Big Sur Highway 1 Bike Route Improvements
Opportunities and Constraints Analysis

Prepared for:

California State Coastal Conservancy

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1. Objectives of the California Coastal Trail and Big Sur Coastal Trail

The California Coastal Trail (CCT) vision is a continuous and interconnected public trail system along the California coastline. Objectives for the CCT include providing pedestrian and bicycle connections to other trail systems and overlooks of the Pacific Ocean, while preserving the natural environment and cultural resources within the CCT area. The Big Sur Coastal Trail is a proposed segment of the CCT within the 75 miles of coast extending from the Carmel River in Monterey County south to San Carpoforo Creek in San Luis Obispo County. This is the study area for the current analysis (see Figure 1).

Since 2001, progress has been made toward development of the CCT throughout the state. *Completing the California Coastal Trail*, a document prepared by the California Coastal Conservancy in 2003, highlights the CCT goals and objectives, issues and constraints, and recommendations for further policy initiatives. Additionally, the non-profit organization CoastWalk developed planning maps for the CCT through the entire state that show where substantial improvements for the CCT are necessary.

Bike route improvements along Highway 1 in the Big Sur study area would be considered part of the CCT system, improving access and safety for touring as well as local bicyclists. Such improvements would also have the potential to serve pedestrians by linking off-highway segments of the CCT to wider shoulders along Highway 1.

1.1. Scope and Objectives of the Analysis

This paper summarizes an analysis of existing conditions, constraints and opportunities to provide bike route improvements in the right-of-way of Highway 1 through the Big Sur study area. This analysis is not intended to provide a definitive conclusion as to the feasibility or desirability of improving any segment of the study area or to be a direct basis for any adopted plan or policy – it is technical information intended for further study and discussion purposes. This study is a planning-level analysis of conditions in the corridor. It provides general, tentative indications of bike route improvement feasibility. In any case, specific studies will be required to consider any specific bike route improvement priorities or projects.

The analysis uses Geographic Information System (GIS) data collected for the 2005 Highway 1 Big Sur Coast Highway Management Plan (CHMP), augmented by GIS data collected by the study consultants and data from a driving inventory of the study area. The objective of the analysis is to present an overview of the physical opportunities and constraints, and their relative significance in each portion of the study area, for consideration in the context of public interests and concerns, and agency policies and priorities. While not all available data were directly used in this analysis, it will be available in the project's GIS database and can be further analyzed for future study. **Attachment 3** contains a list of the GIS data used and a list of all the GIS data that were collected.

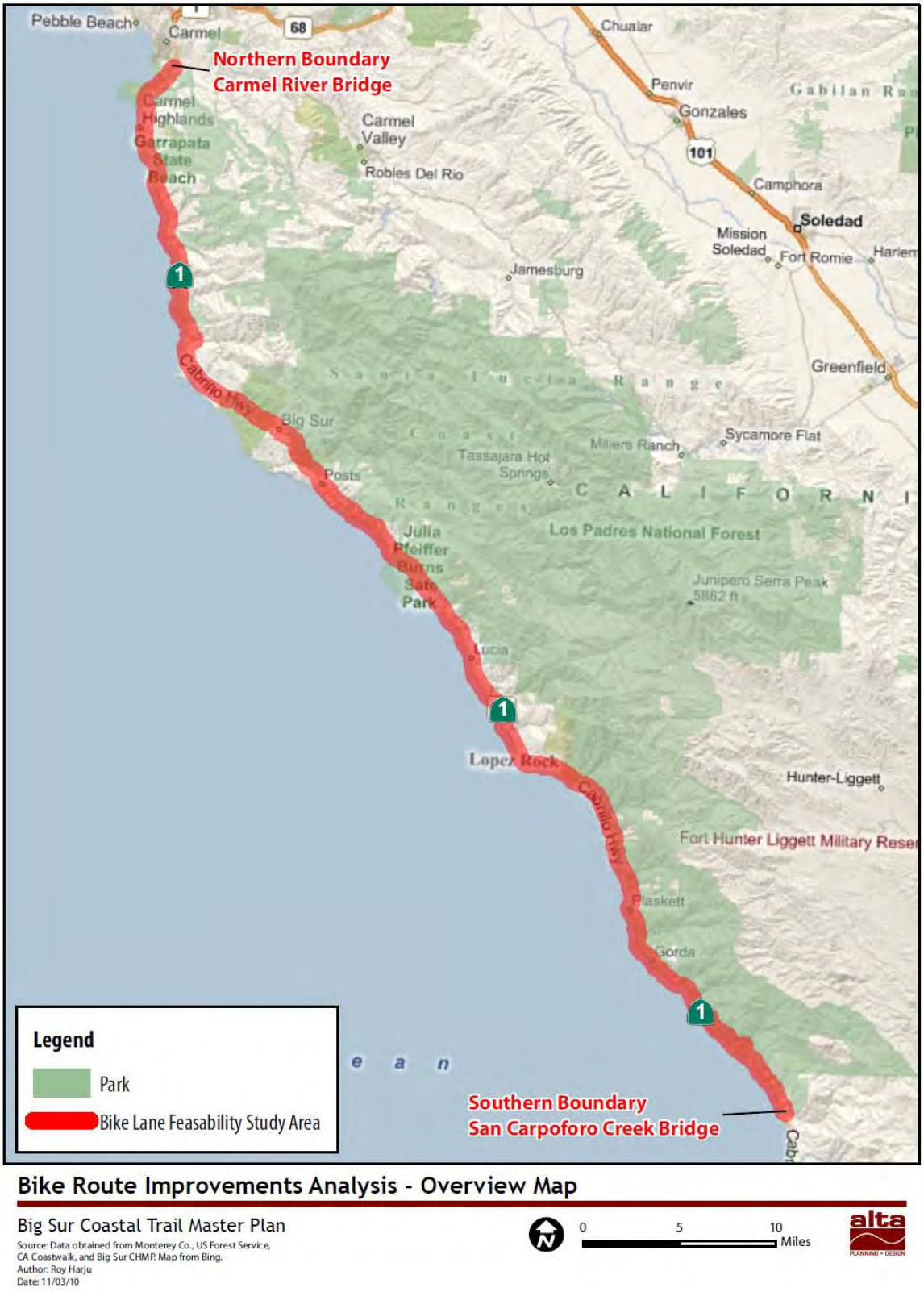


Figure 1 – Study Area Overview

1.2. Caltrans Policies and Standards

California Department of Transportation (Caltrans) standards for roadways and bicycle facilities provide the foundation for this analysis. The project team coordinated with Caltrans District 5 staff during development of the analysis to discuss data, analytical methods, policies and procedures relevant to the study. This section provides a summary of applicable Caltrans policies and standards.

1.2.1. Bikeway Classifications

Bicycle improvements in the state right-of-way must meet Caltrans' standards for bicycle facilities. Chapter 1000 of the Caltrans Highway Design Manual defines three types of "bikeways" as illustrated in *Figure* 2:

- Class I Bike Path - a completely separated paved pathway for the exclusive use of bicycles and pedestrians, with cross-flow minimized;
- Class II Bike Lanes - striped lanes for bike travel on each side of a street or highway, in the same direction as traffic;
- Class III Bike Route - a route signed for shared use with motor vehicle traffic.

Class II bike lanes have specific requirements for striping, marking and signage. Standards require that bike lanes be at least four or ideally, five feet wide. On many highways, especially in rural locations, striped shoulders four feet to eight feet wide exist and are actively used by bicyclists, though the formal designations and markings for bike lanes are absent.

Class III bike routes are designated by route signs placed at all changes of direction and periodically along the route. In the case of Highway 1 through the Big Sur region, the entire route is technically designated as Class III, as no part of the route is designated as Class II, though some potions have the required minimum four foot shoulder.

1.2.2. Shoulder Standards

The Caltrans Highway Design Manual standards call for an eight-foot shoulder on all highways where feasible.[1] This is to provide a breakdown lane for vehicles, but it also accommodates bicycles. Where highway improvements are being implemented, Caltrans' policy is that this eight foot shoulder standard shall be met unless an exception to standards is justified by specific conditions and review process. If a project to provide more room for bikes, or any other significant improvement, is undertaken, Caltrans standards require the project to provide eight foot shoulders or demonstrate that eight feet is not feasible.

[1] The citations for the shoulder widths can be found in the Highway Design Manual (HDM) Indices 302.1, 302.2, and 307.3. Index 307.3 contains the reference to Design Information Bulletin (DIB) 79, which concerns the applicability under conditions typically found on projects in the Big Sur area.

