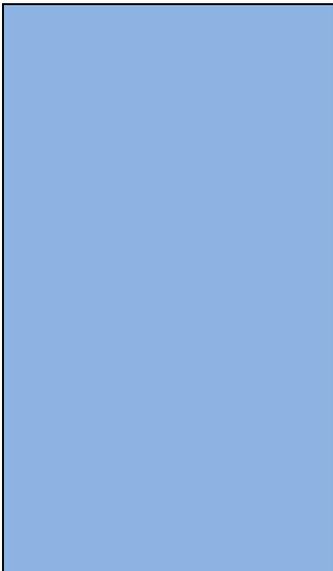




# Town of Oak Creek

Tramway Park Preliminary Master Plan

December 31, 2017 (Draft)



# TOWN OF OAK CREEK

## TRAMWAY PARK PRELIMINARY MASTER PLAN

*December 31, 2017 (DRAFT)*

### **Prepared for:**

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## SECTION ONE: INTRODUCTION

### PLAN OVERVIEW

The Town of Oak Creek's (Town) 2015 Comprehensive Plan Update (Comp Plan) identified the need to plan for the development of the approximately 8.5-acre Town-owned Tramway Subdivision property (hereinafter "Tramway Park"). A 9.44 acre parcel was acquired and subdivided (see Figure 1) in 2014 due to the property's proximity to the Public Works complex and the Town's Capital Improvement Plan's direction to obtain land to construct an additional Public Works shop, the remainder of the property remains available for other uses.

The Comp Plan identifies the community's continuing key concerns as "affordable housing, strengthening/diversifying the economy, and preserving Oak Creek's small town character (p. 6.) Relevant to this undertaking, the Comp Plan provides additional direction including

- Calling for the Town to "investigate all available means to implement housing initiatives" (p. 26); and
- Supporting and providing "incentives to encourage new and expanded local businesses in Oak Creek and to diversity commercial and retail services to better serve residents' and visitors' needs" (p. 23);

The Oak Creek Recreation Master Plan, Spring 2014 (Rec Master Plan) identified certain uses for Tramway Park (see Figure 2). An RV Park, tent campground and common amenity building/area are identified as desirable for this remainder property, noting that the intent of the campground would be "to allow for more tourists (hikers, bikers, hunters, fisherman, etc.) to be able to stay in Oak Creek and contribute to its local economy" (p. 33.) This endeavor is further specifically supported in the Comp Plan which states that the Town should "[d]evelop the town-owned property southwest of town limits as an RV park, campground, and public park" (p. 48.)

In May, 2017 the Town received matching funding from the Associated Governments of Northwest Colorado (AGNC), Routt County (County) and the State of Colorado Rural Economic Development Initiative (REDI) to complete a Preliminary Master Plan for Tramway Park (Master Plan) to "inform the development of a small home neighborhood, Tiny Home Area/RV Park/Tent Campground and associated community space" and to undertake the "initial planning and civil engineering necessary to move forward with this much needed development" (AGNC Grant Application). This effort was seen as a way to combine the direction of both plans in an efficient and effective way.

Patten Associates Inc., Civil Design Consultants Inc., and MGC Design Inc. were engaged as the consultant team (Consultants). The Master Plan process began In June, 2017 with a review of the existing data and platting information. Site visits were conducted by Town staff and the Consultants; utility infrastructure was analyzed. The gathered information was used to assess and analyze the property's site constraints and opportunities as well as the appropriate location(s) and viability for the identified uses.

A Conceptual Site Plan (Site Plan) included as Figure 3, incorporating the guidance provided in the Rec Master Plan and Comp Plan, the site constraints and opportunities analysis, and the infrastructure needs and requirements assessments, was developed in coordination with Town staff. Some highlights include:

- Reinforced that the first use of the land needed to accommodate the Town's Public Works Department needs.
- The southwest corner of the property provides a natural amphitheater site. An adjacent property was included and assessed for viable access to the natural amphitheater site;
- The 100-year floodplain bisects the property north-to-south along the existing drainage. While constrained from most types of development, the floodplain provides an amenity on the site conducive to recreational uses, e.g. nature park, trails and playground uses, as well as potentially handling increased drainage requirements due to development.
- The multiple uses planned and the variety of user-types, while potentially achieving the Town's goals regarding the types and amounts desired, will need to be carefully balanced. Consideration of how the commercial components of an RV Park and public amphitheater are matched to the internal and adjacent residential use(s) and how all are served by utility and road infrastructure will need careful planning.

The Site Plan was presented to Town Planning Commissioners in a work session format in December, 2017. The Consultants and staff sought feedback and direction on the concepts outlined on the Site Plan as well on needed next steps.

## USE OF THE PLAN

This Master Plan is intended to be a guideline for further action on the Town-owned Tramway Park property. The goals and objectives outlined in each section should be used to guide decision-makers and others who may wish to undertake the development of the property in an orderly and comprehensive manner. The Master Plan should remain dynamic and incorporate the guidance provided, the decisions that are made and undertakings determined to be prudent. While much additional work is needed to make such a reality, the community has a general road map for the property in this Master Plan.

### Action Items

*Undertake a process that encourages the community to participate in the design and funding decisions surrounding the vision and development of Tramway Park*

- Hold public work sessions with the Town Board and community members to solicit additional feedback and direction prior to the Town Board's acceptance of the Tramway Park Preliminary Master Plan (Master Plan)*
- Revise the Master Plan where and when necessary to ensure it provides accurate direction to Town policymakers and other interested parties*

## SECTION TWO: ENVIRONMENT

### INTRODUCTION

The Town of Oak Creek (Town) is located in Routt County, Colorado, at an elevation of approximately 7400 feet above sea level in Sections 31 and 32 of Township 5 North, Range 85 West of the Sixth Principal Meridian. Oak Creek enjoys an alpine climate, with typically a wet spring, mild summer, cool autumn and a long, snowy winter season.

The Town obtained the 8.43 acre parcel (Parcel) that is the focus of this Master Plan in 2014 to allow the expansion of the Public Works grounds that are directly adjacent to the Parcel and to “bank” the balance of the property for future Town endeavors.

### TRAMWAY PARK ENVIRONMENT

Situated and extending south from County Road 25 (CR25)/Soroco Storage to the edge of Rossi Meadow, the Parcel lies between the Highland View Addition Subdivision/Lillian Lane/Oak Creek Public Works campus area to the east and two residential parcels located in unincorporated Routt County to the west. The site is bisected north-south by a drainage coming from the adjoining agriculturally-used Rossi Meadow that follows the sloping site topography to the north under CR25 to Oak Creek, a small stream flowing through the town that bears its name less than one-half mile away. The following provides some information about the Parcel's environment with regard to soils, vegetation, wetlands, wildlife and visual character.

