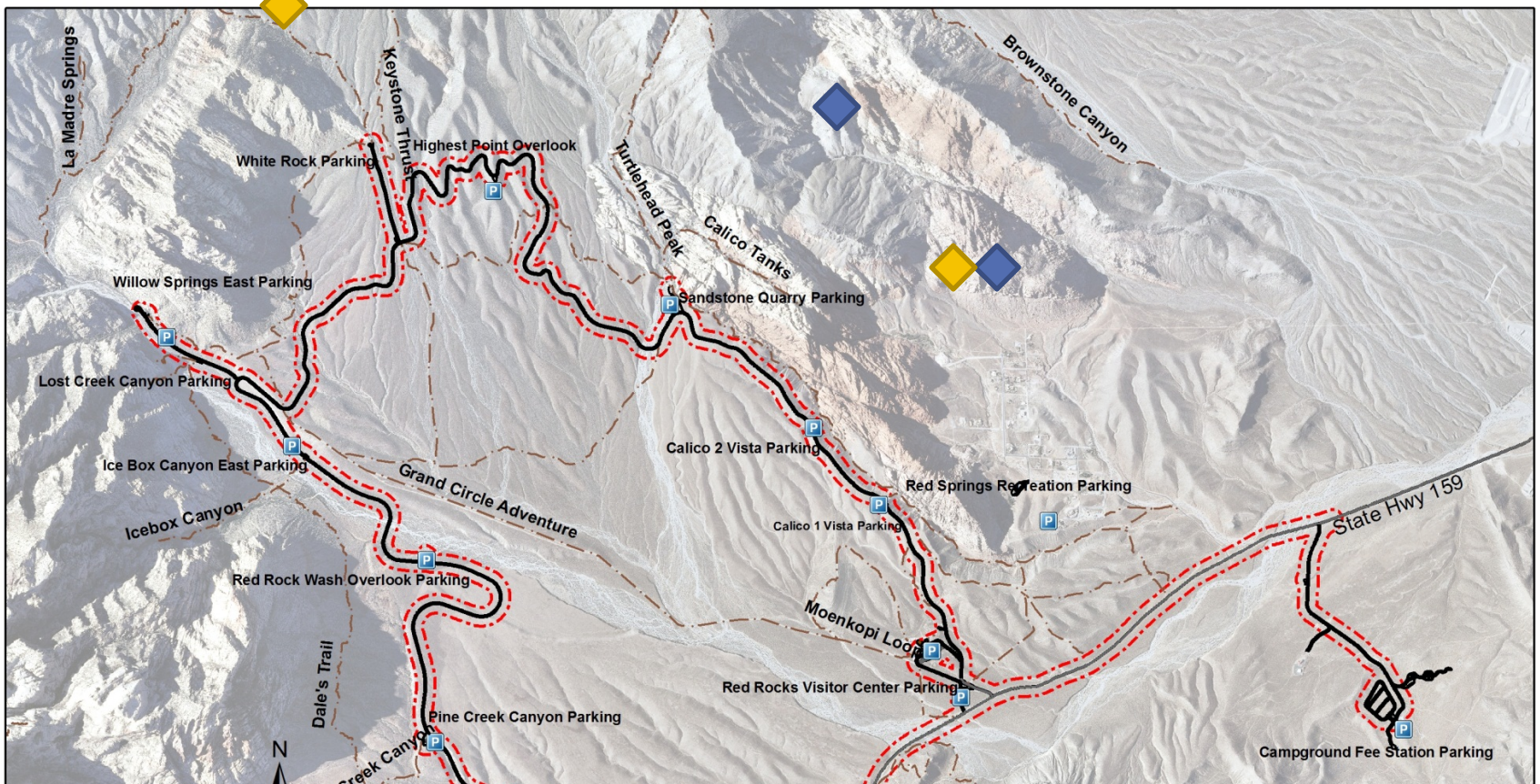
Appendix I: Maps of New Signs

Location of New Signage

- Share the Road and Bicycles May Use Full Lane
- Keep Right Except to Pass, Pass with Care, Slower Drivers Use Pullouts

Red Rock Canyon National Conservation Area Base Map



Signage on Scenic Drive

W16-1P

R4-2

R4-16

R4-11

All signs from Manual on Uniform Traffic Control Devices for Streets and Highways, 2009 Edition. Federal Highway Administration.

Appendix II: Parking Reconfigurations and Expansions

Separate File (16 pages)