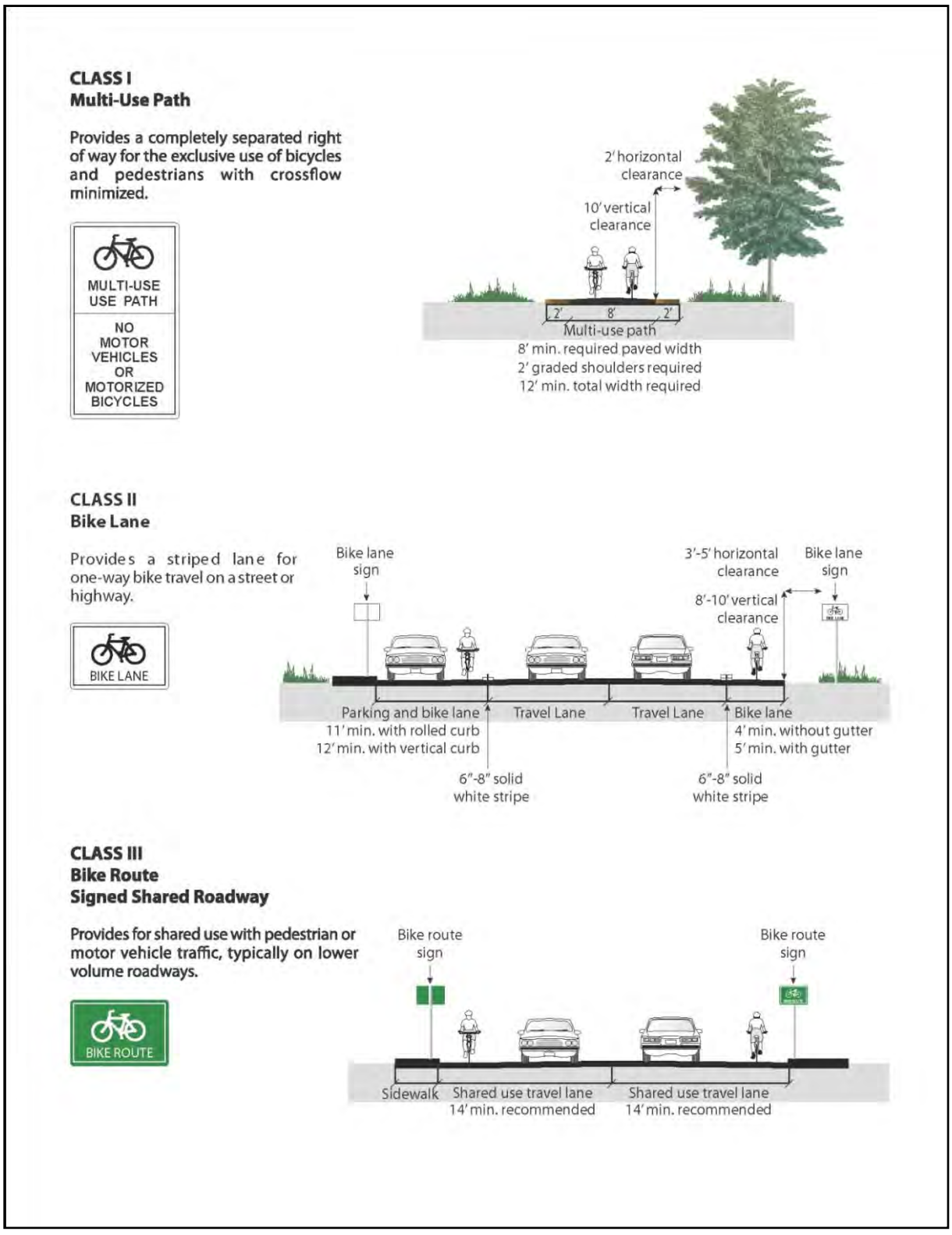


Figure 2 – Caltrans Bikeway Classifications

1.2.3. Highway Concept Plan

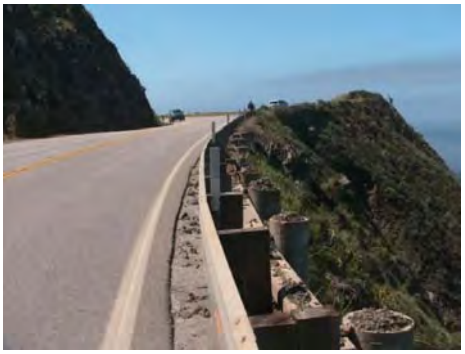
The *Highway Concept Plan* is Caltrans' long-term planning document, typically prepared for each state route. The plan evaluates current and projected conditions along the route, establishes a twenty-year planning vision or concept, and recommends long- and short-term improvements to achieve the concept. Segment 12 in the Caltrans District 5 Highway Concept Plan for Highway 1 corresponds to the study area for the bike route improvements analysis. The entire project study area on Highway 1 is designated in the Concept Plan as open to bicyclists with bicyclists sharing the highway with motorized vehicles (Class III route). The Highway Concept Plan for this portion of Highway 1 calls for standard width travel lanes and four-foot shoulders where possible to accommodate vehicles and bicyclists, rather than the Caltrans standard eight-foot shoulders. This policy is due to the significant constraints to providing wider shoulders in the Big Sur region. Four-foot shoulders have typically been provided, at minimum, in portions of Highway 1 that have been reconstructed due to landslides. Along the entire 75 miles of the study area paved shoulders vary from eight feet to zero feet, depending on constraints and projects undertaken.

2. Methodology

Based on the Caltrans standard for shoulder widths of eight feet, and the Highway 1 Concept Plan policy and Caltrans District 5 practice of providing four foot shoulders, this analysis evaluates the presence of or feasibility to create either four foot shoulders or eight foot shoulders along Highway 1. Using the GIS data, the consultants aggregated opportunity and constraint factors to determine a score for every approximately 100 foot segment of highway. Separate scores were determined for each side – the northbound side and the southbound side, because conditions varied considerably between the two sides in some cases. The four foot shoulder feasibility analysis and the eight foot shoulder feasibility analysis used the same five criteria to develop an aggregated score: Shoulder Type, Existing Culverts, Low-Sensitivity Vegetation, Sensitive Vegetation, and Recreation Areas. A more detailed discussion of the criteria and classifications follows.

2.1. Primary Criterion: Shoulder Type

Approximate shoulder widths were collected using Global Positioning System (GPS) equipment during the study area inventory performed by the project consultant. The inventory determined that segments in the study area have existing shoulders that range in width from zero to over eight feet wide. All segments with shoulder widths of eight feet or greater were considered already improved in the eight foot shoulder analysis and segments with existing four foot or greater shoulder widths were considered already improved in the four foot roadway shoulder analysis.

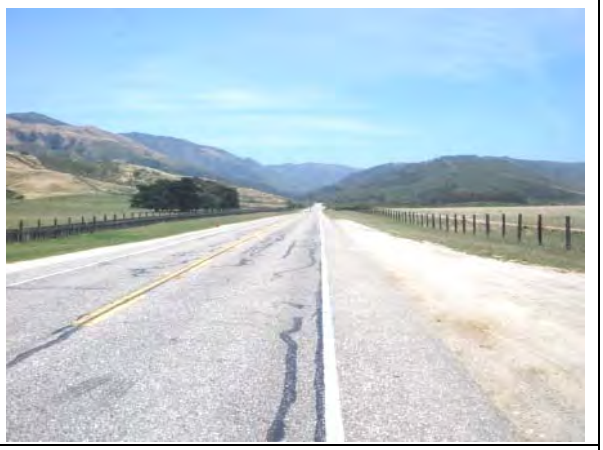


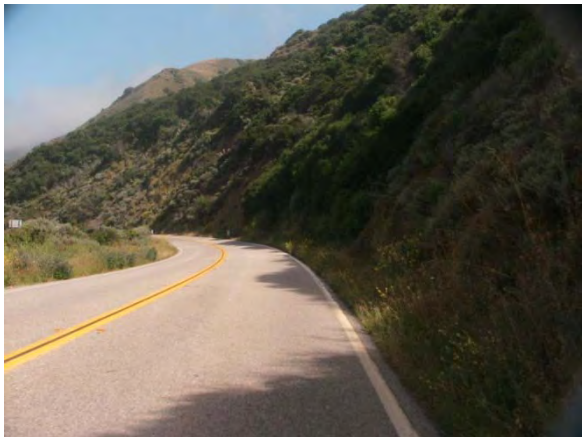
This southbound segment of Highway 1 has no existing shoulder

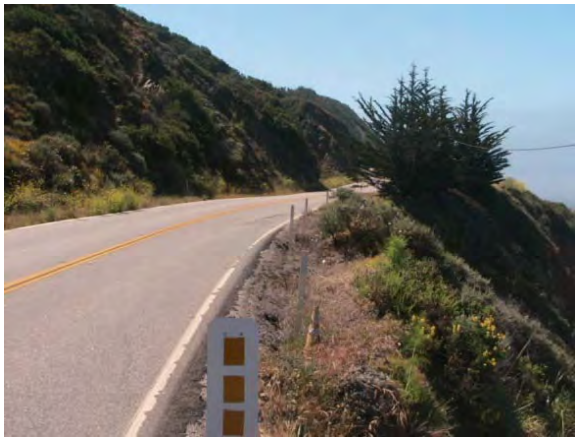
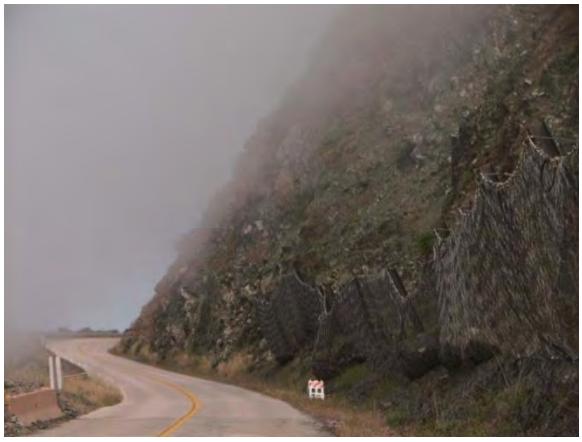
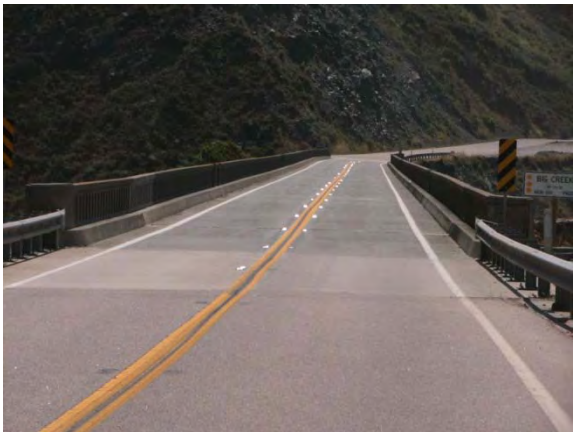
The project consultant used the collected data to further classify the existing road shoulder conditions on both sides of Highway 1, combining the inventory data with GIS data for turnouts mapped for the AMGEN Tour of California bicycle race. The consultant team classified the shoulder types into the seven categories described in *Table 1*.