#### *GEOLOGY*

The far northern reaches of the Parcel have a steep topography with CR25 located at its toe. The north side of the adjacent CR25 in this area (downhill) has experienced slope failure in an area consisting of man-made fill materials placed over natural soils. It also appears that some slope movement has occurred on the south side (uphill) of the existing roadway adjacent or within this steep area of the Parcel (reference Appendix A).

#### *SOILS*

Routt Loam is the predominant soil type in the Rossi Meadow area. This is a deep, well-drained soil type, formed in loess and alluvium derived from sandstone and shale.

#### *VEGETATION*

Data on vegetation has been interpreted from references contained in the Comp Plan. The predominant vegetation on the open hillsides surrounding the Town including this Parcel, other than sagebrush, is grasslands and scrub oak. The Parcel is currently grazed, and there is a cluster of large mature cottonwood trees adjacent to CR25 where the drainage is gathered before moving under the County road.

#### *WETLANDS*

The Army Corps of Engineers define wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas". Determination of the location of wetlands, if any, located on the site will need to happen to any development activity.

## FLOODPLAINS

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Oak Creek and unincorporated Routt County contains information on floodplains. Map Number 08107C1039D, February 4, 2005, shows that a portion of the Parcel is located within the Zone A Floodplain (see Appendix B). It should be noted that the floodplain maps are very approximate in nature and should not be used for detailed planning. Additional on-site delineation of the extents of the property influenced by the floodplain will be necessary as the project moves forward.

### Action Items

1. *Natural vegetation shall be protected whenever possible.*
2. *Vegetation shall not be removed from areas that may contribute to a landslide, mudflow or debris flow. Areas of vegetation removed for construction shall be reclaimed with new vegetation.*
3. *Prior to seeking final project approval or construction activity in wetland areas, a qualified professional shall be retained to determine the full extent of potential wetlands.*
4. *Development in designated floodplain area(s) shall be discouraged, unless unavoidable. Any construction within the designated floodplain shall be designed to prevent damage due to flooding in accordance with FEMA guidelines and shall not be permitted to raise the flood elevation of upstream or downstream property.*
5. *The existing natural drainage ways shall be maintained in a natural state.*

## SECTION THREE: CONCEPT PLAN

### INTRODUCTION

The Consultants incorporated the information gathered during their assessment as well as the guidance provided in the Rec Master Plan and Comp Plan and developed the Conceptual Site Plan (Site Plan) included as Figure 3. The December work session provided a forum to refine the project and next steps that are needed to facilitate its successful development.

### TRAMWAY PARK COMPONENTS & FACILITIES

#### ➤ **Central Parking/Public Recreation Area**

The Site Plan includes a 20 space central parking lot surrounded by outdoor recreation facilities such as recreation courts, play area and picnic facilities, a trail over the drainage/stream to the amphitheater and restrooms, shuttle bus drop-off for the amphitheater.

#### ➤ **Public Works Building/Yard Expansion**

Extend Public Works facilities to west, adding approximately 1.5 acres of useable area. The Site Plan includes a location that is connected to the existing yard for a new 9,600 square foot Public Works building to west of the water tanks with a gated access to the internal Tramway Park road.

#### ➤ **Residential Neighborhood/Workforce Housing**

A residential neighborhood is proposed to be located along a north/south street on the eastern side of the Parcel and adjacent to the existing single family residential development along Lillian Lane. The neighborhood plan provides for up to 31 lots, most of which are 30' wide and 50' deep. These lots could accommodate "small houses" with 500 square feet footprints, which could be 1-2 bedroom units on one or two levels. The street design would provide a two-way street with two parking spaces per unit perpendicular to the street (reference Site Plan and Appendix C for street section graphic).

There are a variety of ways the residential area could be developed ranging from a subdivision with individual lots to a "lease community" (similar to a mobile home park) where "spaces" are rented on a per month basis and the development is managed by a single entity. Similarly, housing types could vary from small homes on foundations to tiny houses on wheels to RV "Park Models" (see Appendix C for example images).

#### ➤ **RV Park/Camping Area**

A small RV Park has been incorporated into the plan in the south central portion of the park. The plan indicates 5 full size RV drive-through spaces (see Site Plan), one full-size back-in space, a smaller drive-through space and a tent camping site on the southeast corner. The RV Park/Camping Area would connect to a new east-west "South Road" that would be an extension of Lillian Lane and also provide access to the residential neighborhood.

#### ➤ **Amphitheater and Park Accessory Building**

The sloped area west of the small stream/drainage lends itself to a nature setting amphitheater with a building that would accommodate the stage as well as a park building that could include central restrooms, showers, laundry and maintenance facility. A two track road connecting to the South Road would provide access to the building and an amphitheater event vendor area, along with a pathway to the central parking/recreation area and the RV Park. The amphitheater would

accommodate roughly 200 people sitting on seating improvements placed at grade within the hillside (see Appendix C for example image).

➤ **Amphitheater/Overflow Parking/Tent Camping Area**

An additional access road is proposed coming off CR 25 west of Soroco Storage. This access road would proceed to the south to a parking area of approximately 42 spaces above the amphitheater slope. The parking area could be used flexibly to accommodate other uses, e.g. tent camping, special vendor events.

➤ **Trail System**

A park trail system will connect all park uses and there are opportunities for future trail connections to other Town trails.

*Action Items*

1. *The development plan shall provide a balanced number of uses and facilities to achieve the Town's goals regarding the types and amounts of housing, recreation, park and commercial/institutional uses.*
2. *Pursue a lot line adjustment subdivision platting to appropriate divide the proposed Public Works building area from the Tramway Park development area.*
3. *Investigate and determine the housing type mix that is appropriate for the Tramway Park residential development including long- and short-term options, tiny homes, multi-family, and innovative opportunities.*
4. *Assure that a significant portion of the residential uses provide affordable work force housing.*
5. *Permit site built homes that meet the provisions of the International Residential Code including Appendix Q – Tiny Houses.*
6. *Determine the feasibility and practicality of the RV Park use and area, e.g. inclusion in the uses, need for redesign to accommodate additional or other camping uses such as tents and small trailers.*
7. *Establish the scope and area to be dedicated to outdoor recreation amenities and facilities in conjunction with the Town's overall needs.*
8. *Ascertain whether the amphitheater will fit the Town's vision for a viable outdoor venue of this type, including whether sufficient parking can be provide or whether transit options need to be explored, and what type of operations and programming management structure is needed.*
9. *Undertake the process to adopt Planned Unit Development regulatory provisions in the Oak Creek Land Use Code to permit flexibility for planned and mixed used development as a Land Use Change of Major Impact.*
10. *Determine what type of development structure is the most advantageous, financially and for the benefit of the Town and community-at-large, including models such as public/private partnerships, homeowner cooperatives, leasing and property management.*

## SECTION FOUR - INFRASTRUCTURE

### INTRODUCTION

Civil Design Consultants Inc. worked in coordination with the Town's Public Works Director to preliminarily assess the internal and external utility and road infrastructure needs, design issues and associated challenges associated with the development of the Tramway Park. Mind was also paid to the opportunities that have the potential to be resolved on surrounding Town infrastructure needs.

