5	0	29	Good	45.94
307	Stanwood	S1	Trail	15	36	7	1	28	Good	102.27
308	Stanwood	S2	Trail	36	36	0	3	0	Poor	53.66
309	Stanwood	S2	Trail	22	32	0	5	25	Poor	95.96
310	Stanwood	S2	Trail	22	48	0	14	20	Poor	61.00
311	Stanwood	S2	Trail	22	42	0	3	20	Fair	34.53
312	Stanwood	S2	Trail	20	48	0	4	0	Fair	36.53
313	Stanwood	S3	Trail	8	24	3	2	40	Fair	67.67
314	Stanwood	S3	Trail	24	24	2	2	62	Poor	76.43
315	Stanwood	S3	Trail	8	26	7	1	65	Fair	52.42
316	Stanwood	S3	Trail	23	48	5	3	49	Fair	62.85
317	Stanwood	S3	Trail	18	34	5	3	40	Fair	73.21
318	Stanwood	S3	Trail	21	34	14	4	40	Poor	113.51
319	Stanwood	S3	Trail	23	30	8	4	45	Fair	137.79
320	Stanwood	S3	Trail	10	24	6	6	62	Fair	99.64
321	Stanwood	S3	Trail	29	18	7	2	80	Poor	83.13
322	Stanwood	S3	Trail	2	28	2	0	70	Good	29.90
323	Stanwood	S3	Trail	28	20	4	3	74	Poor	30.88
324	Stanwood	S3	Trail	20	20	7	2	68	Poor	100.12
325	Stanwood	S3	Trail	16	15	12	0	75	Poor	72.10
326	Stanwood	S3	Trail	16	15	18	0	54	Poor	116.59
327	Stanwood	S3	Trail	7	15	9	0	60	Fair	51.88
328	Stanwood	S3	Trail	32	12	12	1	65	Poor	47.97
329	Stanwood	S3	Trail	14	12	7	0	55	Poor	44.65

#	System	Segment	Type	Grade	Width	Offslope	Entrench	Sideslope	Condition	Length-Ft
330	Stanwood	S3	Trail	38	48	0	0	0	Good	87.99
331	Stanwood	S4	Trail	8	24	1	4	80	Good	227.12
332	Stanwood	S4	Trail	15	18	1	7	40	Fair	149.87
333	Stanwood	S4	Trail	5	22	0	4	70	Fair	92.99
334	Stanwood	S4	Trail	18	20	4	0	70	Poor	115.79
335	Stanwood	S4	Trail	10	24	4	6	70	Poor	94.15
336	Stanwood	S4	Trail	26	48	6	8	60	Poor	98.00
337	Stanwood	S4	Trail	6	26	0	7	60	Good	82.81
338	Stanwood	S4	Trail	15	18	3	0	60	Poor	180.93
339	Stanwood	S4	Trail	6	18	4	0	80	Poor	163.84
340	Stanwood	S4	Trail	18	30	3	0	80	Fair	169.80
341	Stanwood	S4	Trail	20	24	4	0	90	Poor	215.30
342	Stanwood	S4	Trail	8	24	1	3	85	Good	157.74
343	Stanwood	S4	Trail	10	32	1	4	85	Good	104.31
344	Stanwood	S6	Trail	20	28	6	0	40	Poor	97.68
345	Stanwood	S6	Trail	8	24	1	2	40	Fair	63.99
346	Stanwood	S6	Trail	30	24	10	0	40	Poor	48.77
347	Stanwood	S6	Trail	29	24	10	0	35	Poor	140.84
348	Stanwood	S6	Trail	7	24	1	1	40	Fair	34.64
349	Stanwood	S6	Trail	26	28	6	0	65	Poor	41.35
350	Stanwood	S6	Trail	10	32	4	0	50	Fair	115.08
351	Stanwood	S6	Trail	15	26	2	5	50	Fair	65.95
352	Stanwood	S6	Trail	10	26	3	0	40	Fair	221.20
353	Stanwood	S5	Trail	20	24	0	12	0	Fair	28.79
354	Stanwood	S5	Trail	31	24	0	20	0	Fair	24.70
355	Stanwood	S5	Trail	34	36	0	20	0	Poor	55.71
356	Stanwood	S5	Trail	32	28	0	12	0	Fair	42.75
357	Stanwood	S5	Trail	25	28	7	2	0	Fair	79.86
358	Stanwood	S5	Trail	28	24	8	2	40	Fair	112.67
359	Stanwood	S5	Trail	23	24	5	0	75	Good	109.61
360	Stanwood	S5	Trail	25	28	8	3	70	Good	40.18
361	Stanwood	S5	Trail	12	28	2	2	50	Good	69.45
362	Stanwood	S5	Trail	31	28	10	1	50	Good	50.41
363	Stanwood	S5	Trail	35	24	0	24	50	Fair	49.19
364	Stanwood	S5	Trail	18	24	8	2	0	Fair	51.05