The classification considered available paved shoulders, available unpaved shoulder, steepness and apparent stability of adjacent slopes (based on GIS landslide data and identification of existing landslide repair projects), the presence of many mature trees, existing retaining walls, drainage ditches, or utility poles/lines that would have to be relocated. The seven categories generalize the existing shoulder conditions and the land area adjacent to the highway, reflecting the most significant existing conditions that would constrain or facilitate highway widening.

Table 1 – Shoulder Type Classifications

Type	Description	Photo Examples
1	Existing eight- or four-foot paved shoulders – the desired improvements are already in place.	
1A	Some paved shoulder exists with adjacent gravel or dirt shoulder so that the combination is at least eight feet or four feet.	
2	Eight- or four-foot shoulders could be constructed with minor grading and vegetation removal (existing relatively level ground, grass and shrubs, but few trees).	

Type	Description	Photo Examples
3	Eight- or four-foot shoulders could be constructed with moderate grading, small retaining walls (e.g. three to five feet), and/or more significant vegetation removal (numerous trees), or utility pole relocation.	
4	Steep slopes – major construction needed to construct eight- or four-foot shoulders (e.g. retaining walls five feet or more).	

Type	Description	Photo Examples
5	Very steep/unstable slopes with virtually no shoulder (existing evidence of slides, too steep/unstable to support vegetation). Typically would require major retaining walls (6 to 10 feet tall or more) or a sidehill viaduct (cantilevered deck structure) to provide eight- or four-foot shoulders.	 
6	Existing bridges were noted in the analysis and classified into those that have the desired four- or eight-foot shoulders, and those that do not, and would have to be reconstructed or retrofitted to provide them.	

During the GPS inventory, the consultant team noted the availability of sidewalks and/or shoulders on existing bridges and viaducts. Table 2 presents the number of bridges with eight and four foot shoulders/sidewalks.

Table 2 – Bridges with Shoulders

Number of Bridges with Eight Foot Shoulders	1
Number of Bridges with Four Foot Shoulders	14
Number of Bridges without Four Foot Shoulders	27
Total	**42**

2.2. Secondary Criteria: Culverts, Vegetation, and Recreational Areas

In addition to Shoulder Types, four other criteria were used in the analysis of bikeway feasibility on Highway 1: Existing Culverts, Low-Sensitivity Vegetation, Sensitive Vegetation, and Recreation Areas. This section describes these criteria in more detail.

2.2.1. Existing Culverts

The CHMP data includes the location of existing culverts. Culverts are a significant consideration for highway widening because they typically would need to be extended, unless there is already sufficient unpaved shoulder to accommodate the wider pavement (Shoulder Type 1A). Extending the culverts could entail addressing deficiencies in the size or condition of the culvert, many of which have been in place for many years. Extending the culverts also is likely to involve relocation of associated roadside drainage ditches. In addition, the culvert work will take place in drainages that may be under the jurisdiction of the U.S. Army Corps of Engineers and the California Department of Fish and Game, requiring special environmental permits, construction measures, and potentially environmental impact mitigations.

The number of culverts in a segment was used to determine a negative score for this criterion. The available GIS data include the size and shape of the culverts, which will be important factors for specific work that might be required at any particular site, but this is more detail than can be addressed in the current regional-scale analysis.

2.2.2. Big Sur Vegetation Types

Vegetation Type data from the Big Sur Coast Highway Management Plan (CHMP) was used to analyze the vegetation constraints for highway widening. Consultant team Biologist Kathleen Lyons prepared a simplified set of vegetation classifications that was used to assess the potential environmental sensitivity/impact on the different vegetation types included in the CHMP. For the purpose of this Study, nineteen CHMP vegetation types were consolidated into ten classifications. The CHMP and consolidated classifications are presented in Table 3.

Table 3 – Consolidation of CHMP Vegetation Classifications

	CHMP Vegetation Types	Consolidated Types
1	Central Maritime Chaparral Coastal Sage-Chaparral Scrub	Chaparral
2	Northern Foredune	Foredune
3	California Bay Forest Coast Live Oak Forest Monterey Cypress Forest Monterey Pine Forest Upland Redwood Forest	Forest
4	Non-native Grassland	Grassland
5	Intertidal Zone	Intertidal Zone
6	Coastal Terrace Prairie	Prairie
7	Central Coast Cottonwood/Sycamore Riparian Woodland Central Coastal Riparian Scrub	Riparian
8	Ruderal/Disturbed	Ruderal/Disturbed
9	Central Coastal Scrub Central Dune Scrub Northern Coastal Bluff Scrub	Scrub
10	Windrow	Windrow

2.2.3. Low-Sensitivity Vegetation

Based on biologist input, some of these vegetation communities were determined to be less sensitive or protected than others, specifically: grassland, prairie, scrub, foredune, windrow, and ruderal/disturbed. The southbound and northbound shoulders of each highway segment were classified according to the percentage of the road edge covered by low-sensitivity vegetation. The categories are as follows:

- Greater than 50 percent of the area along Highway 1 edge has low-sensitivity vegetation
- Between 0 percent and 50 percent of the area along Highway 1 edge has low-sensitivity vegetation
- No low-sensitivity vegetation exists along Highway 1 edge

2.2.4. Sensitive Vegetation

Sensitive Vegetation for the purpose of this analysis is those plant communities considered rare and worthy of consideration in the California Natural Diversity Database (CNDDB). These are: Central Coast Cottonwood/Sycamore Riparian Woodland, Central Maritime Chaparral, Northern Coastal Bluff Scrub, California Bay Forest, Monterey Cypress Forest, Monterey Pine Forest,

Coastal Terrace Prairie, and locations where buckwheat is present. The percent of sensitive vegetation immediately adjacent to Highway 1 was analyzed for each 100 foot segment in each direction to help determine the constraints for bike route improvements. Each highway segment was classified according to the percentage of the road edge covered by sensitive vegetation. The categories are as follows:

- No Sensitive Vegetation along Highway 1 edge
- Between 0 percent and 50 percent of the area along Highway 1 edge has Sensitive Vegetation
- Greater than 50 percent of the area along Highway 1 edge has Sensitive Vegetation

2.2.5. Recreation Areas

Recreation Areas are included in the data from the CHMP. There are 103 of these facilities in the study area. They include picnic areas, beaches, parks, and campgrounds. These are potential destinations in the study area for bicycle access. The presence of one or more recreational areas within each 100 foot segment of the study area was factored into the analysis.

2.3. Weighting the Criteria

Scores were assigned based on the criteria for every 100 foot section of the study area for the southbound and northbound directions. An analysis was performed for both four foot shoulder feasibility and eight foot shoulder feasibility. The scores for Shoulder Type, Existing Culverts, Low-Sensitivity Vegetation, Sensitive Vegetation, and Recreational Areas were weighted to determine a score representing the potential for bikeway improvements along Highway 1.

Table 4 presents the five criteria and the scores associated with each. The segments with existing eight foot or four foot shoulders were considered already improved and were identified as such in the respective analyses. The primary criterion, Shoulder Type, has the most significant weight in the scoring. The secondary criteria can result in a positive or negative score based on their relative significance as a constraint or opportunity for shoulder widening.

Table 4 –Bike Route Improvements Feasibility Scoring

Criteria	Score	Description
Shoulder Type Based on GPS analysis of existing roadway shoulder.	NA - complete	Type 1 - Existing eight foot or four foot paved shoulder
	20	Type 1a - Eight or four foot shoulder feasible with minimal clearing or grading
	15	Type 2 - Minor clearing and grading improvements to create eight or four foot shoulder
	10	Type 3 -Moderate clearing, grading, retaining walls utility relocation and/or drainage ditch work to create eight or four foot shoulder
	2	Type 4 - Major grading, retaining wall construction up to 5' high, plus any of above work required to create eight or four foot shoulder
	0	Type 5 or 6 - Narrow bridge/viaduct, or very steep/unstable slope or cliff - retaining walls 6' to 10' high or more, viaduct, or bridge reconstruction/replacement required to create eight or four foot shoulder
Existing Culverts	-4	Three or more culverts in or parallel to the segment
	-2	One to two culverts in or parallel to the segment
	0	No culverts in the segment
Low-Sensitivity Vegetation Percent Low-Sensitivity Vegetation within 30 feet of Highway 1.	4	Greater than 50 percent of the area along Highway 1 edge has grassland, prairie, scrub, foredune, windrow, and/or ruderal/disturbed
	2	Greater than 0 percent and less than 50 percent of the area along Highway 1 edge has grassland, prairie, scrub, foredune, windrow, and/or ruderal/disturbed
	0	No grassland, prairie, scrub, foredune, windrow, and/or ruderal/Disturbed along Highway 1 edge
Sensitive Vegetation Percent Sensitive Vegetation within 30 feet of Highway 1.	0	No Sensitive Vegetation along Highway 1 edge
	-2	Greater than 0 percent and less than 50 percent of the area along Highway 1 edge has Sensitive Vegetation
	-4	Greater than 50 percent of the area along Highway 1 edge has Sensitive Vegetation
Recreational Areas Number of recreational area entrances on Highway 1	3	>0 entrances
	0	0 entrances

2.4. Cumulative Scores

Cumulative scores were determined for each approximately 100 foot segment on each side of the highway by adding the positive and negative scores for the individual criteria. The scores were reflected as colors on the analysis overview maps. Already improved segments are shown as purple. Cumulative scores greater than 17 were designated as green (relatively easy to improve). Scores between 7 and 17 are shown as yellow (challenging to improve), and scores less than 7 are shown as red (very challenging to improve).