These efforts developed a list of items that will need further attention in a number of categories, some regardless of whether future development efforts align with the full scope of the Tramway Park Conceptual Site Plan or not. For example, the development of a new Public Works building may increase drainage needs, and require upgraded fire protection, water and sewer facilities. The scope of others may yet be unable to be determined until additional steps are taken to refine the development plan.

#### Action Items

#### ROADS

1. *Acquisition of the County-owned 30 foot wide strip along the south line of the Parcel is needed to accommodate the extension of Lillian Lane and other access needs onto the site.*
2. *Acquisition of a property interest must be acquired from the owner of the Soroco Storage property to allow the development of the West Road access from CR25 to the amphitheater parking area*
3. *Access permit(s) are required from Routt County for the development of the West Road access and for any changes to the Entry Road access at their intersections from County Road 25*
4. *Upon finalization of access points and internal roadway alignments, identify areas that may need rock walls*

#### WATER & SEWER

1. *Plan for the extension of water and sewer services to the west property line of the Parcel with the retention of easements in the development plan*
2. *Undertake a detailed report and analysis of the existing booster pump capacity for fire and domestic water needs*
3. *The installation of water mains within Tramway Park should be looped with an 8" line. The existing 4" water main located in Lillian Lane south of Oak Ridge Drive should be replaced to improve domestic, fire flows and system redundancy*
4. *Confirm condition and exaction location of raw water line bisecting the southeast corner of the Parcel to assure it is avoided with property improvements or realigned*
5. *Confirm the adequacy and conditions of sanitary sewer mains that will carry the additional load from the project*

6. *Confirm the right-of-way proposed to locate the sanitary sewer main north of the Parcel is sufficient*
7. *Water and sewer lines will need to go down side lot lines for the small residential lots. Such may require that the lots encumbered by water and sewer lines be widened*

#### *DRAINAGE*

1. *The increased run-off from the project may require a detention pond so as not to effectively increase the run-off to downstream drainage facilities. Drainage could be collected at or adjacent to the floodplain area. A water feature that will permanently retain water and have capacity to detain peak (2 or 5 year) storm water and is designed to allow for pass-through of larger storm events may be able to be incorporated.*
2. *The adequacy and conditions of the downstream culverts and ditches should be analyzed*
3. *Assure there is adequate drainage between the small residential lots. Such may require that lots encumbered by drainage facilities be widened*

#### *OTHER*

1. *Undertake additional survey work, wetlands delineation, geotechnical investigation and architectural efforts to allow for detailed design of next phase(s)*
2. *Obtain a detailed layout for the Public Works building including access points with correction radii for heavy equipment and layout for additional yard/laydown area*

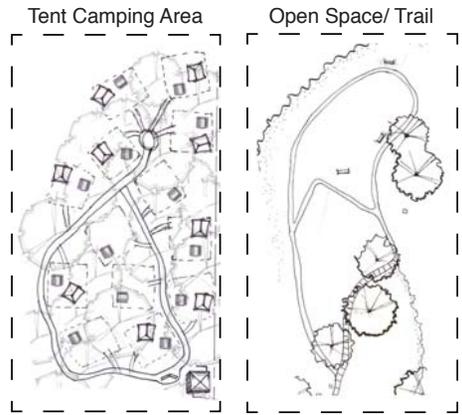
## FIGURES

FIGURE 1 – TRAMWAY SUBDIVISION PLAT

FIGURE 2 – RV PARK CONCEPT PLAN – OAK CREEK RECREATION MASTER PLAN,  
P. 33

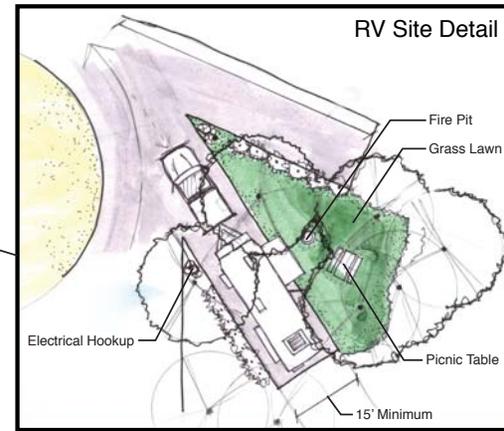
FIGURE 3 – TRAMWAY PARK CONCEPTUAL SITE PLAN





- Entrance
- Community Play Area
- Public Parking
- Volleyball Court
- Entrance Station
- Back-In RV Sites (8)
- Bathroom, Shower, and Laundry Facility

The design on the left (above) is a tent-campground concept. The design on the right is a trail and open play area. Both of these designs can be placed in different areas of the whole RV site. They are also both simple developments that could be moved if the town needs more space for the water plant to the east.



### RV Park

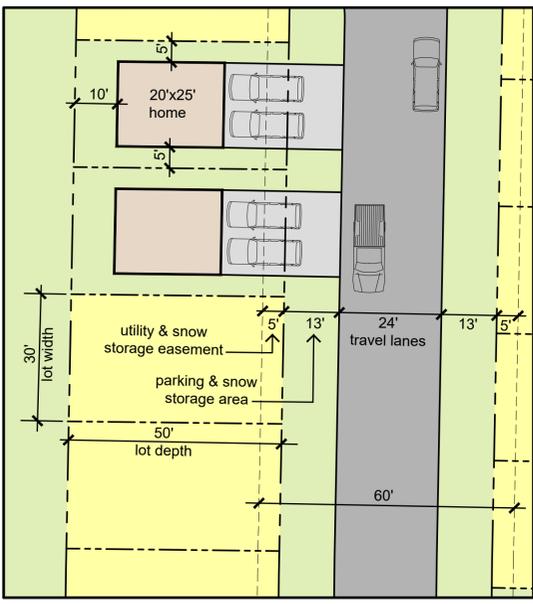
The area east and south of the storage units off of CR25 has been identified by the City of Oak Creek as an area for potential development of a new tent and RV campground. The intent of the campground is to allow for more tourists (hikers, bikers, hunters, fisherman, etc.) to be able to stay in Oak Creek and contribute to its local economy.