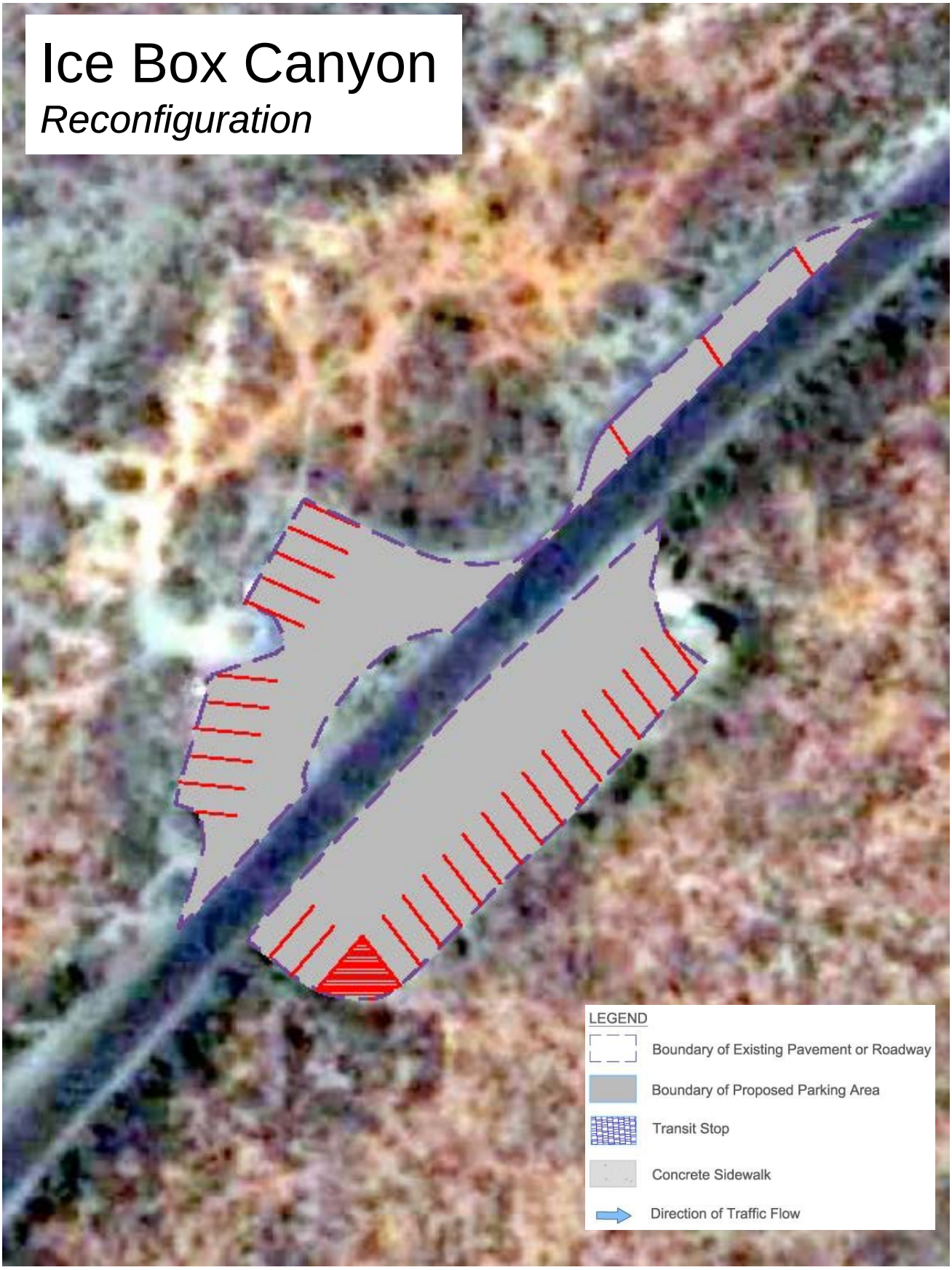
Calico Vista II

Reconfiguration

Lost Creek
Reconfiguration

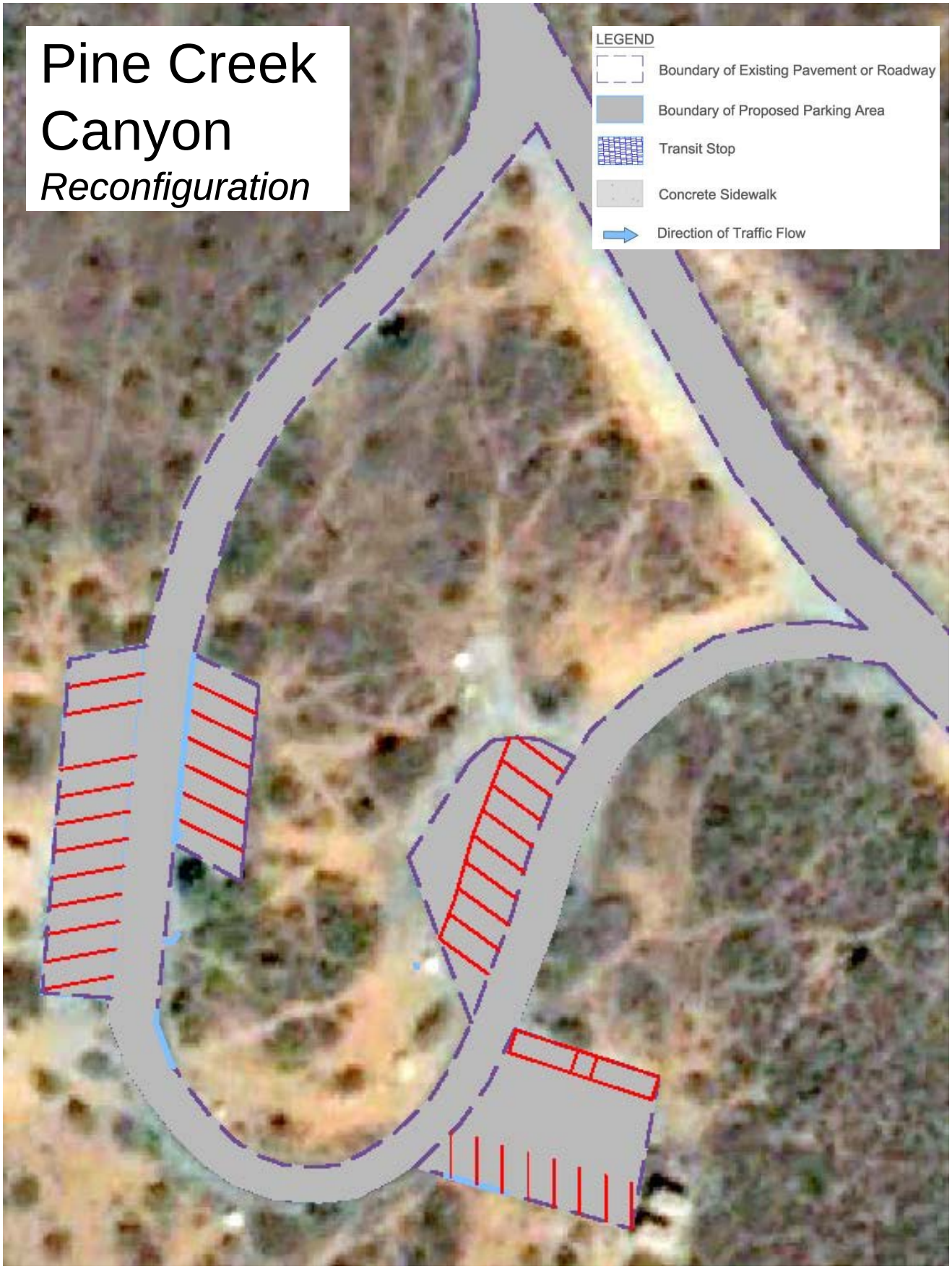
Ice Box Canyon

Reconfiguration



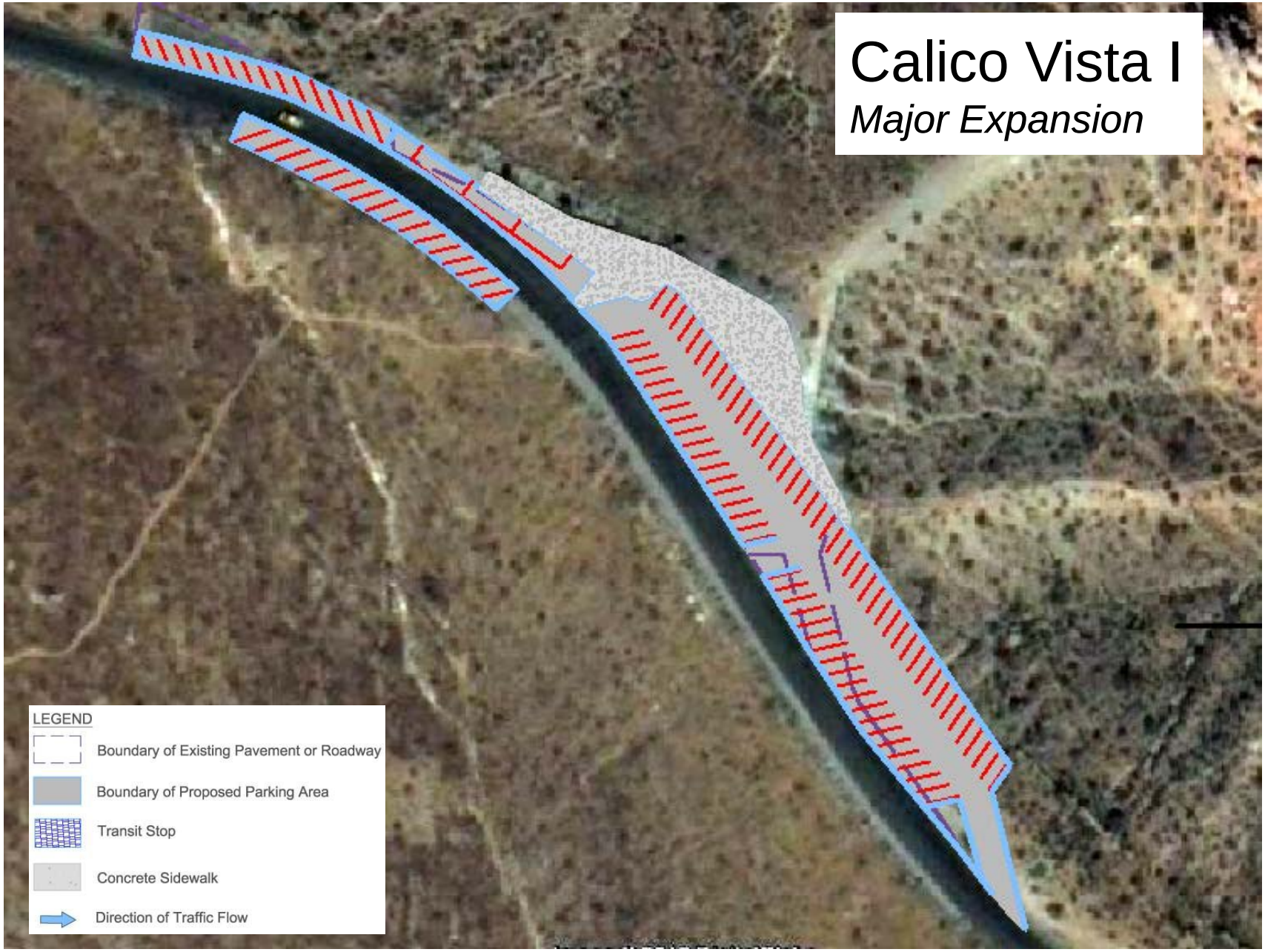
Pine Creek Canyon

Reconfiguration



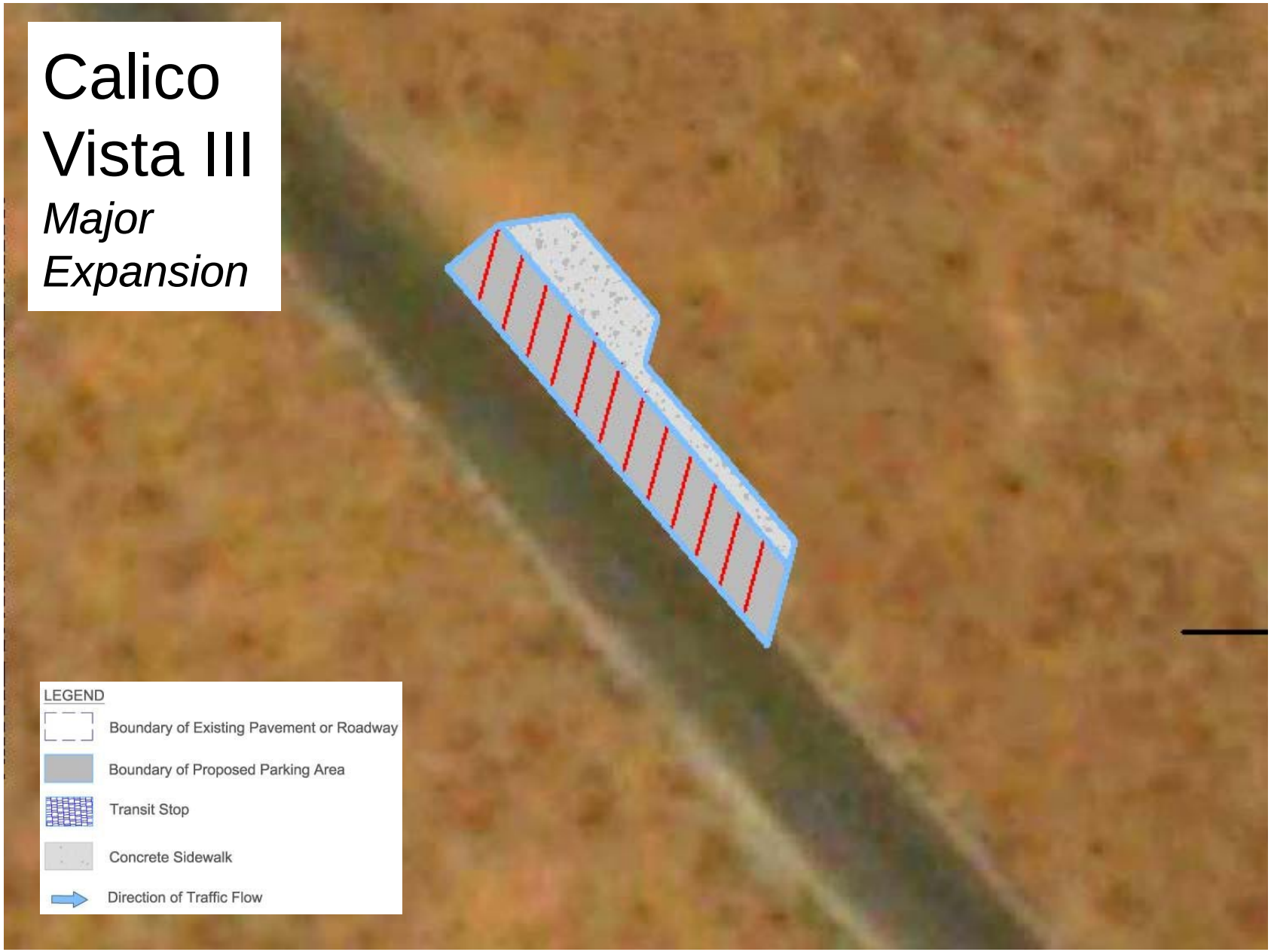
Major Parking Expansion (Alternative A)

- Examples shown for:
  - Calico I
  - Calico III (new lot)
  - Pine Creek Canyon
- Other lots will be the same as in Limited Parking Expansion


Calico Vista I
Major Expansion
LEGEND
Boundary of Existing Pavement or Roadway
Boundary of Proposed Parking Area
Transit Stop
Concrete Sidewalk
Direction of Traffic Flow