Scores for Shoulder Type 1a were not adjusted for the culvert or vegetation criteria because by definition these areas have sufficient combination of existing paved or unpaved shoulder available to create the paved shoulders without extending culverts or disturbing vegetation. Depending on existing culverts, the adjacent vegetation, and to a lesser extent on presence of Recreation Areas, Type 2 Existing Shoulders could stay in the "yellow" category, move into up into a "green" score or down to a "red" score. Type 3 and 4 Existing Shoulders could score no higher than "yellow", or move down to a "red" score. Types 5 and 6 Existing Shoulders cannot score above "red". The cumulative scores for individual segments were verified as relatively realistic representations of actual conditions based on spot checks of numerous roadway segments using Google Street view and aerial photos.

The results of the cumulative score analysis are summarized in Table 5 through 8. These tables present the total number of segments within each score range and the corresponding color shown on the attached maps. Table 5 and Table 6 are the results from the eight foot shoulder analysis and Table 7 and Table 8 and are the results from the four foot shoulder analysis.

As Table 5 and Table 6 present for the eight foot analysis, there are more southbound segments in the top tier (green). This is generally due to the steep cut banks and slide areas adjacent to Highway 1 on the northbound side. The results demonstrate that eight foot shoulders will be very challenging to implement (red) in almost half of the roadway segments and approximately 40 percent of the segments for four foot shoulders.

The results in Table 7 and Table 8 show that there are no green segments in the four foot shoulder analysis. This is because all of the segments in the eight foot analysis that have green results have at least a four foot shoulder. Therefore, in the four foot analysis, these are shown as purple on the maps. The number of "green" segments drops to zero in the four foot shoulder analysis because four foot shoulders exist in virtually all locations where it is relatively easy to construct them.

Table 5 – Southbound Eight Foot Shoulder Feasibility Analysis

Color	Score	Number of Segments	Percent of Total
Purple	Existing Shoulder	23	0.6%
Green	>17	1196	30.1%
Yellow	7-17	978	24.6%
Red	<7	1783	44.8%
Total		**3980**	

Table 6 – Northbound Eight Foot Shoulder Feasibility Analysis

Color	Score	Number of Segments	Percent of Total
Purple	Existing Shoulder	27	0.7%
Green	>17	588	14.8%
Yellow	7-17	1403	35.2%
Red	<7	1962	49.3%
Total		**3980**	

Table 7 – Southbound Four Foot Shoulder Feasibility Analysis

Color	Score	Number of Segments	Percent of Total
Purple	Existing Shoulder	1701	42.7%
Green	>17	0	0.0%
Yellow	7-17	778	19.5%
Red	<7	1501	37.7%
Total		**3980**	

Table 8 – Northbound Four Foot Shoulder Feasibility Analysis

Color	Score	Number of Segments	Percent of Total
Purple	Existing Shoulder	1174	29.5%
Green	>17	0	0.0%
Yellow	7-17	1100	27.6%
Red	<7	1706	42.9%
Total		**3980**	

Attachment 4 is a master table that provides the detail of the scores for each criterion for each segment. The "green, yellow, red" scoring is a very rough generalization of the opportunities and constraints that would be encountered on any specific segment of the highway. The numerical scores provide a more detailed range of relative feasibility for the 100 foot segments than the "green, yellow, red" maps. In any case, the criteria selection, analysis methods, and weighting of the criteria could be done in many other ways. Focusing in on the detail of the scores, the GIS data used, and the GIS data available will allow a more specific understanding of opportunities and constraints for bike route improvements on any particular segment of the highway.

2.5. Mapping the Results

The method of mapping the analysis results is illustrated in **Attachment 1**. The maps display feasibility in terms of purple (already improved), green (relatively easy to improve), yellow (challenging to improve) or red (very challenging to improve). These color classifications are based on the aggregated score of opportunity and constraint factors for every approximately 100 foot segment of highway described above. The presence or feasibility of four foot roadway shoulders is represented by the inner bands of color along the highway, and presence or feasibility of eight foot shoulders is represented by the outer bands of color. The two analyses used the same five criteria to develop an aggregated score: Shoulder Type, Existing Culverts, Low-Sensitivity Vegetation, Sensitive Vegetation, and Recreation Areas.

Complete mapping of the analysis results is provided in **Attachment 2**, a series of 14 overview maps (1 inch = 0.5 mile) identifying the relative challenges for providing four foot and eight foot bike route/shoulder improvements in both directions of Highway 1.

3. Summary – Opportunities and Constraints

Highway 1 shoulder widths, conditions, adjacent land uses and facilities vary considerably through the study area. Overall, Big Sur's rugged beauty corresponds to significant physical and aesthetic constraints. Even in the least constrained areas, widening for bike access, or for other purposes, could have significant visual or environmental effects and significantly change the character of the scenic highway. In many areas, creating eight foot shoulders, or even minimal four foot shoulders, may be physically and/or financially infeasible. This analysis is intended as a starting point for discussion and more detailed study of areas where further consideration of bike route improvements is warranted.

The 14 maps in Attachment 2 display the aggregated scores of opportunities and constraints in a simplified way that can be understood visually. There are many ways that the data could be combined, scored and presented to produce an assessment of bike route improvement feasibility, but the general conclusions regarding the major physical constraints and their geographic locations are likely to be similar.

Existing 4 foot shoulder segment, "green" for creating 8 foot shoulders

The "green" areas with the most opportunity to add wider shoulders tend to be relatively flat coastal terrace portions of the corridor. These sections often have some existing paved and unpaved shoulder. In many cases, these are the existing turnouts on the highway used by tourists as overlook stopping points and for Caltrans' maintenance vehicles to store material. There may be some conflict between the shoulder widening and these uses, which would need to be resolved in future, more detailed studies.

Trees on the west side (right) and utilities on the east side (left) are obstacles to shoulder widening

In the "yellow" areas of the corridor, there is potential to widen Highway 1 but with more constraints. Inherent in the Shoulder Type designations are obstacles such as trees, driveways, utility poles, and private improvements. For example, on the northern end of the corridor, through Carmel Highlands, there are numerous private residential driveways, walls, trees, and nearby structures. Additionally, in this area there is a series of retaining walls on private properties immediately adjacent to the highway preventing expansion (short sections of red). Other constraints include existing cut banks and near vertical rock faces extensively vegetated with wildflowers. Providing a wider shoulder in these areas would impact these banks and the visual interest that native vegetation provides, potentially constituting significant environmental impacts.

Highway 1 slide area under construction

"Red" sections of Highway 1 are typically winding and narrow with little or no existing shoulder and very steep and potentially unstable slopes immediately above and/or below the highway. These sections will be difficult to improve for wider shoulders. These sections have steep to near-vertical cut slopes on the east side of the highway typically greater than 20 feet high, and slopes on the west side often extending directly down to the Pacific Ocean. Adding shoulder width in these areas will have major impacts to the adjacent vegetation and the visual interest of Highway 1, as well as presenting significant engineering challenges.

Typical steep, rocky cut slopes

There are also many major slope failure areas along Highway 1. In some of these locations, Caltrans has completed or is currently conducting major projects to rebuild the roadway. Current practice along Highway 1 in conjunction with these repairs is to provide minimum four foot shoulders rather than standard eight foot shoulders, although in some locations where space is available, eight foot or wider shoulders have been provided.

3.1. Pedestrian Accommodation Opportunities

Although this analysis was directed at improvements for bicycle access, the study and the background data may also be useful for studying accommodations for pedestrians, including segments where constraints may dictate that the desired off-highway Coastal Trail for hikers must be located in the highway right-of-way. If pedestrians are to share the shoulder with bicyclists, a four foot shoulder would be impractical, but an eight foot shoulder may be adequate. Ideally the pedestrian/hiking route would be separated from the shoulder, and except in developed areas, it would probably be unpaved. The constraints and opportunities for accommodating pedestrians may be a little more flexible than bicycle accommodations, because the route could more easily depart from the road alignment horizontally or vertically. The benched retaining walls and setback behind guardrails in some of the recent landslide repair project provide potential opportunities for parallel pedestrian trails.

Potential space for pedestrians in a highway reconstruction project

3.2. Potential Next Steps

Through the Coastal Conservancy, this analysis and the associated data will be available to the Big Sur Community, other interested members of the public, and to Caltrans and other agencies with jurisdiction on the Big Sur Coast. The analysis and data may be useful to groups and agencies for further discussion, analysis or planning of bike route improvements or trail connections on the Big Sur Coast. Based on public interest and agencies' ability to participate, the analysis and data could be used to study or plan bicycle access improvements in specific areas where they may benefit local bicyclists accessing stores, work places, public services, recreational areas, schools, and transit, as well as Coastal Trail users.