#### Current Programming:

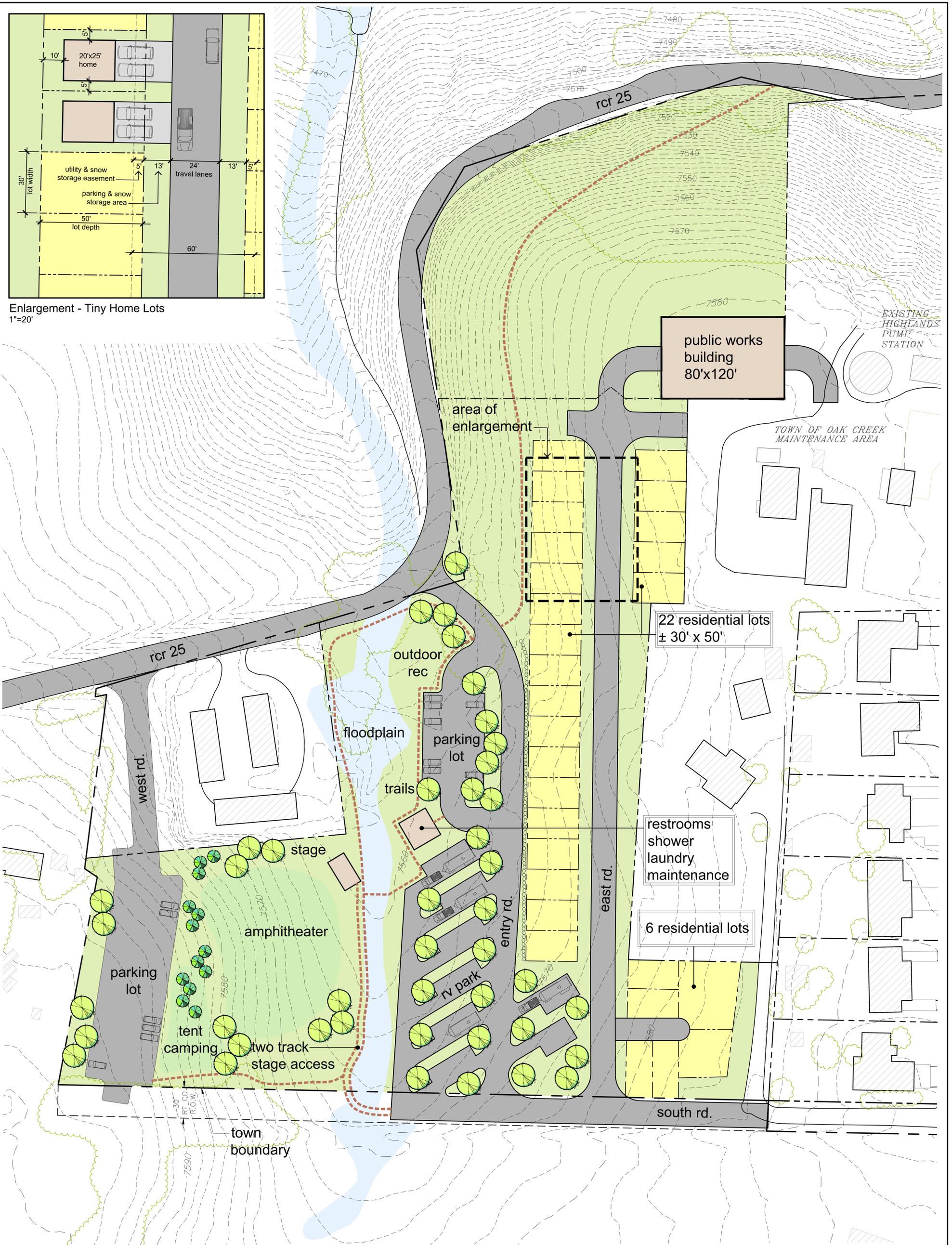
- None. The town is working to acquire this parcel

#### Proposed Programming:

- RV and tent campground
- Public park space

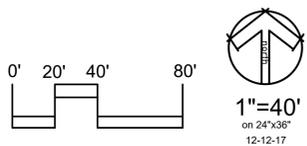


Enlargement - Tiny Home Lots  
1"=20'



# Tramway Park

Conceptual Site Plan  
Oak Creek, CO



Civil Design Consultants, Inc.  
Engineers and Planners



APPENDIX A:

GEOTECHNICAL INVESTIGATION AND PRELIMINARY SLOPE FAILURE EVALUATION

COUNTY ROAD #25 LANDSLIDE

NORTHWEST COLORADO CONSULTANTS

JULY 25, 2011



Geotechnical Investigation and Preliminary Slope Failure Evaluation  
County Road #25 Landslide  
Routt County, Colorado

Prepared For:

Routt County Road and Bridge  
Attn: Heather McLaughlin  
P.O. Box 773598  
Steamboat Springs, CO 80477

Job Number: 11-8938

July 25, 2011

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## **Conclusions**

The slope failure is likely the result of a combination of factors including groundwater/subsurface runoff perched over the claystone bedrock surface and steep topography. The existing outboard (downhill) slope of County Road #25 is currently in an unstable configuration and reconstruction is necessary to provide long-term stability.

NWCC believes there are at least three alternatives for stabilizing the slope and reconstructing the roadway. The slope may be reconstructed using properly drained embankment fill materials, mechanically stabilized earth (MSE) fill or a retaining wall system anchored into bedrock.

A discussion of the geologic and geotechnical considerations related to the slope failure and preliminary reconstruction recommendations are outlined herein.

## **Purpose and Scope of Study**

This report presents the results of a geotechnical investigation for the landslide that has occurred along the north side of County Road #25 and immediately southwest of the Town of Oak Creek in Routt County Colorado. The approximate location of the project site is shown in Figure #1.

A field exploration program was conducted on June 29, 2011 to obtain information on subsurface conditions at the site. Material samples obtained during the subsurface investigation were tested in NWCC, Inc.'s (NWCC) laboratory to provide data on the classification and engineering characteristics of the soils and bedrock materials. The results of the field and laboratory investigations are presented herein.

This report has been prepared to summarize the data obtained and to present NWCC's conclusions, preliminary design and construction alternatives and soil design parameters for stabilizing the roadway. Remediation and reconstruction of the failed slopes above and below the roadway is not considered part of NWCC's scope.

## **Site Conditions**

The subject site is located along County Road #25 and approximately 700 feet from its intersection with South Bell Avenue in Oak Creek, Colorado. A site plan showing existing features and approximate locations of the test holes is shown in Figure #2.