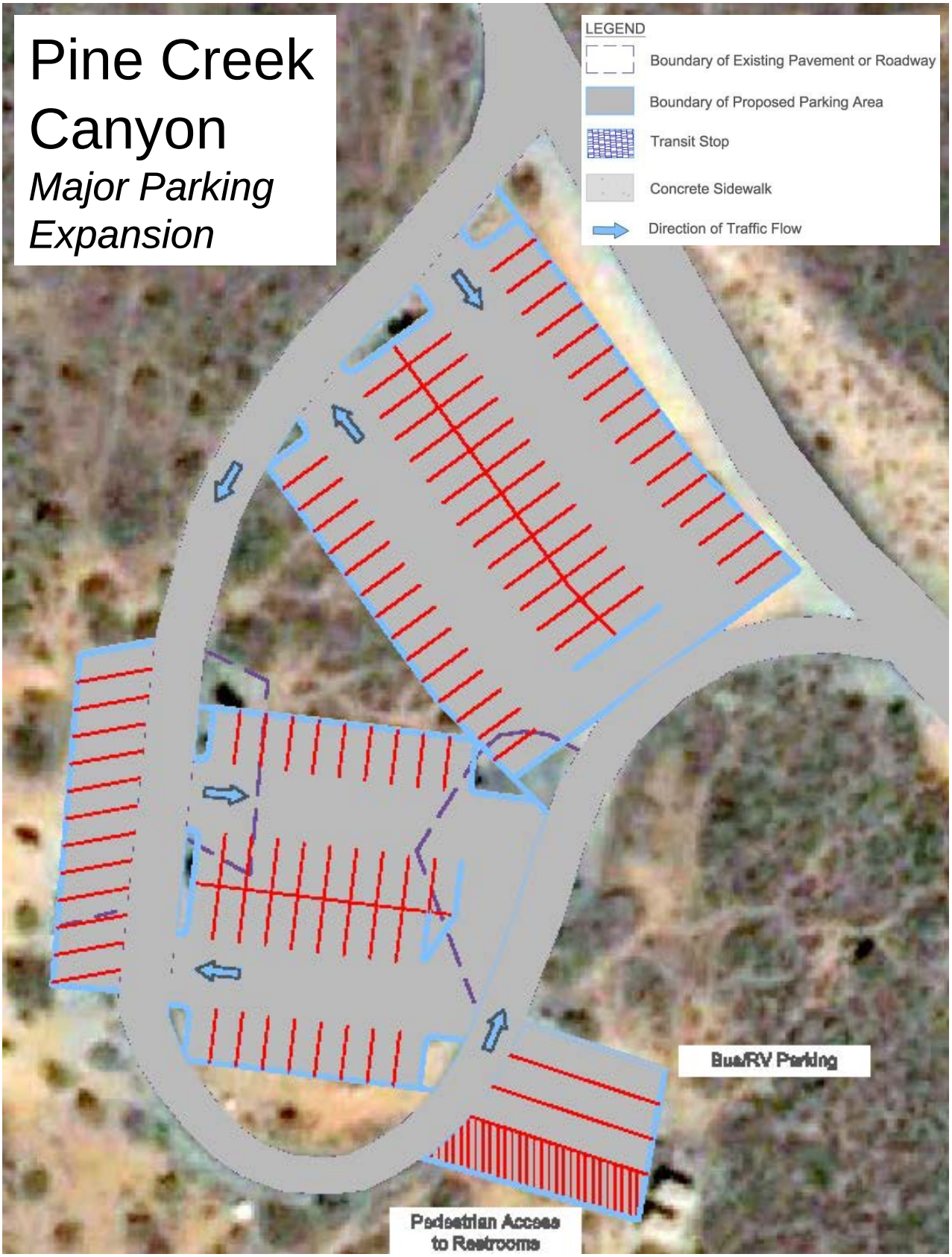
Calico Vista III

Major Expansion



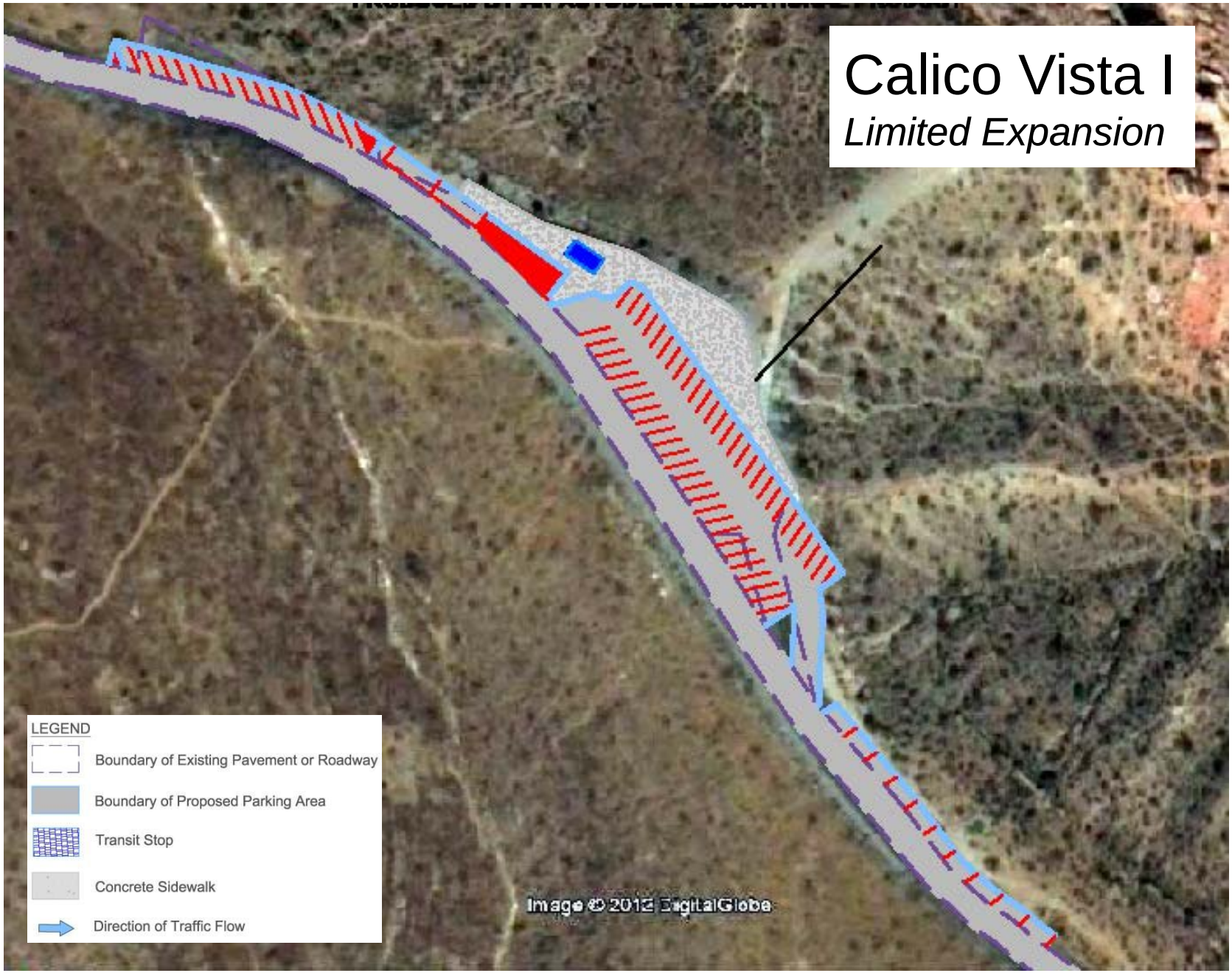
Pine Creek Canyon

Major Parking Expansion



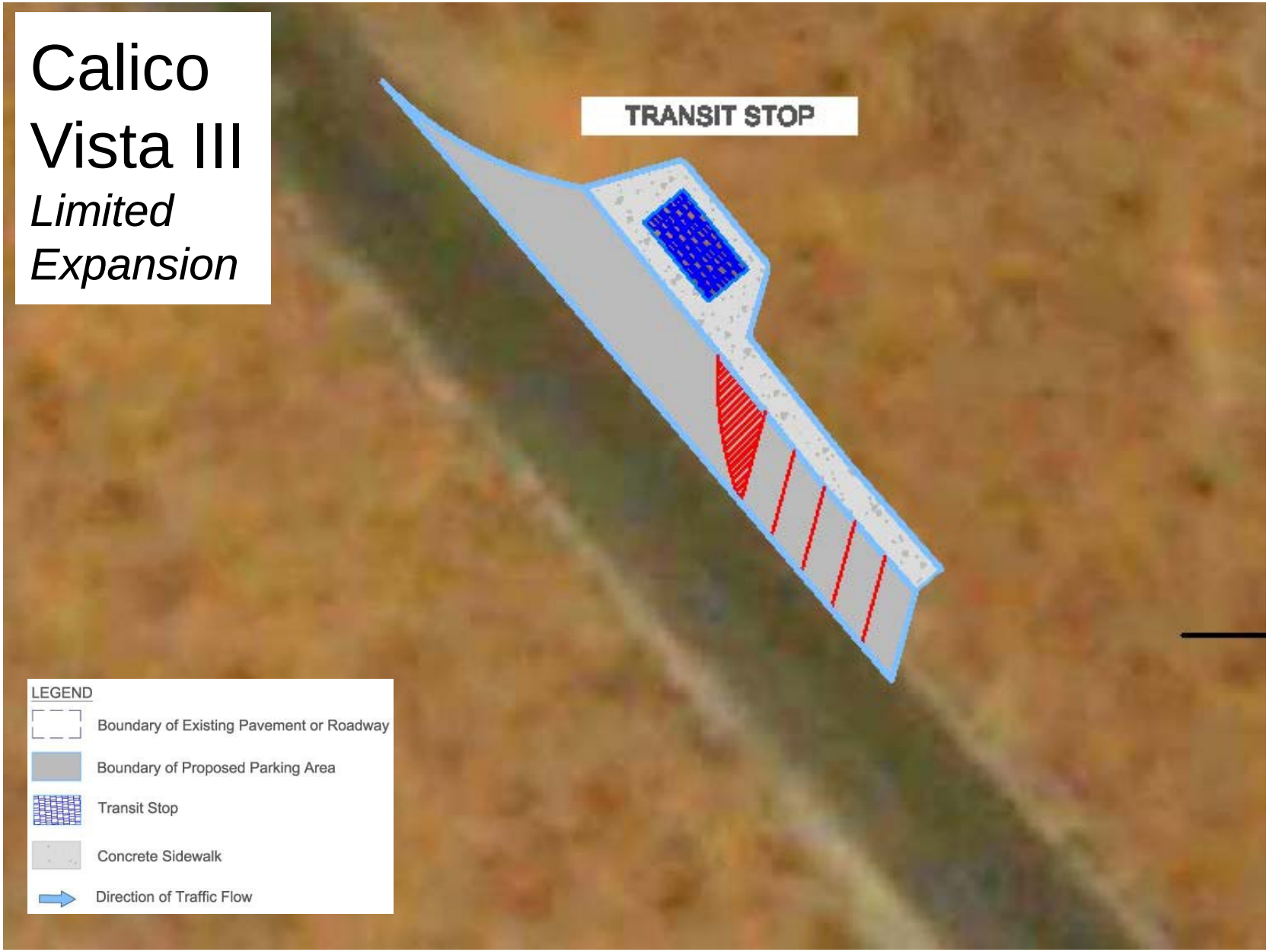
Limited Parking Expansion (Alternatives B and C)

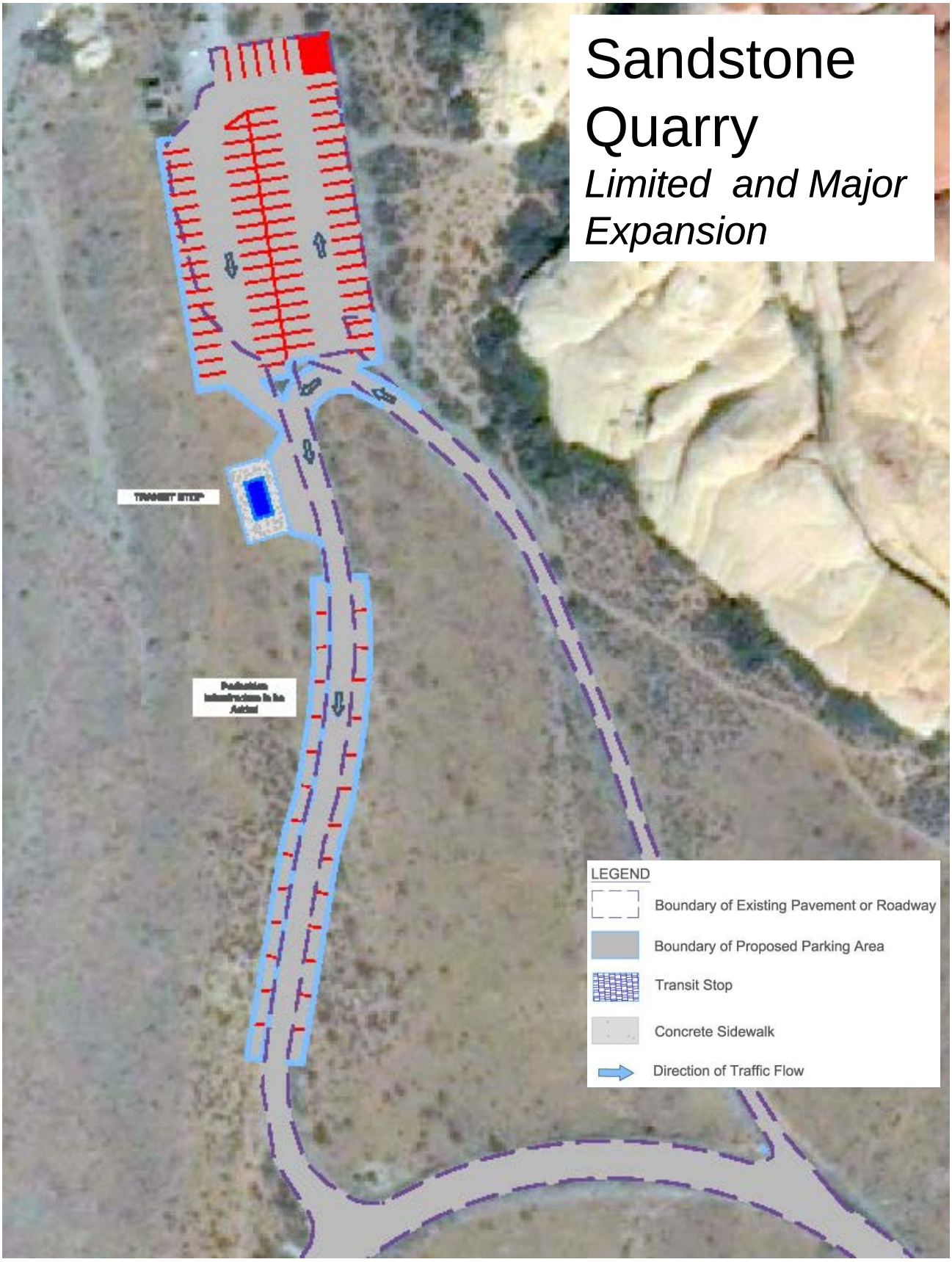
- Examples shown for:
  - Calico I
  - Calico III (new lot)
  - Sandstone Quarry
  - Pine Creek Canyon
- Reconfiguration with transit added (for Alt. B and C):
  - Lost Creek
  - Ice Box Canyon


Calico Vista I
Limited Expansion
LEGEND
Boundary of Existing Pavement or Roadway
Boundary of Proposed Parking Area
Transit Stop
Concrete Sidewalk
Direction of Traffic Flow
Image © 2013 DigitalGlobe

Calico Vista III

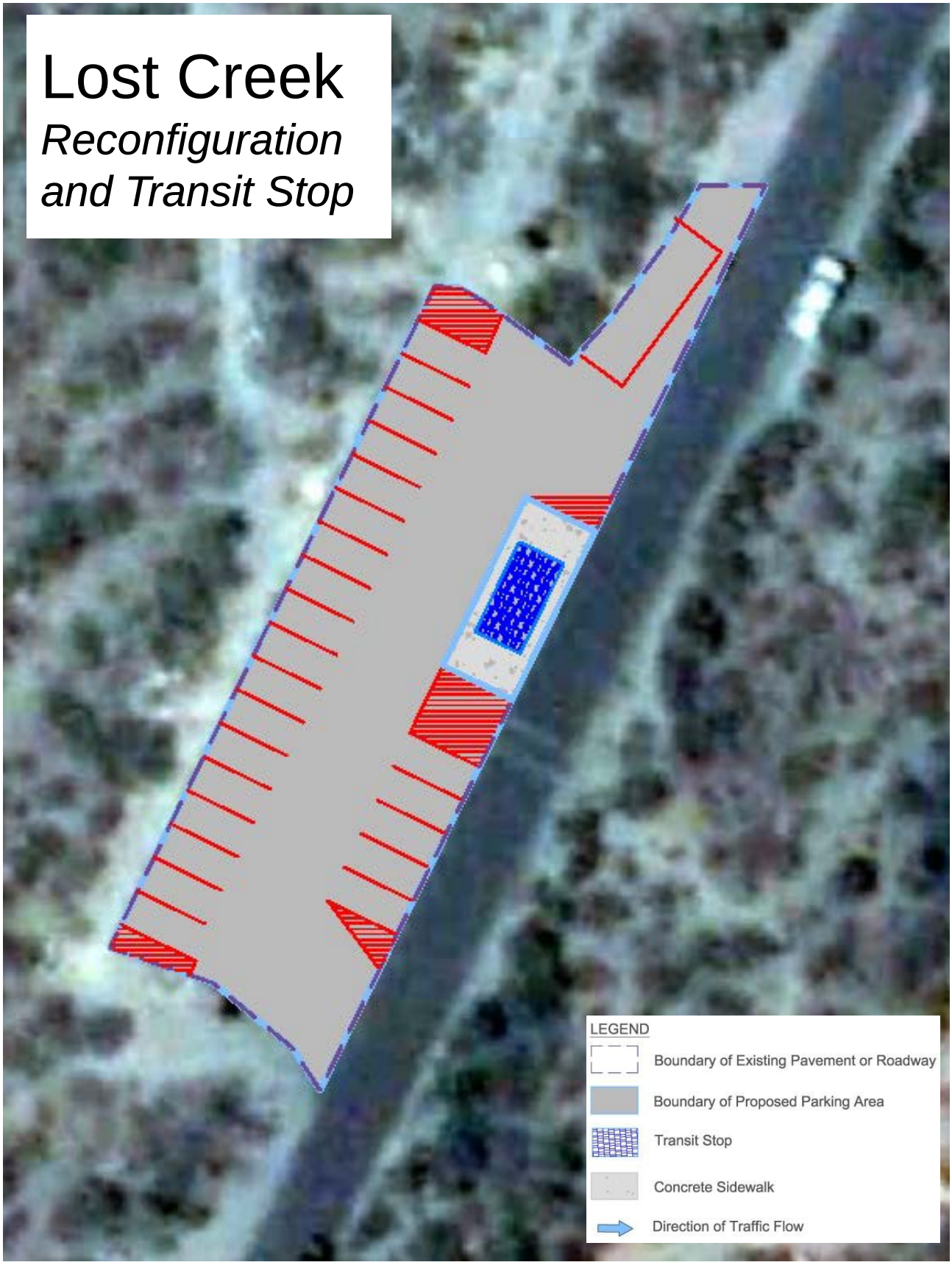
Limited Expansion




Sandstone Quarry
Limited and Major Expansion
LEGEND
Boundary of Existing Pavement or Roadway
Boundary of Proposed Parking Area
Transit Stop
Concrete Sidewalk
Direction of Traffic Flow