3.2.1. Public and Agency Review – Identify Projects and Priorities

Public review of the analysis, and potentially revised or augmented analysis, are critical next steps for identifying potential bike route improvement projects, scoping them, and setting any priorities or preferences. More detailed local or sub-regional planning-level studies could be prepared using the analysis results and the associated data, and other available data. This could occur through a continued dialogue with the community and Caltrans through the local processes already established to work on highway-related issues, including the Coastal Trail Working Group, the Transportation Authority of Monterey County (TAMC) and its Bicycle and Pedestrian Facilities Advisory Committee; Monterey County, and the City of Carmel. Counterparts in San Luis Obispo County in the southern end of the study area include the San Luis Obispo Council of Governments, and the Bicycle and Pedestrian Advisory Committee.

The analysis presented here emphasizes physical factors in the prioritization of shoulder construction, especially the width of existing right-of-way. A more detailed analysis would also consider planning- and policy-level factors. These include the extent of residential or commercial development along any stretch of the highway, existing local or regional plans that identify bicycle improvements that include any particular highway segment, and the possibility of reallocating roadway space where existing lanes are especially wide.

3.2.2. Add-ons to Caltrans Projects

An opportunity exists to provide more than the minimum four foot shoulders as well as parallel pedestrian accommodations where Caltrans is redesigning and rebuilding sections of Highway 1, however timing is a real challenge to arranging such add-ons because these are typically emergency repair projects that have a tight schedule. Also, restrictions on federal funds for emergency projects preclude using them for this purpose; the funding would have to come from another source. Providing more than replacement of the existing shoulder is possible, but requires agreements with all the participating agencies for the add-on project. Knowing priority areas for bike route improvements in advance could facilitate such advance project coordination.

3.2.3. Additional Environmental and Technical Studies

The presence of cultural resources is another potentially critical constraint that is not addressed in the current analysis, except for historic highway elements such as bridges and walls that are

contained in the CHMP data. Caltrans has data regarding known location of cultural resources, but does not release the data publicly in order to protect artifacts from disturbance or theft. An important next step for any specific study area is to obtain a report from a qualified archaeologist regarding the presence of cultural resources in the area potentially impacted by the project. This could be completed for future planning-level studies, and would certainly need to be completed as part of any specific project plans.

Preliminary engineering to prepare more precise improvement concepts and plans will require topographic and boundary survey of the project area, including existing utilities, drainage facilities, private access and improvements, and other relevant features, as well as additional site-specific inventory of biological and cultural resources.

Geologic stability is a major constraint for highway widening. Obtaining more detailed geologic information is a critical next step in determining widening requirements and feasibility. Geotechnical investigations will be required as part of the early study of any project area that involves significant slopes.

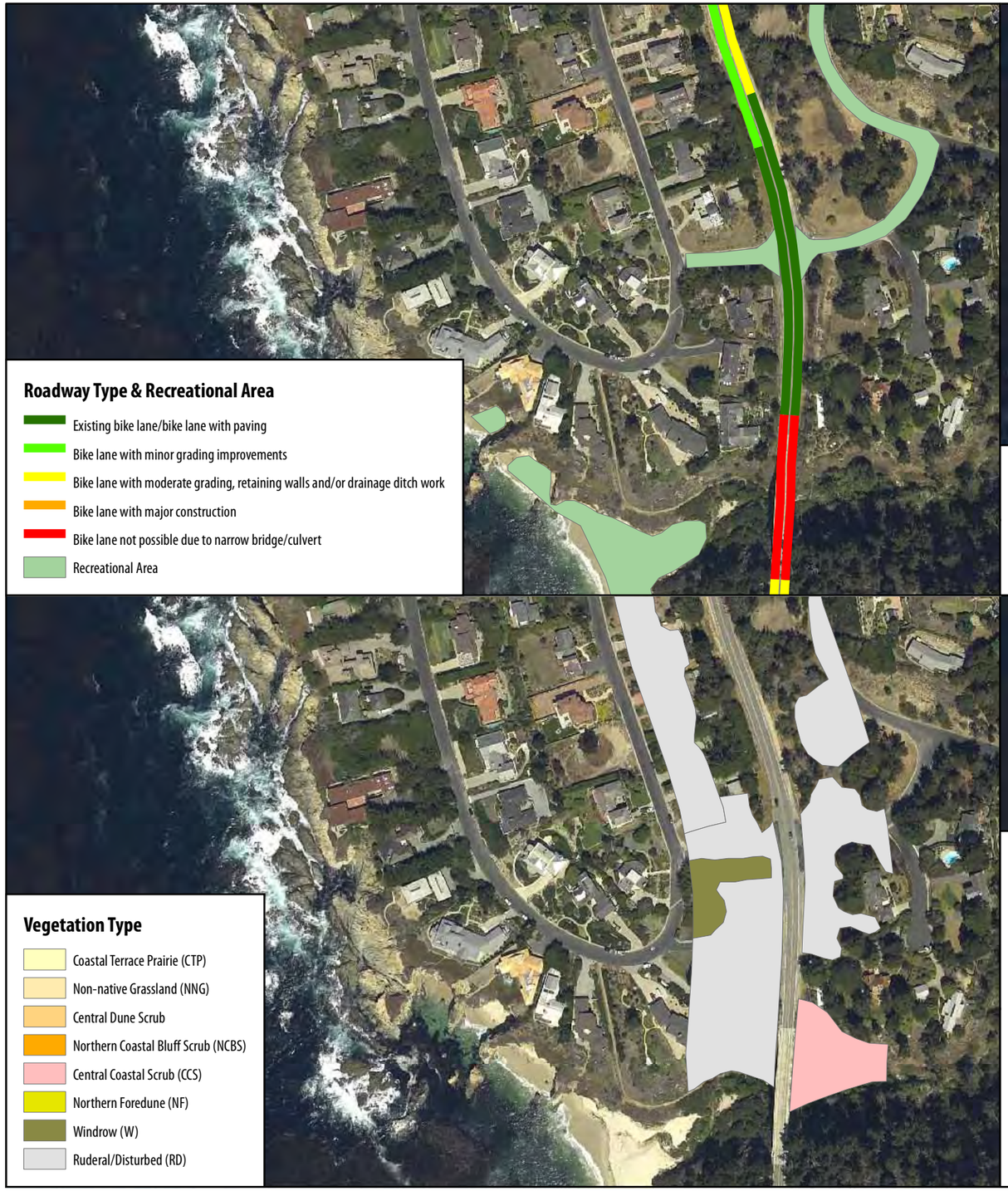
3.2.4. Environmental Impact Analysis

Environmental impact analysis reflecting all the technical studies and issues identified for any particular segment would be required for improvements. This would include documentation and public review processes to comply with the California Environmental Quality Act (CEQA), and potentially also the federal National Environmental Protection Act (NEPA) if federal funds or facilities are involved.

3.2.5. Construction Plans

Construction plans and contract documents would then be prepared and after review and finalization through Caltrans, and the project would be put out to bid and constructed.

Attachment 1 – Bike Route Analysis Detail Example



Bike Route Improvements Analysis Detail

Big Sur Coastal Trail Master Plan

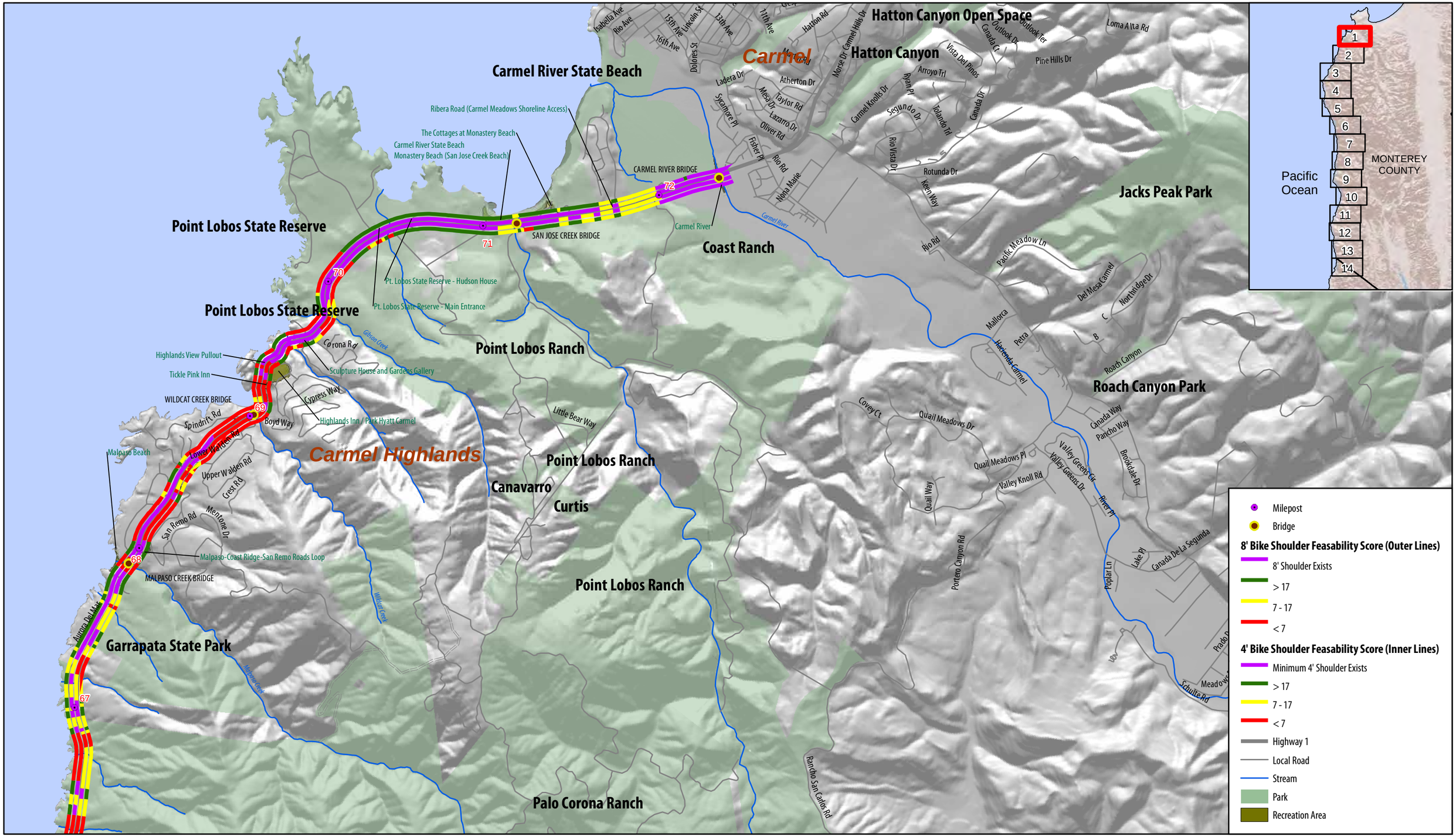
Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 250 500 Feet