The landslide (slope failure) is located along the northern (downhill/outboard) side of County Road #25. The roadway section in the failure area appears to consist of man-made fill materials placed over natural soils. We observed two failure zones in this area both approximately 75' in length. They are separated by a 50' section of road way that has not yet failed as severely. It also appears that some landslide activities/slope movement has occurred to the south (uphill) of the existing roadway. Although no free groundwater was encountered at the time of drilling, we did notice evidence of seepage along the failure slope. The presence of water flowing through the fill materials and natural soils above the bedrock are more than likely responsible for the failure. Photographs of the landslide are presented in the attached Appendix A.

Although the debris flow is generally not vegetated due to the disturbance, natural vegetation in adjacent areas consists of dense deciduous brush and scrub oak with natural grasses and weeds. Natural topography of the site generally slopes steeply down to the north on the order of 20 to 30 percent.

## **Field Investigation**

The field investigation was conducted on June 29, 2011 and five (5) test holes were advanced within the right-of-way for County Road #25 at the approximate locations shown in Figure #2. The test holes were advanced through the existing fill materials, overburden soils and underlying bedrock materials with 4-inch diameter continuous flight power augers using a CME 55 truck-mounted drill rig.

Samples of the subsurface materials were taken with a 2-inch I.D. California liner sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. This test is similar to the standard penetration test described by ASTM Method D 153-86. Penetration resistance values, when properly evaluated, indicate the relative density or consistency of the materials. Depths at which the samples were taken and the penetration resistance values are shown on the logs of the exploratory test holes, Figure #3. The Legend and Notes associated with the logs are shown in Figure #4.

## **Laboratory Investigation**

Samples obtained from the exploratory test holes were examined and classified in the laboratory by the project manager for NWCC. Laboratory testing included standard property tests, such as natural moisture contents, dry unit weights, grain size analyses and liquid and plastic limits. Unconfined-compressive strength tests were also conducted on samples to evaluate the strength values of the fill materials, overburden soils and bedrock materials.

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The laboratory test results are summarized in the attached Table 1. The laboratory testing was conducted in general accordance with applicable ASTM specifications.

## **Subsurface Conditions**

The subsurface conditions encountered in the test holes were variable and generally consisted of a layer of road base fill materials overlying clay fill materials, natural clays/weathered claystone and claystone bedrock that extended to the maximum depth investigated in each of the test holes. Graphic logs of the test holes are shown in Figure #3 and the associated Legend and Notes are presented in Figure #4.

A layer road base fill materials was encountered at the ground surface in all test holes and was encountered to depths ranging from 1 ½ to 4 feet beneath the existing ground surface (bgs). A layer of clay fill materials was encountered beneath the road base fill materials in Test Holes 1, 2, 4 and 5. These fill materials extended to depths ranging from 5 to 9 feet bgs. The fill materials consisted of clays that were slightly sandy to sandy with occasional gravels, moderately to highly plastic, soft to stiff, moist to very moist and dark brown to brown in color. Samples of the fill materials classified as CL and CL-CH soils in accordance with the Unified Soil Classification System.

Natural clays/weathered claystone materials were encountered beneath the clay fill materials in Test Holes 1, 2, 4 and 5, as well as beneath the road base fill materials in Test Hole 3. These materials extended to depth ranging from 7 to 12 feet bgs. The natural clays/weathered claystone materials were nil to sandy, fine to medium grained, highly fractured, blocky, moderately to highly plastic, stiff to weathered, moist to very moist and brown to gray in color. Samples of the natural clays/weathered claystone materials classified as CL soils in accordance with the Unified Soil Classification System.

Claystone bedrock was encountered below the natural clays/weathered claystone materials in all of the test holes and extended to the maximum depth investigated in each test hole. The claystone bedrock was nil to slightly sandy, moderately to highly plastic, medium hard to very hard, slightly moist to moist and gray to dark gray in color. The bedrock samples classified as CL and CL-CH soils in accordance with the Unified Soil Classification System.

Unconfined-compressive strength testing of the clay fill materials yielded unconfined-compressive strength values ranging from 1,100 to 2,200 psf. Unconfined-compressive strength testing of the natural clays/weathered claystone bedrock yielded unconfined-compressive strength values ranging from 3,700 to 8,300 psf. Unconfined-compressive strength testing of the bedrock materials yielded unconfined-compressive strength values ranging from 10,400 to 13,800 psf. The laboratory test results are presented in Table 1.

Free groundwater was not encountered in the test holes at the time of drilling or when measured 14 days after the drilling was completed. Groundwater conditions can be expected to fluctuate significantly with changes in precipitation and runoff at the site.

### **Slope Failure Analysis**

Based on the results of the field and laboratory investigations, NWCC believes the slope failure can be characterized as a small sized slump displaying rotational and translational movement and appears to be located within the fill materials and natural clays/weathered claystone materials just above the competent bedrock surface. Groundwater seepage was observed on the exterior slopes in the failure areas. Caving of the test holes was also noted when measured two weeks after drilling. Caving is often indicative of loose soils and/or the presence of groundwater.

Steep topography and groundwater seepage in fill materials and underlying natural soils over relatively impervious bedrock is likely a major contributing factor in the slope failure. Increased loading and saturation of these soils can be a contributing factor to slope failure. Although surface drainage features related to the roadway may have altered site drainage from its historical pathways, impacts to groundwater flow and levels is unknown.

### **Preliminary Stabilization and Reconstruction Recommendations**

The outboard edge of the roadway is currently in an unstable condition, and measures should be taken to stabilize/reconstruct the roadway. NWCC believes there are at least several alternatives for stabilizing the head scarp area and reconstructing the outboard edge of the roadway. The alternatives indicated below are listed in the order of descending risk:

- Installation of underdrain systems beneath the roadway and construction of new embankment fills using conventional earth moving or rock/boulder fill techniques and without mechanical reinforcement (MSE) techniques (geogrid). The embankment fills using conventional earth moving techniques should be constructed with the finished face not exceeding a 2 (Horizontal) to 1 (Vertical) face; whereas, the rock/boulder fills may be constructed with a finished face of 1 (H) to 1 (V);
- Installation of underdrain systems beneath the roadway and construction of a mechanically stabilized earth (MSE) embankment fills using conventional earth moving fill techniques and geogrid reinforcement. This option could be completed with either a geogrid reinforced earthen face constructed at a 1(H) to 1(V) configuration or a vertical block masonry/precast concrete facing;

- Construction of a retaining wall system and underdrain system along the outboard edge of the roadway. There are at least several potential retaining wall system alternatives including; (a) soil nailed wall with shotcrete facing, (b) drilled and concrete encased or driven H-piles with treated timber lagging with or without tiebacks.