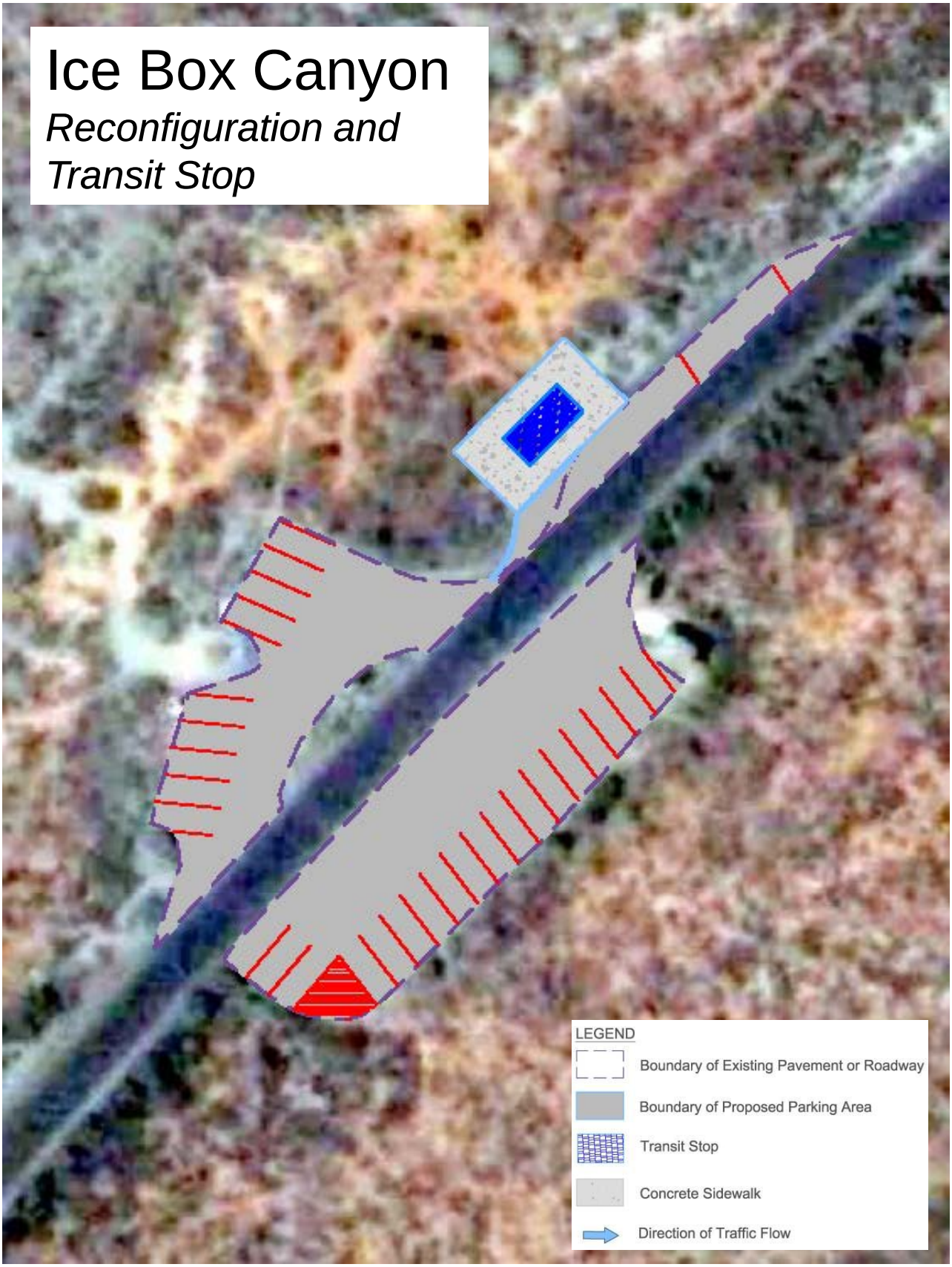
Lost Creek

Reconfiguration and Transit Stop



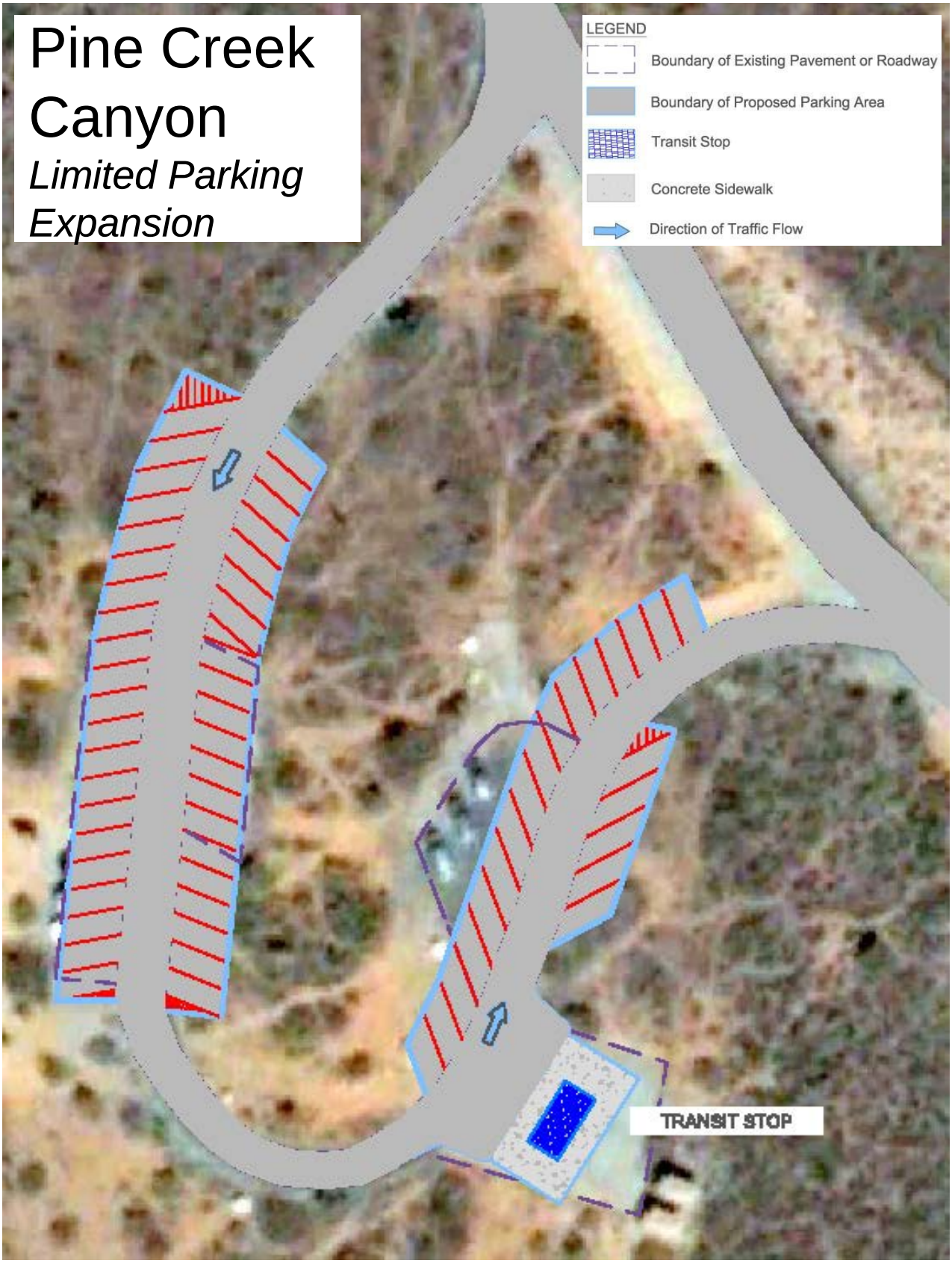
Ice Box Canyon

Reconfiguration and Transit Stop



Pine Creek Canyon

Limited Parking Expansion



Appendix III: Use of Traffic Counters

The BLM should use traffic counters as a management tool to track and control parking at high use lots during peak periods. Traffic counters placed at the entry and exit of parking lots can help the BLM determine when lots reach or exceed capacity. By connecting this data to dynamic message signs (DMS),[33] the BLM can alert visitors that lots are full and are closed to additional vehicles. The data from traffic counters can be connected to DMS at lot entrances, at the Visitor Center, at the fee booth, and along SR 159 to help visitors plan their visit accordingly. The system would likely be easy to install and effective at RRCNCA due to the one-way direction of Scenic Drive and the use of separate entrances and exits at several of the high use lots.

A functioning system like the one above requires the purchase, installation, and maintenance of traffic counters and DMS for all high use parking lots. It also requires programming a computer system to connect traffic counter data with parking lot capacity and to transmit data to signs in real time. Finally, it requires a minimal staff capacity for ongoing monitoring and maintenance.

System Operations and Capacity

The basic steps and logic behind the traffic counter program are as follows:

- Traffic counters are installed at all high-congestion lots with software connections to real-time monitoring in a centralized computer program.
- Traffic counters record vehicles entering lot (#ENTRIES) and vehicles exiting lot (#EXITS). The computer program stores the number of parking spaces in each lot (CAPACITY).
- When #ENTRIES - #EXITS > CAPACITY, then a DMS stationed near entrance reads “Lot Closed Temporarily.”
- When #ENTRIES - #EXITS < CAPACITY, then the sign is blank or reads “Lot open.”
- Data transmits to a sign located at the entrance to the Scenic Drive, noting the lot names of any closed lots.
- The system can be programmed such that when #ENTRIES - #EXITS = CAPACITY - 3, a message reads “LOT NAME near capacity.”

The system should use portable DMS on a seasonal basis, transporting them to storage during non-peak periods. The BLM could also choose to install permanent DMS at high congestion lots. The system can also include one or more permanent DMS at the fee booth, at another point on Scenic Drive and on SR 159.

[33] Dynamic message signs are electronic message boards that can be placed beside roads or parking lots to communicate messages updated on a real-time basis.

Establishing the system requires engineering expertise for installing the traffic counters and programming the operating system, including testing and refining the system. The BLM can use staff engineers to coordinate the installation, and they should work closely with partners at Nevada DOT and Central Federal Lands Highway Division (FHWA). Both of these partners have experience in establishing traffic counter and DMS systems. The BLM can also choose to enlist the expertise of a consultant to coordinate the installation of the system and to provide staff training on operations and maintenance of the system. If the BLM hires a consultant to design and refine the system, it may incur a one-time cost between $20,000 and $50,000.

The system would involve a small level of BLM staff capacity for initial set up and ongoing operations. The system manager (BLM or a consultant) would need to test the system during its first few months of operation. This may involve occasional manual traffic counts and checks for system accuracy. BLM staff could be trained to help with system management, including recalibrating the system, installing traffic counters, and transporting DMS. If the BLM wishes to enforce lot closures, the traffic counter system would also require additional BLM law enforcement to ticket visitors who enter or park in undesignated spaces in closed lots. However, it can also function as a self-enforcing system.

System Components and Costs

The costs for traffic counter system components are based on the Intelligent Transportation Systems in the National Parks and Federal Public Lands – 2011 Update,[34] which contains a survey of ITS technologies across public lands, and examples from two public lands sites published in the Cape Cod National Seashore Intelligent Transportation Systems Implementation Plan (2011)[35] and the Gateway National Recreation Area – Sandy Hook Unit Parking Management Study (2003).[36] The Volpe Center is the author of all three studies.