1 inch = 250 feet

alta PLANNING + DESIGN

Attachment 2 – Bike Route Analysis Maps 1-14



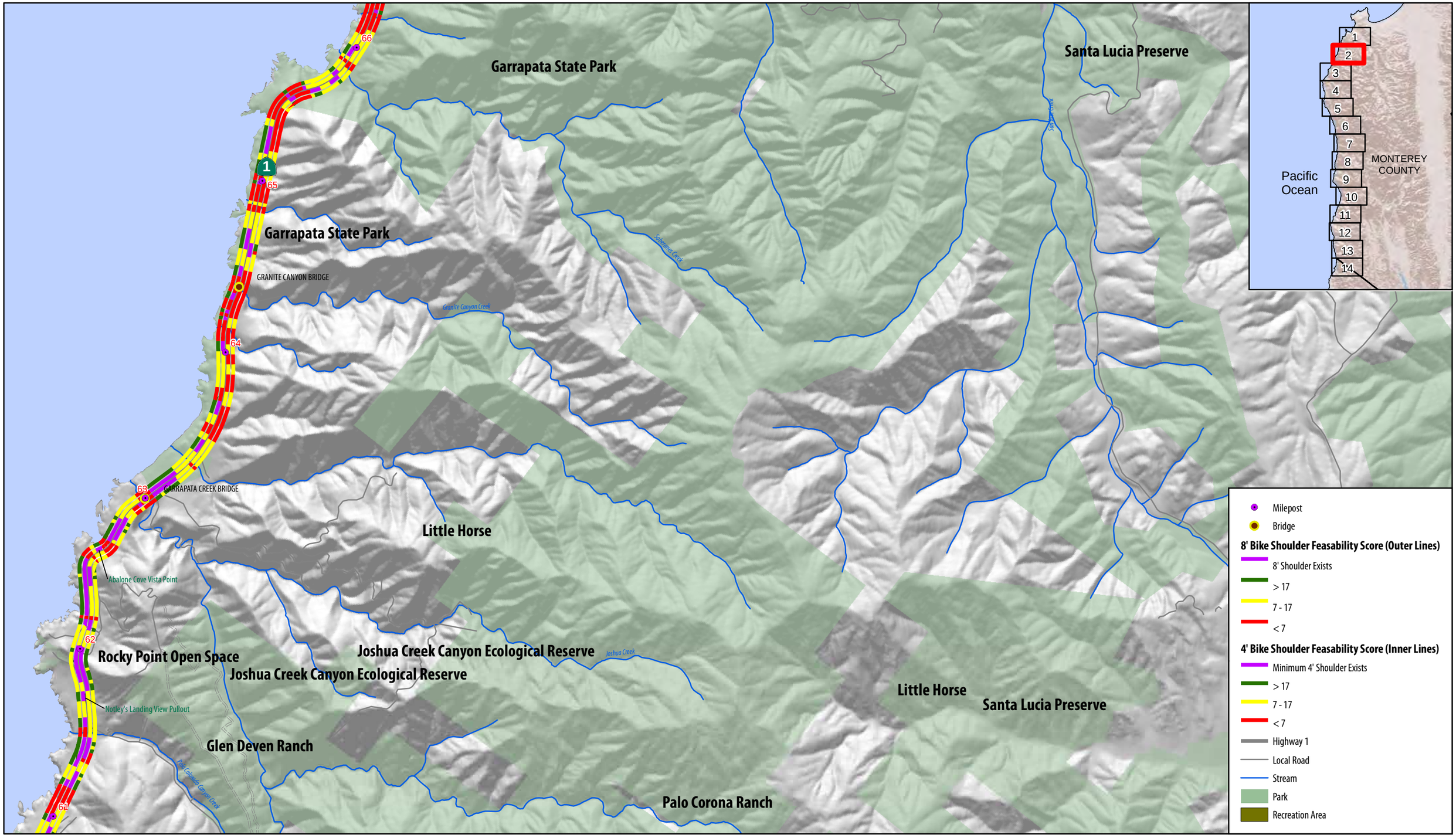
Bike Route Improvements Analysis - Map 1

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



Bike Route Improvements Analysis - Map 2

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

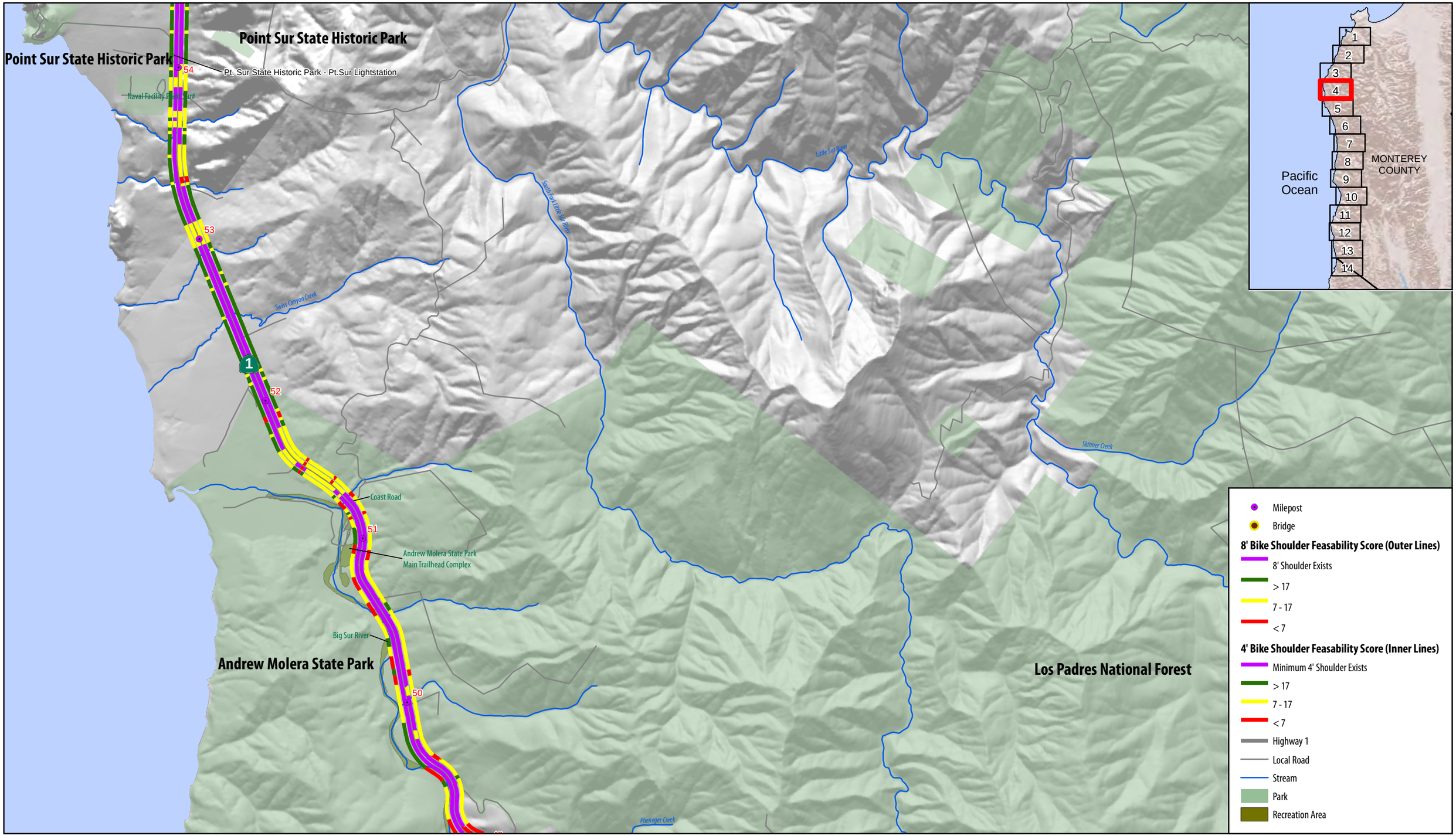
Bike Route Improvements Analysis - Map 3