A qualified engineering design/build contractor should be retained for design and pricing of retaining system alternatives. NWCC can supply the client with a list of qualified engineering contractors. NWCC can provide design and construction recommendations suitable for construction using conventional, rock fill or MSE earth fill techniques.

The following soil properties should be used in the design of an MSE embankment fill or retaining wall system:

**Natural Soils and Existing Fills:** Density: 120 pcf; Phi Value: 15 degrees; Cohesion: 250 psf

**Bedrock:** Density: 130 pcf; Phi Value: 25 degrees; Cohesion: 1,500 psf

The on-site material that comprises the debris flow (with the exception of any organic materials) should be suitable for use in embankment or retaining wall fill, but may require moisture conditioning prior to use. All fill materials placed for embankment or retaining wall fill should be compacted to at least 95% of the maximum standard Proctor density and within 3 percent of the optimum moisture content as determined in accordance with ASTM D698.

The existing fill materials and underlying natural soils and weathered claystone materials must be removed and the excavations extended down to stable bedrock and incorporate benching of new embankment fills into bedrock for the three embankment reconstruction scenario's provided above. Benches should be continuous across the embankment and constructed to at least 6 feet in width in stable bedrock.

Underdrain systems will be required to intercept groundwater flowing near the bedrock surface. The underdrain systems should be incorporated into each embankment bench and generally consist of a 4-inch perforated PVC pipe (SDR35) covered with washed or screened ¾ -inch rock and covered with Mirafi 140N filter fabric, or an equivalent product. The individual drainage pipes should slope at least 2 percent to a common solid 4-inch PVC collection pipe that daylights away from the slope failure. The number of drains can be significantly reduced if rock/boulder fill materials are used to reconstruct the embankments.

## Limitations

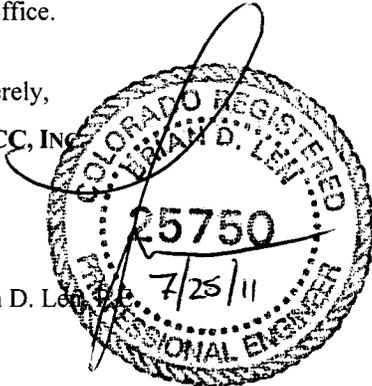
The recommendations given in this report are based on the soils, bedrock and groundwater conditions encountered in the test holes, and those exposed during this investigation. We believe that this information gives a high degree of reliability for anticipating the performance of the reconstructed/stabilized slope; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soils, bedrock or groundwater profiles beneath or adjacent to those observed. We do not guarantee the performance of the stabilized/reconstructed slopes in any respect, only that our engineering work and judgments meet or exceed the standard of care of our profession at the time they were rendered.

It should be stressed that the soil and groundwater conditions encountered at this site were highly variable and seasonal changes in groundwater levels should be expected. Additional dewatering efforts may be required to stabilize the slope.

If there are any further questions concerning this report, or if we may be of further service, please contact this office.

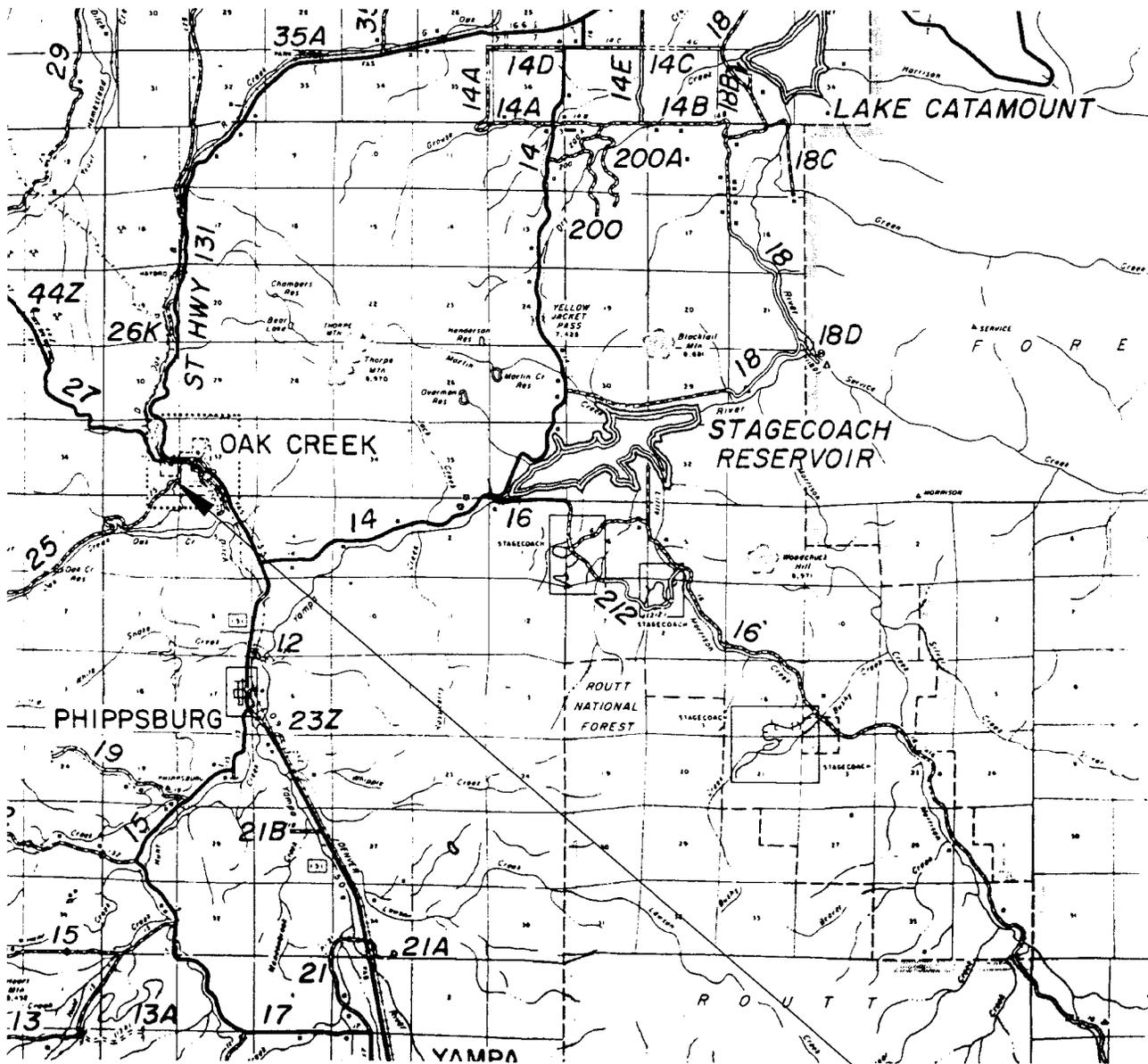
Sincerely,  
NWCC, Inc.