The study team recommends the use of portable DMS, which are much less expensive than permanent signs and can be removed from Scenic Drive during non-peak seasons. New portable DMS are very durable and easily transportable, relative to older signs. Portable signs are approximately $20,000 per sign, with an annual operating cost between $600 and $1,800 each and a lifespan of 14 years. Permanent DMS would cost between $50,000 and $70,000 each, with annual maintenance costs around $3,000 and a lifespan of 10 years.

Pneumatic tubes are a simple and low-cost way to count traffic entries and exits. Pneumatic tubes cost between $700 and $1,300 per installation, with some additional costs (approximately $5,000, although

[34] U.S. DOT Volpe Center, Intelligent Transportation Systems in National Parks and Federal Public Lands – 2011 Update, http://www.volpe.dot.gov/coi/ppoa/publiclands/projects/itslessons.html, accessed February 10, 2012.
[35] U.S. DOT Volpe Center, Projects – National Park Service Cape Cod National Seashore, http://www.volpe.dot.gov/coi/ppoa/publiclands/projects/capecod3_its.html, accessed February 10, 2012.
[36] U.S. DOT Volpe Center, Projects – National Park Service Gateway National Recreation Area, Sandy Hook Unit, http://www.volpe.dot.gov/coi/ppoa/publiclands/projects/nyharbor_sandyhook3.html, accessed February 10, 2012.

it will range based on the system) for receivers and software. Each parking lot would need two tubes installed – one for each direction of traffic. Annual maintenance would be between $500 and $800 per installation, with a life of 5 to 15 years. The BLM may be able to acquire or borrow pneumatic tube systems from Nevada DOT or other partners, especially for a limited pilot test. If the BLM wanted to pursue a more permanent traffic counter system, they could install an inductive loop system at a total cost of approximately $3,000 installation, or $6,000 per parking lot. The loop system is more intensive to install but would have a longer lifespan. Installation of an inductive loop system could occur if the BLM repaves the parking lots and Scenic Drive.

Appendix IV: Parking Model Validation

To verify the accuracy of the data, the study team compared its observations to the findings of the 2001 Transit Feasibility Study, which conducted a similar data collection exercise on Saturday, November 2, 2001. With a couple of notable exceptions, the 2011 observations fall roughly in line with visitation patterns observed in 2001. The table below compares the lot by lot duration of stay data collected for the current study.

Table 24- Weekend Day Duration of Stay Distribution: 2001 and 2011

	Calico I		Calico II		Sandstone Quarry		Ice Box		Pine Creek	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
1-15 min	51%	46%	39%	47%	47%	33%	47%	50%	22%	33%
16- 60 min	42%	40%	18%	40%	29%	26%	19%	17%	18%	13%
61 – 120 min	5%	10%	14%	8%	18%	14%	31%	14%	33%	18%
121 min +	2%	5%	29%	4%	6%	26%	3%	19%	27%	36%

Differences in the data collected for both studies may be the result of evolving parking use patterns over time or they may be due to variances in daily use patterns. For example, the greater proportion of shorter duration stays at Calico II recorded in 2011 may be the result of rain on the day preceding data collection negatively affecting climbing conditions on the sandstone cliffs popular among climbers. Similarly, the greater proportion of long duration stays at Sandstone Quarry in 2011 may have been the result of visitor interest in the light snow covering present at higher altitudes. Given the numerous reasonable yet untestable hypotheses for differences in observed parking use patterns, the study team chose not to adjust parking stays for the purposes of the study, but rather to take the observed data as given.

Appendix V: Precedent Research for Transit Ridership on Public Lands

Transit Ridership

A survey of ridership on four voluntary bus shuttles in public lands across the United States found that about 6 to 12 percent of visitors will choose to ride a voluntary shuttle service. These survey results are consistent with an earlier estimate that 5 to 10 percent of visitors to public lands would take a voluntary transit system.[37] Ridership can be higher or lower depending on local conditions and characteristics of the service.

Survey data from currently operating shuttles can help explain why people choose to ride a voluntary system. A 2009 survey of bus riders at Colonial National Historical Park found that some of their motivations include the following[38]:

1. The desire to let someone else do the driving
2. The opportunity to hear live or recorded interpretation
3. To avoid driving in an unfamiliar area/to avoid missing a specific destination
4. Lowering environmental impact
5. Saving money on fuel and wear-and-tear

According to the *Alternative Transportation System Demand Estimation for Federal Land Management Agencies* study, a wide variety of service characteristics can influence the proportion of visitors who will choose to ride a voluntary transit system. Basic service characteristics such as schedule and route have large impacts on ridership. If a visitor has a specific destination in mind before travelling to a unit, they won't use transit unless it serves their planned destination. However, many visitors arrive without specific destinations in mind, and are willing to go where the shuttle takes them. Some service characteristics that can attract these visitors or those with a specific destination include the following[39]:

- Frequent service, with headways of fifteen minutes or less, can encourage a higher mode share for transit. A one-hour headway is the upper range of what voluntary riders will tolerate.
- Scheduling enhancements, such as starting a route on the hour and on the half hour, can make a shuttle seem more user-friendly. Clearly posted arrival times at stops or real-time countdowns can also influence a visitor to wait a few minutes and take a bus they know is coming soon.
- Amenities such as covered shelters, benches, paved stops, and gear storage areas on the bus can attract more visitors to take a shuttle.

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[37] Cambridge Systematics, Inc. and BRW Group, Inc., Federal Lands Alternative Transportation Systems Study Summary of National ATS Needs, August 2001, http://fta.dot.gov/documents/3039_study.pdf, accessed February 10, 2012.
[38] U.S. DOT Volpe Center, Colonial National Historical Park Shuttle Service Survey Report, February 2010, http://ntl.bts.gov/lib/42000/42100/42164/DOT-VNTSC-NPS-10-03.pdf, accessed February 10, 2012.
[39] U.S. DOT Volpe Center, Alternative Transportation System Demand Estimation for Federal Land Management Agencies, September 2011, http://ntl.bts.gov/lib/44000/44200/44243/ATS_Demand_Estimation_1_.pdf, accessed February 10, 2012.

- Factors that play an important part in urban transit mode choice, such as travel time, are less important to the voluntary shuttle rider in a recreational setting. The conflict between a fast travel time and frequent stops is less important in a public lands context, and having a large number of stops can actually increase ridership.
- Social considerations can influence voluntary ridership as well, with popular services attracting more riders than an empty bus stop.

Studies show that the most powerful factor affecting ridership is the fare charged to ride a system. Evidence from Reds Meadow Valley Recreation Area shows that ridership dropped by 59% when fares were increased by 400%.[40] Incremental increases and decreases in the fare at Reds Meadow Valley caused decreases and increases in ridership over three decades of service. Many federal land units with alternative transportation systems bundle their entrance fee with the increased cost of providing transportation into one seamless transaction. This allows for a perceived "free" service and prevents delays in payment onboard the transit vehicle. It also distributes the cost of the service among all visitors, both riders and non-riders, as the benefits of the system include reduced congestion for all visitors.

Hiker/Climber Shuttle Ridership

The study team reviewed four shuttle systems targeted to hikers, climbers, and cyclists as comparable examples for RRCNCA. Shuttle buses targeted to these recreational users have had success at a variety of public lands across the country. The Bizz Johnson Trail bus in California, the Appalachian Mountain Club (AMC) Hiker Shuttle in New Hampshire, Rocky Mountain National Park's Hiker Shuttle in Colorado, and the Bus-Up 90 in Washington operate in a variety of environments under public, non-profit, and concessionaire operating models. Their design allows them to meet the demands of their visitors and environments, but also share several elements, including the following:

- **Added value beyond the personal vehicle.** None of these systems is mandatory to access a recreation resource, and so the system must provide additive value if visitors are to spend the additional money, time and effort associated with parking and waiting for the shuttle. Additionally, these costs should be minimized through careful planning. The AMC Hiker Shuttle allows visitors to return to their vehicles after a one-way hike, while the Bus-Up 90 acts as a chairlift by carrying users to the summit of a long downhill cycling trail. Accomplishing either using a private vehicle would require two vehicles or a party member who stays behind.
- **Connectivity to gateway communities and other transit services.** All four of the systems have direct connections with other transit services and with gateway communities. Connecting to other services allows users to visit several sites on one trip, and opens an area to car-free

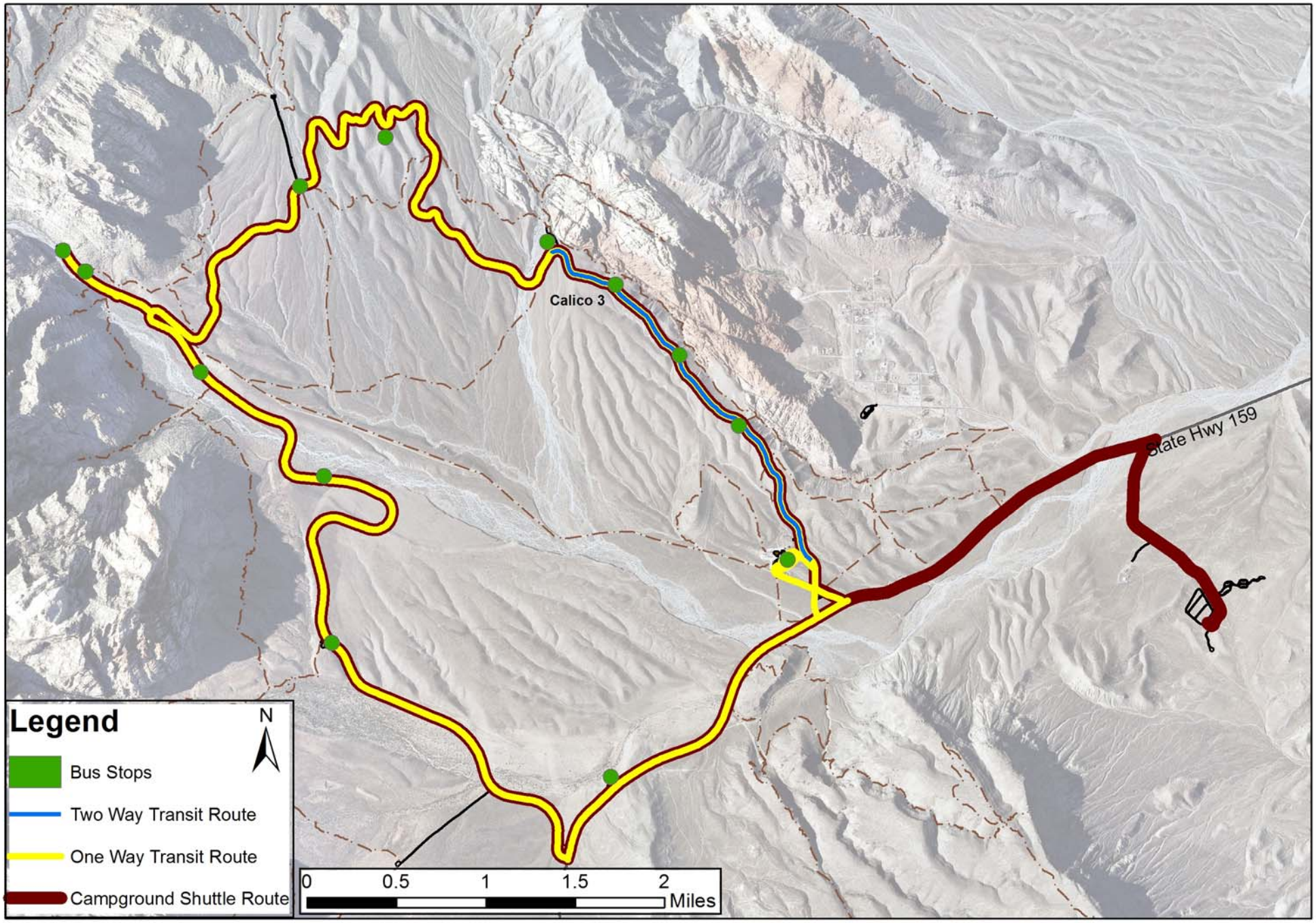
[40] *Ibid*.

visitors. All four of these voluntary recreation shuttles connect gateway communities to recreation destinations. This characteristic also increases the number of destinations that a user can visit without returning to their car. It also opens recreation destinations to car-free local residents or guests and can be used to increase awareness of public lands, as seen with the Bizz Johnson Trail Bus. Although an extension to Las Vegas is not currently feasible, the effectiveness of any transit service within RRCNCA would be improved if a transfer to RTC is available, for example at the Red Rock Casino or at the Visitor Center.

- **User fee/fare to fund service.** The operating costs of hiker shuttles all charge a user fee to recover their costs of operation. Three of the systems charge this directly to the user as they enter the transit vehicle, while Rocky Mountain National Park adds the transportation user fee into the cost of entry to the Park.