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



Bike Route Improvements Analysis - Map 4

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

Bike Route Improvements Analysis - Map 5

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

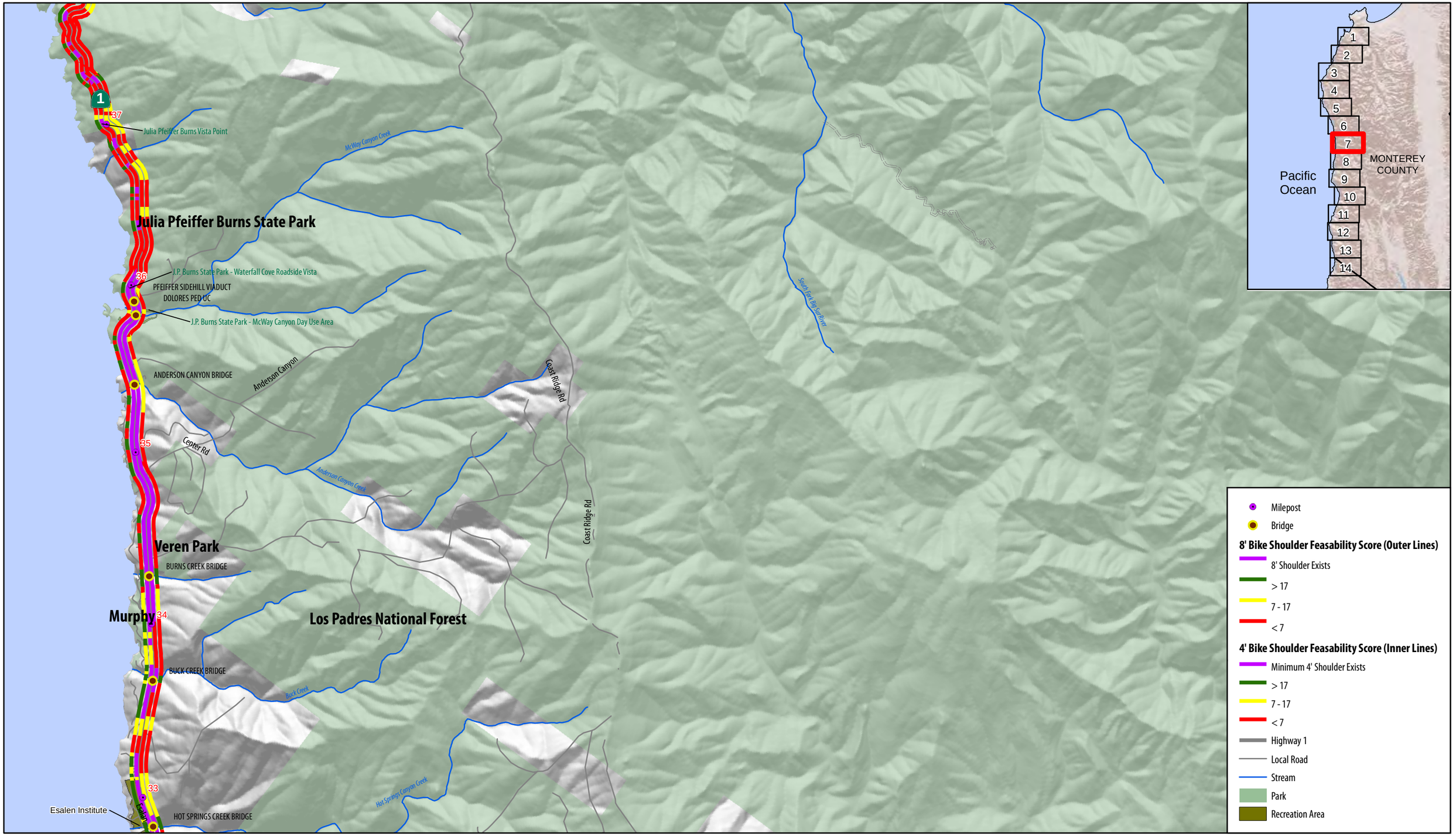
Bike Route Improvements Analysis - Map 6

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



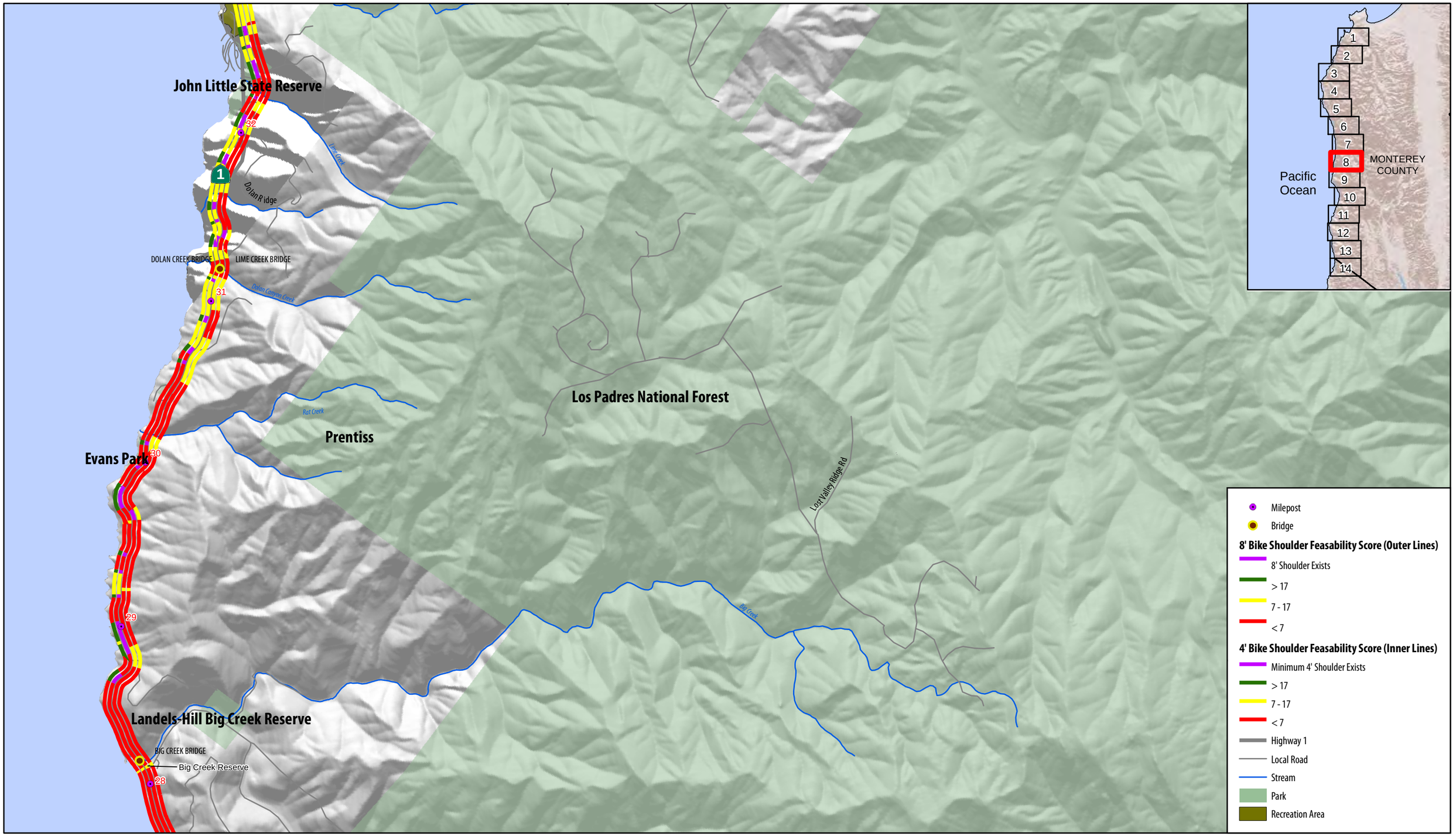
Bike Route Improvements Analysis - Map 7

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



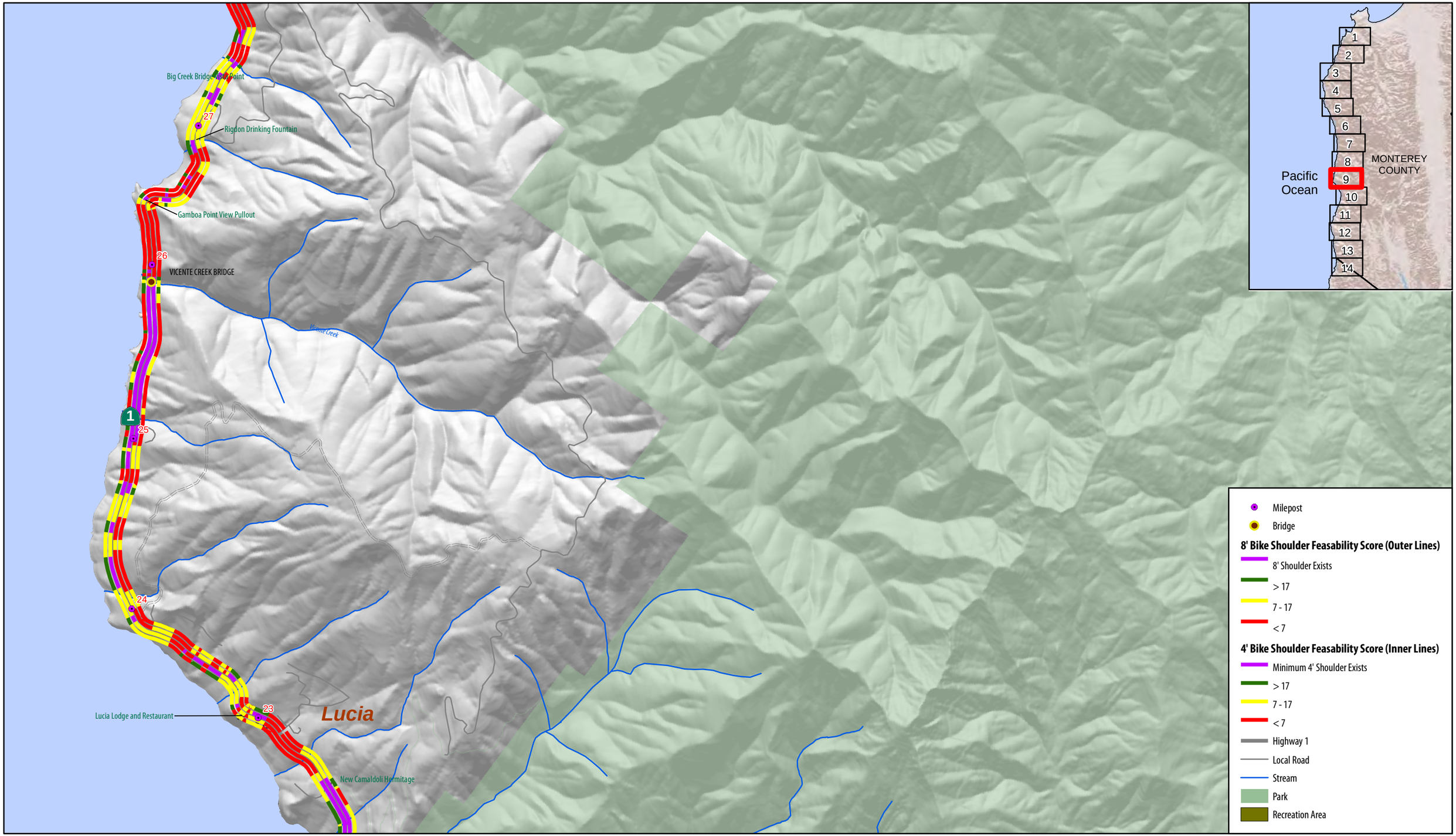
Bike Route Improvements Analysis - Map 8