Brian D. Lee





NOT TO SCALE



PROJECT SITE

Title: VICINITY MAP

Date: 7/11/11

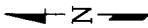
Job Name: RCR #25 Slide

Job No. 11-8938

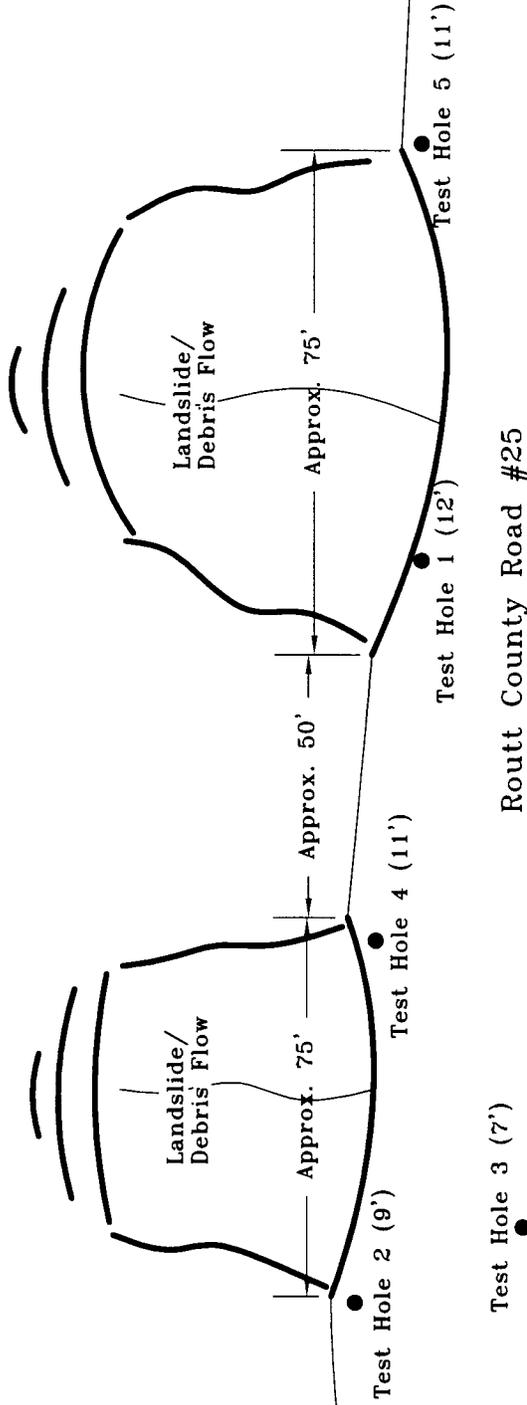
Location: County Road #25, Routt County, Colorado

Figure #1

**NWCC**  
North West Colorado Consultants, Inc.  
Geotechnical / Environmental Engineering - Materials Testing  
(970)879-7888 - Fax (970)879-7891  
2580 Copper Ridge Drive  
Steamboat Springs, Colorado 80487

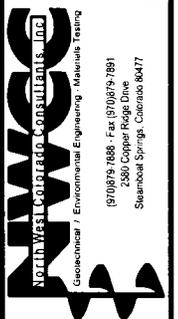


NOT TO SCALE



(12') = Indicates Depth to Bedrock  
● Test Hole 1 = Indicates Approximate Test Hole Location and Number

|  |                         |
|--|-------------------------|
| <b>Title:</b> SITE PLAN/LOCATION OF TEST HOLES           |                         |
| <b>Job Name:</b> RCR #25 Slide                           | <b>Date:</b> 7/11/11    |
| <b>LOCATION:</b> County Road #25, Routt County, Colorado | <b>Job No.:</b> 11-8938 |
|  | <b>Figure #:</b> 2      |