Appendix VI: Transit Map

Red Rock Canyon National Conservation Area
Transit Routes



Appendix VII: Transit Route Segments and Distances

Table 25 – One-Way Transit Segment Distances and Average Travel Speed

Segment distances	Cumulative Distance (miles)	Segment Distance (miles)	Average Speed (mph)
Visitor Center to Calico I	1.38	1.38	10
Calico I to Calico II	1.93	0.55	15
Calico II to Calico III	2.43	0.50	15
Calico III to Sandstone	2.98	0.55	15
Sandstone to High Point Overlook	5.04	2.06	15
High Point Overlook to White Rock Drive	6.19	1.15	15
White Rock Drive to Lost Creek	7.91	1.72	15
Lost Creek to Willow Springs	8.38	0.47	15
Willow Springs to Lost Creek	8.78	0.4	15
Lost Creek to Ice Box	9.55	0.77	15
Ice Box to Red Rock Wash Overlook	10. 57	1.02	15
Red Rock Wash Overlook to Pine Creek	12.26	1.69	25
Pine Creek to Scenic Drive exit lot	14.26	2	25
Scenic Drive exit lot to Red Rock Overlook lot	14.81	0.55	30
Red Rock Overlook lot to Visitor Center	17.14	2.33	30

The hiker/climber shuttle would follow the same route, with an additional stop at the campground at the beginning of the route (with stops along the Scenic Drive on a request basis). The total distance of the morning hiker/climber shuttle runs would thus be 22.85 miles.

Table 26 - Two-Way Transit Segment Distances and Average Travel Speed

Segment distances	Cumulative Distance (miles)	Segment Distance (miles)	Average Speed (mph)
Visitor Center to Calico I	1.38	1.38	10
Calico 1 to Calico II	1.93	0.55	15
Calico II to Calico III	2.43	0.50	15
Calico III to Sandstone	2.98	0.55	15
Sandstone to Calico III	3.53	0.55	15
Calico III to Calico II	4.03	0.50	15
Calico II to Calico I	4.58	0.55	15
Calico I to Visitor Center	5.96	1.38	15

Appendix VIII: Pilot

Prior to engaging in a significant transit operations contract, the Volpe Center recommends the use of a pilot test to introduce the concept of transit to RRCNCA visitors and to test variables of transit service. A pilot can help the BLM design a transit system that can best meet the needs of RRCNA and its visitors.

The pilot should include the route considered in Alternatives B, including one-way transit service on Scenic Drive and/or a hiker/climber shuttle from the campground to Scenic Drive. RRCNCA should select a route using either the preferred alternative identified in the Transportation Feasibility Study, or include multiple alternatives. The pilot can begin operations prior to the completion of the Environmental Assessment. The BLM can only implement the two-way route following construction of the transitway, which can only occur after the EA. Following completion of the transitway, the BLM should conduct a pilot of varying service options for a combination of two-way and one-way service.

Considerations

1. The pilot should closely follow the route and schedule established in Alternative B, with the purpose of testing the feasibility of transit service.
2. The pilot should be used to test for ridership demand and service preferences, especially in terms of operating hours and frequencies.
3. The pilot should include a significant data collection component to collect ridership information and to learn about willingness to pay, factors that may encourage or discourage transit use, and other route or service preferences.
4. The pilot should be as simple as possible with clear instructions to orient and welcome new users.

Management

1. The BLM sets routes and schedules, coordinates interpretation, and provides parking.
2. The BLM enters into a contract with a local transportation provider.
    a. The local transportation provider can be RTC or a private company.
    b. The contractor responsibilities include leasing vehicles, hiring drivers, running transit operation, and maintaining all equipment.
3. The BLM should work with one of RRCNCA's friends groups to assist with interpretation and funding.

Routes and Schedules

1. Operating hours and days: 9 AM through 5 PM on Saturdays and Sundays.
2. Operating season: Seasonal for one year, operating in the fall and spring peak months (starting either in October or March).
    a. The pilot should begin at the first October or March that the BLM is ready to oversee pilot operations.
3. Visitors will start at the Visitor Center, board a bus, and stop at each parking area along Scenic Drive.
    a. Each transit stop should have a temporary sign or decal and a transit information panel.

4. Headways: Transit headways should be consistent. This study recommends 20 minutes. The BLM should create a shuttle contract that is flexible, allowing for service to operate more frequently if demand is high.
5. The schedule with posted headways and approximate times of shuttle arrival at each lot will be posted at the Visitor Center and at each transit stop. Each posting should indicate language such as the following for Calico I: "Shuttle arrives at 9:10 AM and every 20 minutes thereafter. Last shuttle departs at 5:10 PM."

   The following is a list of first and last arrivals at Scenic Drive stops:

Table 27 - Sample Transit Schedule at Scenic Drive Stops

Stop	First Arrival	Last Departure
Visitor Center	9:00 AM	5:00 PM
Calico I	9:10 AM	5:10 PM
Calico II	9:14 AM	5:14 PM
Sandstone Quarry	9:20 AM	5:20 PM
Highpoint Overlook	9:30 AM	5:30 PM
White Rock Drive	9:39 AM	5:39 PM
Willow Springs	9:48 AM	5:48 PM
Lost Creek	9:51 AM	5:51 PM
Ice Box Canyon	9:57 AM	5:57 PM
Red Rock Wash Overlook	10:04 AM	6:04 PM
Pine Creek	10:09 AM	6:09 PM
Red Rock Overlook	10:18 AM	6:18 PM

Infrastructure

1. Utilize the existing Visitor Center parking for shuttle riders.
2. If overflow parking needed, use Visitor Center overflow lot and the lot near the fee booth.
3. Use temporary signage to direct visitors using the shuttle to park in designated areas.
4. Visitors to board shuttle at Visitor Center (or near fee booth, if overflow parking is in use).
5. Use decals or temporary signs to indicate shuttle pick-up at Visitor Center and shuttle stops at each lot.

Finances

1. The number of service hours for the pilot would be between 350-400 hours.
   a. 16 hours per weekend, approximately 24 weekends for the pilot
2. Work with local transit providers and contractors to determine the costs per service hour.

    a. Includes vehicle leasing, fuel, and drivers.
3. BLM staff can estimate overhead costs.
    a. Hours of BLM staff time to manage
    b. Marketing and promotional materials (including printing)
    c. Coordination of interpretive services
    d. Signage and preparation of parking and bus stops
4. Consider running tests using fees and no fees.
    a. For one operating period, charge fee of $1.00 per passenger if RRCNCA can secure a waiver to allow shuttle riders to by-pass the amenity fee. If this is the case, implement the issuance of a paper receipt that visitors must display on their dashboards as they travel Scenic Drive.
    b. For another operating period, offer the shuttle for free after visitors pay the entrance fee.

Promotion and Marketing

1. Use visual markings on transit vehicles to denote connection to RRCNCA.
    a. Apply high-quality cardboard signs using Velcro, to bus exterior
    b. Optionally use vinyl signs and large decals.
2. Advertise shuttle service widely to visitors.
    a. Post notice and instructions on BLM and friends groups' websites.
    b. Advertise for two months in advance in the Visitor Guide (handout at fee booth).
    c. Submit a press release through BLM public affairs.
    d. Create handouts/brochures with a route map to distribute at the Visitor Center.
        i. Start to distribute brochures at least four weeks in advance of pilot.
        ii. Inquire into placing brochures at hotels and casinos.
    e. Use a large, semi-permanent easel sign at Visitor Center entrance when the shuttle is operating.
    f. Use a variable message sign at the site entrance that reads, "Free shuttle available to travel Scenic Drive."
5. Guidelines for marketing materials:
    a. Keep marketing materials brief, highly-visible, and easy to understand.
    b. Use simple messages and large text.
    c. Carefully proofread all marketing materials in advance.
6. Enlist the assistance of friends groups to vet marketing materials.
7. Set up visitor education displays at the Visitor Center focused on transit use.

Data Collection

1. Ridership
    a. On two- to three-weekends during each operating period, use volunteers on each bus to record visitor boarding and disembarking at each stop.
2. Expenses
    a. BLM to track staff time in planning, marketing, and oversight

   b. Contractor to provide list of all operating and capital costs
3. Use a comment card or brief, written questionnaire to record visitor preferences:
   a. Record date, time, and type of transit route
   b. Activity (sightseeing, hiking, climbing, picnicking, photography, other)
   c. Length of stay (at site and at each parking lot)
   d. Willingness to pay (dollar amount) and sensitivity to price fluctuations
   e. Desired frequency of service
   f. Preference of transit route; introduce two-way transit idea and ask if they would be likely to use it
   g. Motivations for using transit
   h. Sources of information for learning about transit service
4. Vehicle selection and operation
   a. Drivers/interpreters to monitor how often the vehicle reached capacity and had to turn passengers away.
   b. Contractor to note any problems with visitor access or equipment storage on vehicle.
   c. Contractor to note vehicle performance on Scenic Drive, including maneuverability, access to each transit stop, and performance on steep grades.

Evaluation Questions

1. Does the service tend to be more attractive to sightseers looking for an interpretive experience or to hikers and climbers, looking to leave their cars behind? For short-term or long-term users?
   a. *If a large majority of transit riders fall into one category, the BLM should consider catering future transit to the preferences of that group.*
   b. *If there are significant numbers of transit riders in both categories, the BLM should consider both a sightseeing-based service and a hiker/climber shuttle.*
2. What are the primary visitor purposes in using a transit system?
   a. *Consider adjusting service frequency, interpretation opportunities, routes, and hours of service to attract more riders, based on indicated motivations for using transit.*
3. Which parking lots are most and least popular with transit riders?
   a. *If some lots have very few or no visitors boarding and disembarking at their stops, the BLM should consider eliminating those lots from transit service.*

Appendix IX: Transit Vehicle Selection

The following table compares standard diesel vehicles with different engines (V6 and V8) and passenger capacity to determine the best vehicle choice for RRCNCA. The recommended hybrid diesel buses have slightly different costs than those shown below, but provide the added benefit of reduced air pollution.

Table 28 - Transit Vehicle Comparison

Bus Type	Vehicle Cost	Capacity	Fuel cost	Fuel Economy (MPG)	Maint. $/mile	Engine Overhaul	Trans. Overhaul	Overhaul Mileage
30-40 foot heavy duty transit bus, diesel (V8)	$289,819	30	$4.64	5	$1.44	$23,185	$12,172	250,000
Cutaway, medium-duty bus, diesel (V6)	$144,909	30	$4.64	7	$1.44	$17,389	$12,172	250,000
Full-size passenger van, gas	$28,982	15	$4.06	14	$0.93	*	*	*

*** The service life of a full-size passenger van is short enough that overhauls are not warranted.**

Source: Volpe Bus Lifecycle Cost Model

Appendix X: Operating Model Analysis

Sources for Cost Estimates

The following series of tables are the outputs from the Bus Lifecycle Cost Model for Alternatives B and C, which was the primary model upon which the study team based its estimates for transit service costs at RRCNCA. Figure 35 shows the annual costs of operation for Alternatives B and C, as well as the cumulative cost for the entire operation over 12 years. Table 29 and Table 30 provide details for each alternative, including model inputs based on the assumptions in section 3.5. All "Year 1" costs are inflated to 2015 dollars, at an inflation rate of 3%.

The study team verified the cost estimates from the Bus Lifecycle Cost Model by comparing the costs with those of other agencies. For this exercise, the study team researched the operating costs of the Regional Transportation Commission (RTC) of Las Vegas, the local transit provider. RTC contracts all of their operations and maintenance, in a similar operations model to that recommended for RRCNCA. The RTC reports an hourly operating expense of $88.62 for scheduled service and $68.20 for demand response service from their contractors.[41] This compares to a projected cost of about $82.07 per hour for Alternative B and $71.79 per hour for Alternative C, primarily because RRCNCA requires regular transit service, similar to RTC's fixed-route service. One primary difference between RTC and the service proposed for RRCNCA is that RTC operates heavy-duty transit vehicles (for scheduled service) and provides more intensive service, increasing maintenance and other costs. Demand response service for RTC has a lower hourly cost, likely due to the use of smaller, more efficient vehicles. The similarity between costs of scheduled and demand response service is significant to RRCNCA because it provides a glimpse into actual transit service provision cost in the local Las Vegas market, and helps to verify the results of the model used in this analysis. While the model suggests that RRCNCA's cost may be in between the two costs figures for RTC, it is also important to note that RTC may enjoy a savings due to the scale of its operation.

[41] Agency profile for the Regional Transportation Commission of Southern Nevada (RTC), 2010 National Transit Database, http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2010/agency_profiles/9045.pdf, accessed February 2, 2012.