400	Ridge	R1a	Trail	12	120	11	12	20	Poor	685.21
401	Ridge	R1b	Dirt Road	14	120	0	8	45	Fair	122.09
402	Ridge	R1b	Dirt Road	0	108	0	0	0	Good	92.20
403	Ridge	R1b	Dirt Road	16	120	14	4	45	Good	156.72
404	Ridge	R1b	Dirt Road	14	120	14	812	70	Good	307.53
405	Ridge	R1b	Dirt Road	14	120	6	5	60	Good	378.30
406	Ridge	R1b	Dirt Road	14	120	14	8	20	Poor	179.48
407	Stanwood	S1a	Oarma Trail	21	18	0	3	0	Poor	215.00
408	Ridge	R1b	Dirt Road	16	120	4	10	20	Fair	273.32
409	Ridge	R1b	Dirt Road	6	130	5	4	0	Fair	116.00
410	Ridge	R1b	Dirt Road	16	140	20	12	0	Poor	124.22
411	Ridge	R1b	Dirt Road	2	120	5	0	0	Good	106.48

#	System	Segment	Type	Grade	Width	Offslope	Entrench	Sideslope	Condition	Length-Ft
412	Ridge	R1b	Dirt Road	5	120	3	0	0	Fair	120.41
413	Ridge	R1b	Dirt Road	9	120	1	1	0	Good	140.99
414	Ridge	R1b	Dirt Road	2	120	2	0	0	Good	97.18
415	Ridge	R1b	Dirt Road	9	120	0	16	0	Fair	105.36
416	Ridge	R1b	Dirt Road	18	130	0	10	0	Fair	346.87
417	Ridge	R1b	Dirt Road	2	100	0	6	0	Good	313.85
418	Ridge	R1b	Dirt Road	12	120	0	12	0	Fair	54.33
419	Ridge	R1b	Dirt Road	27	98	2	20	0	Fair	213.19
420	Ridge	R4	Dirt Road	8	120	5	3	10	Good	131.94
421	Ridge	R4	Dirt Road	8	100	2	0	0	Good	123.01
422	Ridge	R3	Trail	18	22	4	9	20	Fair	201.51
423	Ridge	R3	Trail	15	28	9	4	41	Fair	63.34
424	Ridge	R3	Trail	12	32	0	4	41	Fair	27.47
425	Ridge	R3	Trail	11	32	0	4	41	Fair	38.66
426	Ridge	R3	Trail	20	36	0	10	10	Poor	72.74
427	Ridge	R3	Trail	8	120	0	8	0	Poor	92.73
428	Ridge	R5	Trail	18	26	5	1	50	Fair	50.97
429	Ridge	R5	Trail	23	24	0	4	65	Poor	197.54
430	Ridge	R5	Trail	22	24	0	4	65	Poor	101.64
431	Ridge	R5	Trail	31	24	0	3	55	Poor	90.96
432	Ridge	R1c	Dirt Road	34	120	0	8	0	Poor	231.00
433	Ridge	R1c	Dirt Road	22	120	0	12	0	Poor	232.31
434	Ridge	R1c	Dirt Road	0	120	4	4	0	Good	145.01
435	Ridge	R1c	Dirt Road	14	120	14	8	0	Good	143.22
436	Ridge	R7	Trail	10	120	0	2	0	Good	90.30
437	Ridge	R7	Trail	0	120	0	0	0	Good	148.64
438	Ridge	R1c	Dirt Road	22	120	0	3	0	Poor	175.00
439	Ridge	R6	Dirt Road	22	24	2	2	60	Poor	84.88
440	Ridge	R6	Dirt Road	4	24	0	2	60	Poor	106.57
441	Ridge	R6	Dirt Road	15	28	0	3	60	Poor	166.86
442	Ridge	R1c	Trail	4	120	0	0	0	Good	209.20
443	Ridge	R10	Trail	6	18	2	6	40	Fair	531.56
444	Ridge	R1c	Dirt Road	32	108	0	8	0	Fair	174.97
445	Ridge	R1c	Dirt Road	8	108	0	8	0	Good	164.86
446	Ridge	R1c	Dirt Road	26	108	0	6	0	Good	165.72
447	Ridge	R9	Trail	15	16	2	2	15	Poor	209.00
448	Ridge	R9	Trail	13	60	0	8	0	Poor	184.00
449	Ridge	R9	Trail	6	48	0	6	15	Poor	141.00
450	Ridge	R9	Trail	12	60	0	4	0	Poor	197.00
451	Ridge	R9	Trail	26	42	0	8	0	Poor	97.00
452	Ridge	R8	Trail	23	26	0	4	20	Poor	158.00
453	Ridge	R8	Trail	0	120	0	0	60	Good	606.00
454	Ridge	R7	Trail	10	18	0	2	85	Fair	409.00
455	Ridge	R7	Trail	10	18	0	2	85	Fair	172.00
456	Ridge	R7	Trail	27	36	0	18	40	Poor	515.00