Test Hole 1

Test Hole 2

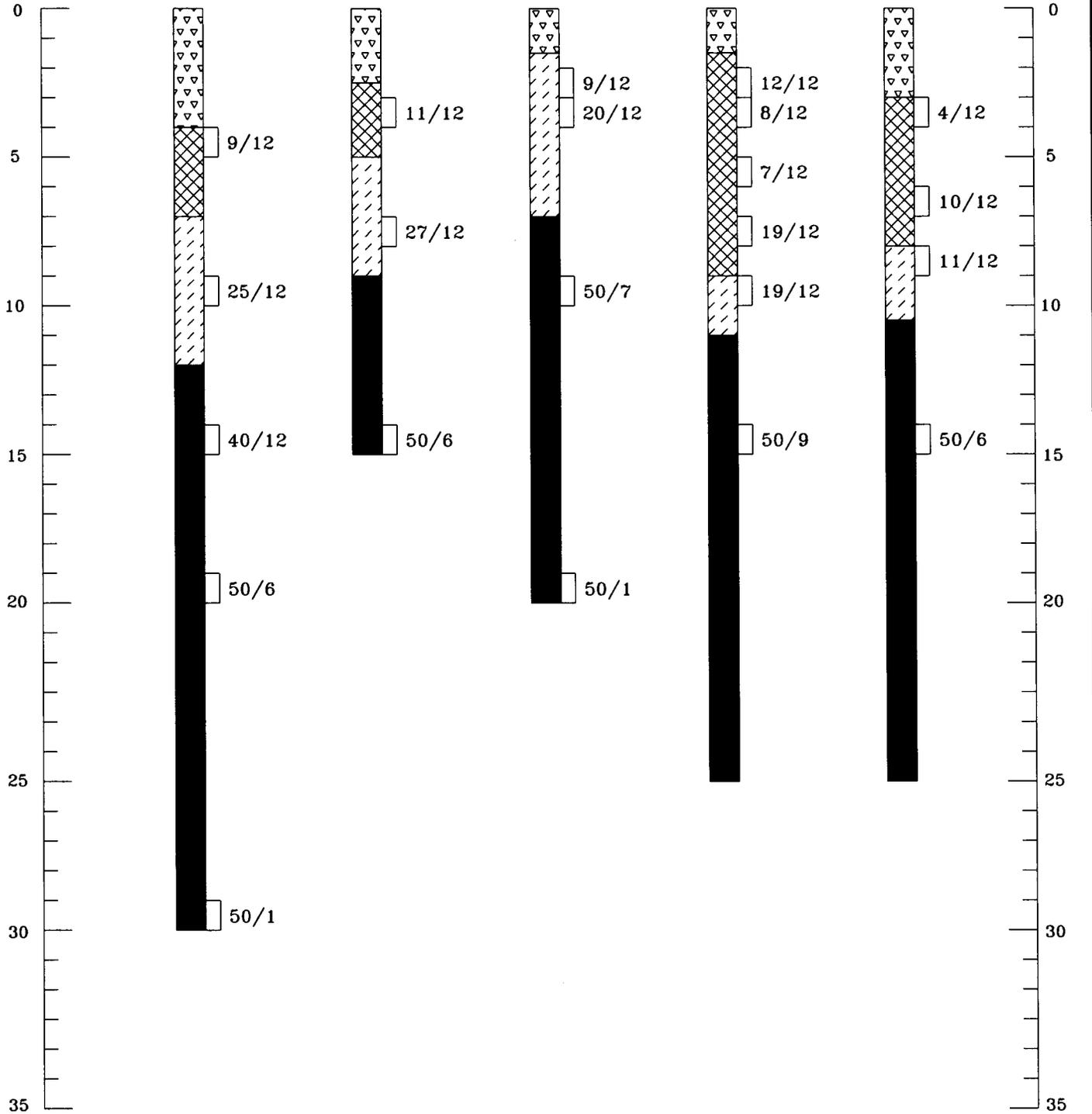
Test Hole 3

Test Hole 4

Test Hole 5

Depth (ft)

Depth (ft)



Title: LOGS OF EXPLORATORY TEST HOLES

Date: 7/11/11

Job Name: RCR #25 Slide

Job No. 11-8938

Location: County Road #25, Routt County, Colorado

Figure #3

**NWCC**  
 North West Colorado Consultants, Inc.  
 Geotechnical / Environmental Engineering - Materials Testing  
 (970)879-7888 - Fax (970)879-7891  
 2550 Copper Ridge Drive  
 Steamboat Springs, Colorado 80487

LEGEND:



ROAD BASE FILL:



FILL: Clays, slightly sandy to sandy with occasional gravels, moderately to highly plastic, soft to stiff, moist to very moist and dark brown to brown in color.



NATURAL CLAYS/WEATHERED CLAYSTONE: Nil to sandy, fine to medium grained, highly fractured, blocky, moderately to highly plastic, stiff to weathered, moist to very moist and brown to gray in color.



CLAYSTONE BEDROCK: Nil to slightly sandy, moderately to highly plastic, medium hard to very hard, slightly moist to moist and gray to dark gray in color.



Drive Sample, 2-inch I.D. California Liner Sampler.

9/12 Drive Sample Blow Count, indicates 9 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

NOTES:

- 1) The test holes were drilled on June 29, 2011 with a CME 55 truck mounted drill rig using 4-inch diameter continuous flight power augers.
- 2) Locations of the test holes were determined in the field by pacing from topographic features at the site.
- 3) Elevations of the test holes were not measured and logs are drawn to the depths investigated.
- 4) The lines between materials shown on the logs represent the approximate boundaries between material types and transitions may be gradual.
- 5) The water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water levels will probably occur with time.

|   |                 |  |
|---|-----------------|--|
| Title: LEGEND AND NOTES                           | Date: 7/11/11   |  |
| Job Name: RCR #25 Slide                           | Job No. 11-8938 |  |
| Location: County Road #25, Routt County, Colorado | Figure #4       |  |

NWCC, Inc.

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

| TEST HOLE | DEPTH (feet) | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | ATTERBERG LIMITS |                      | GRADATION  |          | PERCENT PASSING No. 200 SIEVE | UNCONFINED COMPRESSIVE STRENGTH (psf) | SOIL or BEDROCK DESCRIPTION    | UNIFIED SOIL CLASS. |
|-----------|--------------|------------------------------|---------------------------|------------------|----------------------|------------|----------|-------------------------------|---------------------------------------|--------------------------------|---------------------|
|           |              |                              |                           | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | GRAVEL (%) | SAND (%) |                               |                                       |                                |                     |
| 1         | 4            | 21.4                         | 101.3                     | 46               | 28                   | 1          | 7        | 92                            | 1,800                                 | Fill: Slightly Sandy Clay      | CL-CH               |
| 1         | 14           | 16.0                         | 112.6                     | 45               | 27                   | 0          | 13       | 87                            | 10,400                                | Claystone Bedrock              | CL-CH               |
| 2         | 3            | 20.0                         | 105.8                     | 49               | 35                   | 3          | 7        | 90                            | 2,200                                 | Fill: Slightly Sandy Clay      | CL-CH               |
| 2         | 7            | 12.1                         | 121.6                     | 35               | 18                   | 0          | 16       | 84                            | 8,300                                 | Sandy Clay/Weathered Claystone | CL                  |
| 3         | 3            | 14.1                         | 118.3                     | 40               | 22                   | 4          | 19       | 77                            | 3,700                                 | Sandy Clay/Weathered Claystone | CL                  |
| 4         | 5            | 30.8                         | 84.2                      | 43               | 18                   | 3          | 24       | 73                            | 1,100                                 | Fill: Sandy Clay               | CL                  |
| 4         | 9            | 16.9                         | 111.1                     | 44               | 28                   | 1          | 12       | 87                            | 5,000                                 | Sandy Clay/Weathered Claystone | CL                  |
| 4         | 14           | 12.6                         | 120.0                     | 39               | 19                   | 0          | 1        | 99                            | 12,400                                | Claystone Bedrock              | CL                  |
| 5         | 6            | 20.9                         | 99.2                      | 42               | 25                   | 2          | 20       | 78                            | 3,300                                 | Fill: Sandy Clay               | CL                  |
| 5         | 14           | 11.4                         | 116.8                     | 38               | 21                   | 0          | 2        | 98                            | 13,800                                | Claystone Bedrock              | CL                  |
|           |              |                              |                           |                  |                      |            |          |                               |                                       |                                |                     |
|           |              |                              |                           |                  |                      |            |          |                               |                                       |                                |                     |
|           |              |                              |                           |                  |                      |            |          |                               |                                       |                                |                     |

**Appendix A**  
**Photographs**

# County Road #25 Slide



June 29, 2011, Looking to the east



June 29, 2011, Looking to the west

APPENDIX B:

FLOOD INSURANCE RATE MAP NUMBER 08107C1039D FIRMETTE

24120 COUNTY ROAD 25, OAK CREEK



APPENDIX C:

EXAMPLE GRAPHICS

# Tramway Park Residential Neighborhood Image Board



20'-0"  
(6,10)