Figure 35: Annual and Cumulative Cost for Alternatives B and C

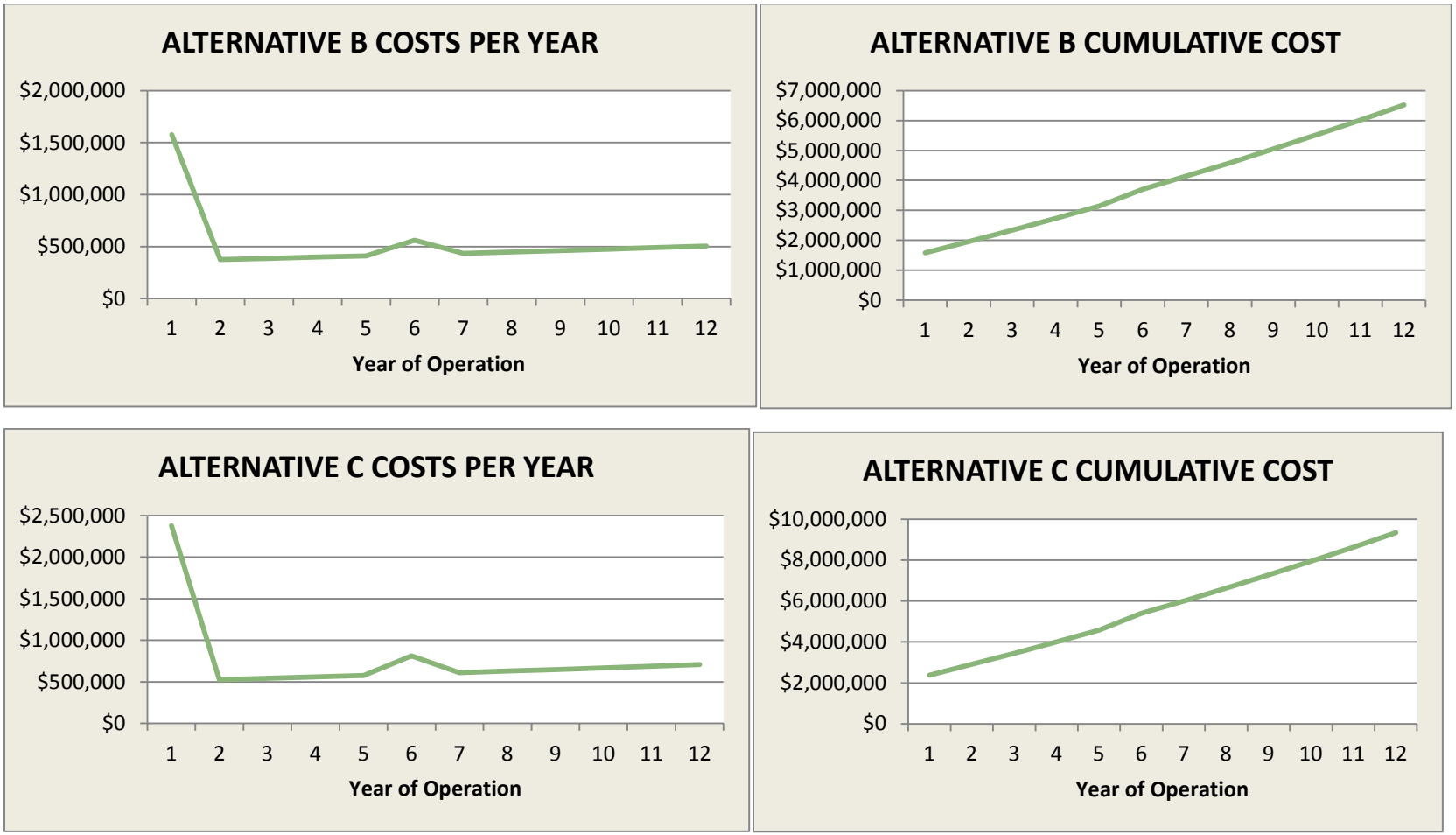


Table 29: Alternative B Shuttle Proforma

Annual O&M costs	**$404,785**
Bus type	Cutaway, medium-duty bus hybrid (V6)
Number of buses	5
VMT per fleet	78,379
VHT per fleet	4,439
Driver costs per fleet	$207,834
Fuel cost per mile	$0.52
Fuel costs (per fleet)	$40,409
Maintenance cost per mile	$1.45
Maintenance cost (per fleet)	$113,649
Overhaul mileage trigger	250,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$31,300
Battery replacement (hybrid)	$27,500
Marketing costs	$42,893
Inflation rate	3.0%

Costs per year							
Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement (hybrids)*	*Total costs per year*	*Cumulative costs*
Year 1 O&M only	*$364,401*	*18,525*				*$364,401*	*$0*
Year 1	$1,575,843	18,525			$0	$1,575,843	$1,575,843
Year 2	$375,333	37,050	$0	$0	$0	$375,333	$1,951,176
Year 3	$386,593	55,574	$0	$0	$0	$386,593	$2,337,768
Year 4	$398,190	74,099	$0	$0	$0	$398,190	$2,735,959
Year 5	$410,136	92,624	$0	$0	$0	$410,136	$3,146,095
Year 6	$422,440	111,149	$0	$0	$137,500	$559,940	$3,706,035
Year 7	$435,113	129,673	$0	$0	$0	$435,113	$4,141,149
Year 8	$448,167	148,198	$0	$0	$0	$448,167	$4,589,316
Year 9	$461,612	166,723	$0	$0	$0	$461,612	$5,050,928
Year 10	$475,460	185,248	$0	$0	$0	$475,460	$5,526,388
Year 11	$489,724	203,773	$0	$0	$0	$489,724	$6,016,112
Year 12	$504,416	222,297	$0	$0	$0	$504,416	$6,520,528

Year one costs	**$1,211,442**
Purchase cost	$1,014,365
Startup costs	$34,778
Maintenance facility	$0
Fueling station	$0
Bus stops and shelters	$162,298

VMT: Vehicle Miles Traveled; VHT: Vehicle Hours Traveled; O&M: Operations and Maintenance

Table 30: Alternative C Shuttle Proforma

Annual O&M costs	**$551,725**
Bus type	Cutaway, medium-duty bus hybrid (V6)
Number of buses	8
VMT per fleet	98,402
VHT per fleet	7,218
Driver costs per fleet	309,621
Fuel cost per mile	$0.52
Fuel costs (per fleet)	50,732
Maintenance cost per mile	$1.45
Maintenance cost (per fleet)	142,683
Overhaul mileage trigger	250,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$31,300
Battery replacement (hybrid)	$27,500
Marketing costs	48,690
Inflation rate	3.0%

Costs per year							
Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement (hybrids)*	*Total costs per year*	*Cumulative costs*
Year 1 O&M only	*$511,341*	*25,199*				*$511,341*	*$0*
Year 1	$2,378,792	25,199			$0	$2,378,792	$2,378,792
Year 2	$526,682	50,399	$0	$0	$0	$526,682	$2,905,474
Year 3	$542,482	75,598	$0	$0	$0	$542,482	$3,447,956
Year 4	$558,757	100,797	$0	$0	$0	$558,757	$4,006,712
Year 5	$575,519	125,997	$0	$0	$0	$575,519	$4,582,232
Year 6	$592,785	151,196	$0	$0	$220,000	$812,785	$5,395,016
Year 7	$610,568	176,395	$0	$0	$0	$610,568	$6,005,585
Year 8	$628,885	201,594	$0	$0	$0	$628,885	$6,634,470
Year 9	$647,752	226,794	$0	$0	$0	$647,752	$7,282,222
Year 10	$667,185	251,993	$0	$0	$0	$667,185	$7,949,407
Year 11	$687,200	277,192	$0	$0	$0	$687,200	$8,636,607
Year 12	$707,816	302,392	$0	$0	$0	$707,816	$9,344,423

Year one costs	**$1,867,450**
Purchase cost	$1,622,984
Startup costs	$47,389
Maintenance facility	$0
Fueling station	$0
Bus stops and shelters	$197,077

Leasing

If the BLM chooses to lease vehicles, the total cumulative cost over 12 years is very similar to the cost of vehicle ownership, with a slight cost savings for leasing vehicles. Table 31 summarizes the GSA's lease rates and applies them to the operating needs for both Alternative B and C. This methodology relies on using the VHT (total vehicle hours) for each alternative and multiplying it by the hourly lease cost.

Table 31 - Annual Lease Cost for Alternatives B and C

	2015 GSA Lease Rates	Alternative B Seasonal Cost	Alternative C Seasonal Cost
Hourly Lease Cost	$71.03	$44,154	$521,704
Mileage fee	$0.57	$44,964	$56,452
Monthly Lease	$821.73	$26,295	$26,295
Supervision	$40,574.59	$40,575	$40,575
Total		$455,989	$636,026

Table 32 and Table 33 compare the lease costs with the cost output from the Bus Lifecycle Cost Model. On the left side of the table are the operating costs for both BLM-owned vehicles (as explained above) and the annual lease costs for 12 years. By owning vehicles, the BLM would save between $92,000 and $127,000 (for Alternative B) and between $84,000 and $117,000 (for Alternative C) per year compared to leasing if considering operating costs alone. When factoring in the total cumulative costs (right side of the table), including capital costs, the cost savings for Alternative B over 12 years is $108,568. The lease rates do not include a transit vehicle to cover breakdowns and maintenance, as described earlier in this study, since rates are based on VHT alone. This is significant because the BLM-owned cost factors in this extra $200,000. With this consideration, the cumulative leasing cost is $309,000 more than if the BLM owned the vehicles.

The results are significantly different for Alternative C. The cumulative cost difference is $426,588 in favor of leasing, not considering the $200,000 additional vehicle cost noted above. With this consideration, leasing is cumulatively about $227,000 less expensive.

Table 32 - Alternative B Lease Comparison

	Annual Operating	Annual Lease	Difference between Operating & Lease	Operating and Capital Cumulative Costs	Lease Cumulative with Capital
Year 1	$364,401	$455,989	-$91,588	$1,616,227	$653,065
Year 2	$375,333	$469,668	-$94,336	$1,991,560	$1,122,733
Year 3	$386,593	$483,758	-$97,166	$2,378,152	$1,606,492
Year 4	$398,190	$498,271	-$100,081	$2,776,343	$2,104,763
Year 5	$410,136	$513,219	-$103,083	$3,186,479	$2,617,982
Year 6	$559,940	$528,616	$31,325	$3,746,419	$3,146,597
Year 7	$435,113	$544,474	-$109,361	$4,181,533	$3,691,072
Year 8	$448,167	$560,808	-$112,642	$4,629,700	$4,251,880
Year 9	$461,612	$577,633	-$116,021	$5,091,311	$4,829,513
Year 10	$475,460	$594,962	-$119,501	$5,566,772	$5,424,474
Year 11	$489,724	$612,810	-$123,086	$6,056,496	$6,037,285
Year 12	$504,416	$631,195	-$126,779	$6,560,911	$6,668,480
			-$1,162,318	**Cumulative difference**	$107,568

Lease Cumulative with Capital does not include an additional transit vehicle to cover breakdowns and maintenance.

Table 33 - Alternative C Lease Comparison

	Annual Operating	Annual Lease	Difference between Operating and Leasing	Cumulative Costs	Lease Cumulative with Capital
Year 1	$551,725	$636,026	-$84,301	$4,169,176	$2,630,492
Year 2	$568,277	$655,107	-$86,830	$4,737,453	$3,285,598
Year 3	$585,325	$674,760	-$89,434	$5,322,778	$3,960,358
Year 4	$602,885	$695,003	-$92,118	$5,925,663	$4,655,361
Year 5	$620,972	$715,853	-$94,881	$6,546,635	$5,371,214
Year 6	$639,601	$737,328	-$97,727	$7,186,236	$6,108,542
Year 7	$658,789	$759,448	-$100,659	$7,845,025	$6,867,990
Year 8	$678,553	$782,232	-$103,679	$8,523,578	$7,650,222
Year 9	$698,909	$805,699	-$106,789	$9,222,487	$8,455,920
Year 10	$719,876	$829,870	-$109,993	$9,942,363	$9,285,790
Year 11	$741,473	$854,766	-$113,293	$10,683,836	$10,140,556
Year 12	$763,717	$880,409	-$116,692	$11,447,553	$11,020,964
			-$1,196,396	**Cumulative difference**	-$426,588

Appendix XI: Capital Funding Sources Available to RRCNCA

Included below are brief summaries of several federal funding programs for which the parking lot improvements, signs, stops and shelters for the transit service may be eligible.

Congestion Mitigation & Air Quality Improvement Program (CMAQ)

The Congestion Mitigation and Air Quality Improvement Program (CMAQ) provides funding for projects and programs in air quality nonattainment and maintenance areas for ozone, carbon monoxide (CO), and particulate matter (PM-10, PM-2.5) which reduce transportation related emissions. The proposed lot reconfigurations and transit service would reduce emissions and congestion by transferring visitors from private cars to a shuttle bus. It would also reduce emissions and congestion by reducing or eliminating the number of drivers searching for parking spaces. Funds are eligible for projects that mitigate traffic congestion and improve air quality; transit projects and bicycle and pedestrian projects are eligible. Funds may be available for pilot transit operations projects. The federal share is typically 80 percent, requiring a 20 percent local match. For more information see:

http://www.fhwa.dot.gov/safetealu/factsheets/cmaq.htm

Federal Lands Transportation Program (FLTP)

The Federal Lands Transportation Program provides funding for transportation planning, research, transit operation and maintenance, preventive maintenance, engineering, rehabilitation, restoration, construction, and reconstruction of Federal lands transportation facilities, including public roads, bridges, trails, parking areas, and transit systems on or adjacent to Federal lands for which the Federal government is responsible. The Bureau of Land Management will receive funds under the FLTP in FY 2013 and 2014, although specific guidance on the amount of funding and how it will be allocated was not yet available at the time of publication. The program is administered by the Federal Highway Administration's Federal Lands Highway Office.

Federal Lands Access Program (FLAP)

The Federal Lands Access Program provides funding for transportation planning, research, engineering, preventative maintenance, rehabilitation, restoration, construction, and reconstruction of Federal lands transportation facilities, including public roads, bridges, trails, parking areas, and transit systems owned by states, tribal governments, and other local governments, that is located on, is adjacent to, or provides access to Federal lands. The Access Program also covers maintenance and operation of transit facilities. Funds are allocated to states, with more funding going to states like Nevada with large public land areas. Programming decisions are to be made within each state by a committee composed of a representative of the FHWA, a representative of the state DOT, and a representative of the appropriate political subdivision of the state. The program is administered by the Federal Lands Highway Office.

Surface Transportation Program (STP)

The Surface Transportation Program provides flexible funding that may be used by states and localities for projects on any federal-aid highway, including the National Highway System, bridge projects on any public road, transit capital projects, and intra-city and inter-city bus terminals and facilities. The federal share is generally 80 percent, requiring a 20 percent local match. For more information see:

http://www.fhwa.dot.gov/safetealu/factsheets/stp.htm

Appendix XII: Evaluation Criteria Analysis

Goal	Objective	Evaluation Criterion	No Action	Alternative A	Alternative B	Alternative C
Visitor mobility	Parking lots can sufficiently accommodate all visitors.	Average daily hours of congestion per lot for the busiest 7 lots	6.25 hours	2.4 hours	0.9-3.9 hours	0.9-3.9 hours
			See Table: Estimated Parking Demand by Lot in Alternatives Evaluation Report.	See Table: Estimated Parking Demand by Lot in Alternatives Evaluation Report.	See Table: Estimated Parking Demand by Lot in Alternatives Evaluation Report.	See Table: Estimated Parking Demand by Lot in Alternatives Evaluation Report.
		Number of lots that cannot accommodate demand on the 90th percentile day in 2025	7 lots	5 lots	1-7 lots	1-7 lots
			Calico I, Calico II, Pine Creek, and Sandstone Quarry are predicted to be congested for most of the design day; Willow Springs, Lost Creek, and Ice Box Canyon are predicted to be congested for about half of the design day.	Calico I and Pine Creek can be expanded to meet demand on the design day. The remaining lots will have less congestion than under the No Action scenario, but environmental and design constraints prevent further expansion.	Under a high transit ridership scenario, limited lot expansion will meet parking demand (or there will be less than one hour of congestion) at all lots except for Calico II. Under a low transit ridership scenario, all lots will have some congestion.	Under a high transit ridership scenario, limited lot expansion will meet parking demand (or there will be less than one hour of congestion) at all lots except for Calico II. Under a low transit ridership scenario, all lots will have some congestion.

Goal	Objective	Evaluation Criterion	No Action	Alternative A	Alternative B	Alternative C
Safety	There is a reduction in unsafe travel conditions due to infrastructure.	Annual number of bicycle or pedestrian injuries or fatalities	Baseline	Equal to No Action baseline	Smaller reduction from No Action baseline	Larger reduction from No Action baseline
			The BLM does not have specific data on traffic incidents, but the overall number of injuries and fatalities is extremely low. Therefore it is difficult to predict if the alternatives would have an appreciable difference on the injury or fatality rates.	An increase in future numbers of visitors, without reducing number of vehicles, will result in pedestrian and bicycle safety conditions similar to those of a No Action scenario. Management strategies may also support safer driving behavior.	A slight decrease in the number of vehicles on the road (due to transit) and new management strategies may result in some improved safety conditions for pedestrians and bicyclists.	A decrease in the number of vehicles on the road (due to transit) and new management strategies may result in more improved safety conditions for pedestrians and bicyclists.
		Annual number of vehicle collisions	Baseline	Equal to No Action baseline	Smaller reduction from No Action baseline	Smaller reduction from No Action baseline.
			The BLM does not have specific data on traffic incidents, but the overall number of injuries and fatalities is extremely low. Therefore it is difficult to predict if the alternatives would have an appreciable difference on the injury or fatality rates.	There will be a significant increase in the number of vehicles in parking lots and roadways, as well as increased size of parking lots, resulting in safety conditions similar to that of the No Action scenario.	A slight decrease in the number of vehicles on the road (due to transit) may offer some improved safety conditions for vehicles.	A more significant decrease in the number of vehicles on the road (due to transit) may offer more improved safety conditions for vehicles.
		Response time of emergency vehicles	Slower than current	Faster than current	Faster than current	Faster than current
			There will be a significant increase in the number of vehicles in parking lots and roadways, without new infrastructure to accommodate these vehicles, resulting in more congestion for emergency response vehicles.	While there will be more vehicles, the new parking infrastructure will remove much of the increase in new vehicles from undesignated parking in the ROW, and parking management strategies will close roads or lots during emergencies.	A decrease in the number of vehicles in undesignated parking on the ROW (due to parking expansion and transit) will improve response times for emergency vehicles. Management strategies to close roads or lots will also improve emergency response time.	A decrease in the number of vehicles in undesignated parking on the ROW (due to parking expansion and transit) will improve response times for emergency vehicles. The BLM can also open the reverse direction of the transitway for emergency vehicle use, as needed.
	There is a reduction in unsafe travel behavior.	Frequency of parked vehicles obstructing roadway	Greater than current	Reduced from current number	No change/Reduced from current number	No change/Reduced from current number
			There will be a significant increase in the number of vehicles at the site, and with no new infrastructure to accommodate these vehicles, there will likely be more parked in undesignated areas.	The significant increase in the number of vehicles at the site will be largely accommodated by increases in parking capacity.	While overall visitation will increase, some visitors will use transit and others will be accommodated by limited parking expansion. The net result will be no change, or possibly a reduction (depending on transit ridership).	While overall visitation will increase, some visitors will use transit and others will be accommodated by limited parking expansion. This alternative accommodates higher levels of transit ridership, and assumes a reduction in undesignated parking.

Goal	Objective	Evaluation Criterion	No Action	Alternative A	Alternative B	Alternative C
Visitor Experience	The strategy does not detract from the visitor experience.	Interpretation elements	Does not include interpretation	Does not include interpretation	Includes interpretation elements	Includes interpretation elements
			There is no interpretation associated with visitors' transportation experience, nor is any planned for the future.	This alternative does not include new interpretation.	The transit service will include an interpretive element, such as a recording of the site's natural and cultural features.	The transit service will include an interpretive element, such as a recording of the site's natural and cultural features.
		Time spent traveling around Scenic Drive for hikers and climbers.	Increased	No change	No change	Reduced
			An increase in the number of vehicles at the site, due to growth in visitation, will result in more congestion for climbers	New parking expansion will help offset the increase in vehicles, which should limit any congestion delays due to parking from undesignated vehicles.	If the shuttles are running at high frequencies, the shuttle can operate at higher frequencies and result in travel times equal to driving a personal vehicle.	Two-way transit will significantly decrease the travel time for hikers and climbers using Calico I, Calico II, and Sandstone Quarry. Other lots will have no change in travel time.

Goal	Objective	Evaluation Criterion	No Action	Alternative A	Alternative B	Alternative C
Resource Protection	Scenic and aesthetic resources can be enjoyed by current visitors and future generations.	Visual impact of transportation infrastructure and vehicle congestion	No visible change in amount of paved areas visible from Scenic Drive, trails, or other visitor amenities. However, major congestion will degrade visual and aesthetic appeal.	Large increase in the amount of paved areas and vehicles that are visible from the Scenic Drive, trails, or other visitor amenities.	Small increase in amount of paved areas visible from Scenic Drive, trails, or other visitor amenities.	Moderate increase in the amount of paved areas and vehicles that are visible from the Scenic Drive, trails, or other visitor amenities.
			There will be no infrastructure changes, but there may be visual impacts from more cars parking at lots and along the road.	The alternative greatly increases the parking lot areas, resulting in a large number of new, visible paved areas.	The alternative increases parking by a limited amount, and in selected areas, so there will be a small impact in visual resources.	The alternative increases parking by a limited amount, but the construction of a two-way transitway significantly increases visual impact for the first three miles of the Scenic Drive.
	Cultural resources are preserved.	Impact on cultural resources	No direct impact to resource from vehicles.	Potential for minor impact that could be easily mitigated or avoided.	Potential for minor impact that could be easily mitigated or avoided.	Potential for minor impact that could be easily mitigated or avoided.
			The No Action alternative involves no new construction and therefore no anticipated impacts. However, increased visitation may result in more human impacts on cultural resources.	All parking expansion alternatives include expansions to Sandstone Quarry, which will be designed to avoid impacting cultural resources. Any resource impacts resulting from infrastructure improvements will be mitigated.	All parking expansion alternatives include expansions to Sandstone Quarry, which will be designed to avoid impacting cultural resources. Any resource impacts resulting from infrastructure improvements will be mitigated. Added interpretation elements can also educate visitors about the sensitivity of cultural resources.	All parking expansion alternatives include expansions to Sandstone Quarry, which will be designed to avoid impacting cultural resources. Any resource impacts resulting from infrastructure improvements will be mitigated. Added interpretation elements can also educate visitors about the sensitivity of cultural resources.
	Natural resources are preserved.	Anticipated impact on vegetation, soils, hydrology, habitat, or species.	Potential for impact.	Potential for impact.	Potential for minor impact that could be easily mitigated or avoided.	Potential for impact.
			An increase in the number of vehicles on the site, without new strategies to accommodate the vehicles, will increase parking in undesignated areas. Parking in undesignated areas has significant impacts upon vegetation, soils, and habitat.	The parking expansion included in this alternative will have the greatest increase of paved areas, resulting in more impacts to natural resources. Any resource impacts resulting from infrastructure improvements will be mitigated.	The limited parking expansion included in this alternative offers the most flexibility to avoid areas of significant impact. Any resource impacts resulting from infrastructure improvements will be mitigated. Added interpretation elements can also educate visitors about the sensitivity of cultural resources.	Although this alternative includes a more limited parking expansion, it also includes significant widening of Scenic Drive. Any resource impacts resulting from infrastructure improvements will be mitigated. Added interpretation elements can also educate visitors about the sensitivity of cultural resources.

Goal	Objective	Evaluation Criterion	No Action	Alternative A	Alternative B	Alternative C
Financial and operational feasibility	Strategy is financially feasible and sound.	Capital costs	$0	Parking: $2,400,000	Transit: $1,211,000; Parking: $884,000	Transit: $3,617,000 (includes $1.75 million for two-way road); Parking: $884,000
		Operations and maintenance costs (annual)	$0	minimal	$364,000	$492,000
	BLM has the capability to operate and maintain	Staff capacity of operations and maintenance	BLM operates and maintains with current or anticipated staff levels.	BLM can operate and maintain with support from current partners or Friends groups	BLM will need management assistance for operations and maintenance.	BLM will need management assistance for operations and maintenance.
			The alternative includes no new activities, and therefore the BLM can operate and maintain under current staff levels.	The BLM can largely manage the parking expansion within their current capacity, but they may need assistance or limited additional capacity for reopening the carpool lot, closing lots during peak periods, and periodically enforcing long- and short-term parking.	The BLM will need outside assistance, such as through a contractor or concessionaire, to run the transit system, and BLM will also need additional staff capacity to manage transit operations. BLM may be able to run some transit operations with the assistance of partners or Friends groups.	The BLM will need outside assistance, such as through a contractor or concessionaire, to run the transit system, and BLM will also need additional staff capacity to manage transit operations. BLM may be able to run some transit operations with the assistance of partners or Friends groups.

BLM

The Bureau of Land Management was established in 1946 and is part of the U.S. Department of the Interior. We manage public lands, mostly in the 12 Western states, that encompass 258 million acres — an area equivalent to the size of Texas and New England combined — and 700 million acres of subsurface mineral estate.

U.S. Department of the Interior
Ken Salazar, Secretary

Bureau of Land Management
Bob Abbey, Director

For more information about Transportation on BLM lands see:
http://www.blm.gov/wo/st/en/prog/Recreation/recreation_national/travel_management.html