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



Bike Route Improvements Analysis - Map 9

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

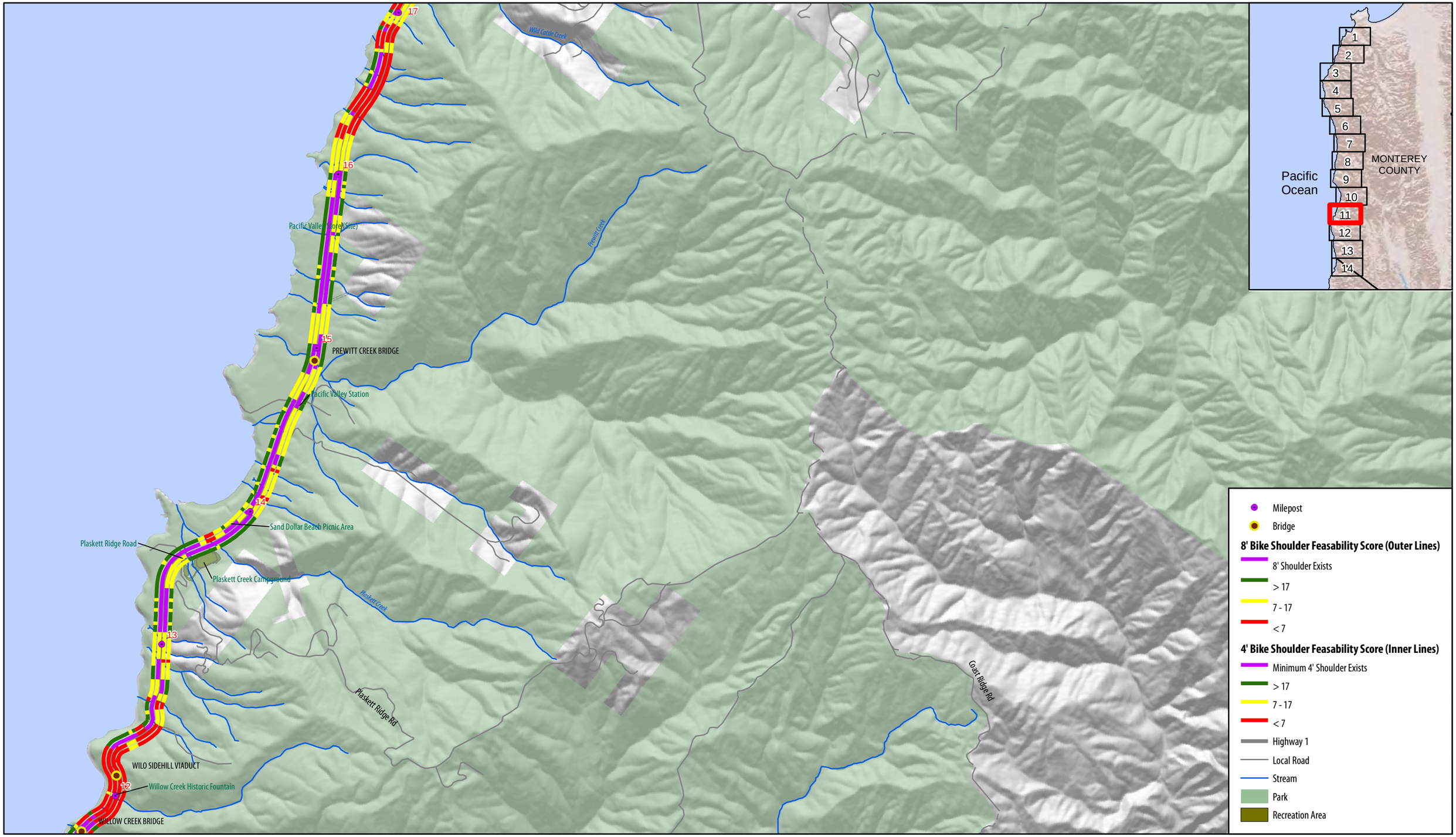
Bike Route Improvements Analysis - Map 10

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



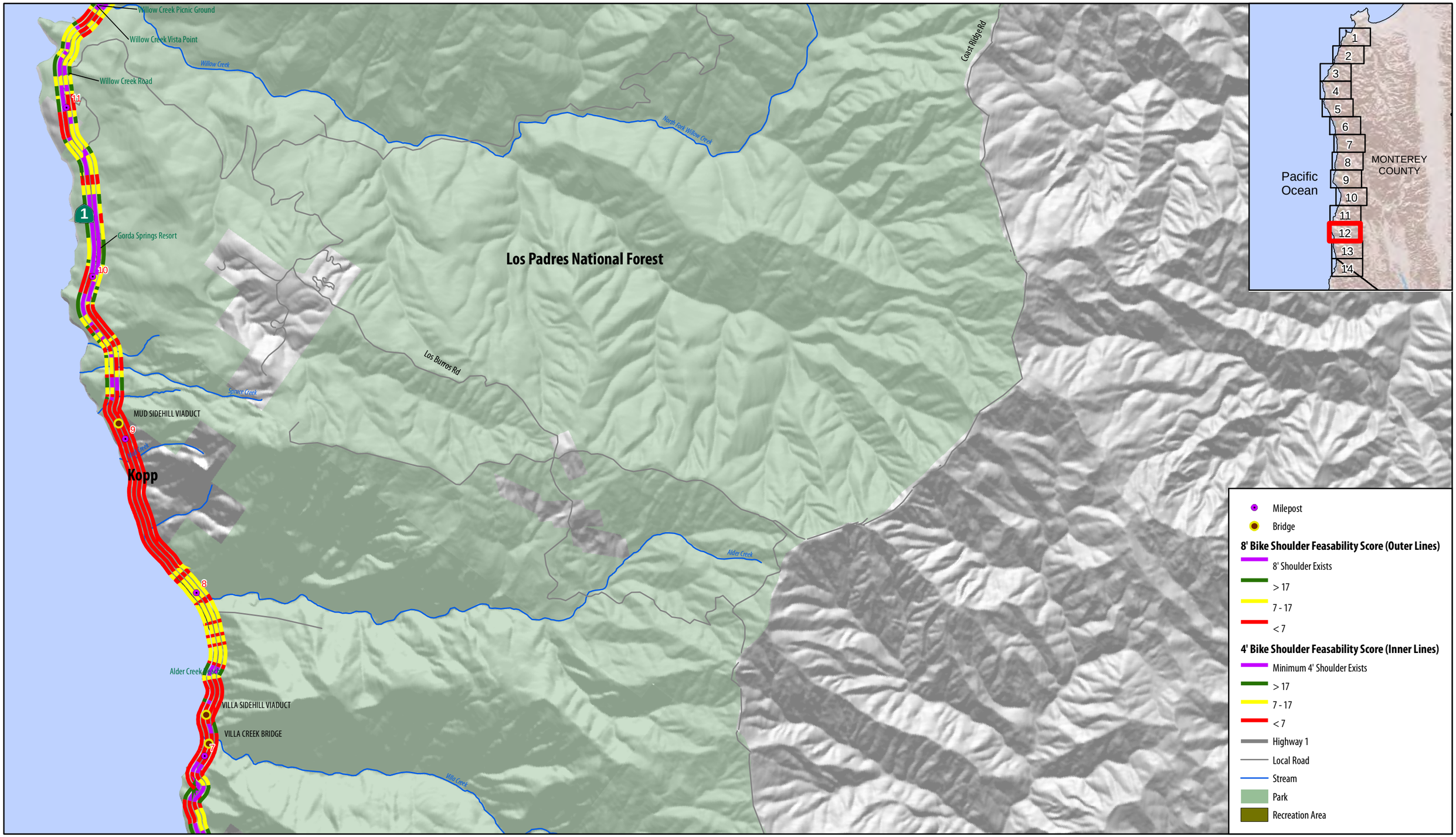
Bike Route Improvements Analysis - Map 11

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



Bike Route Improvements Analysis - Map 12

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

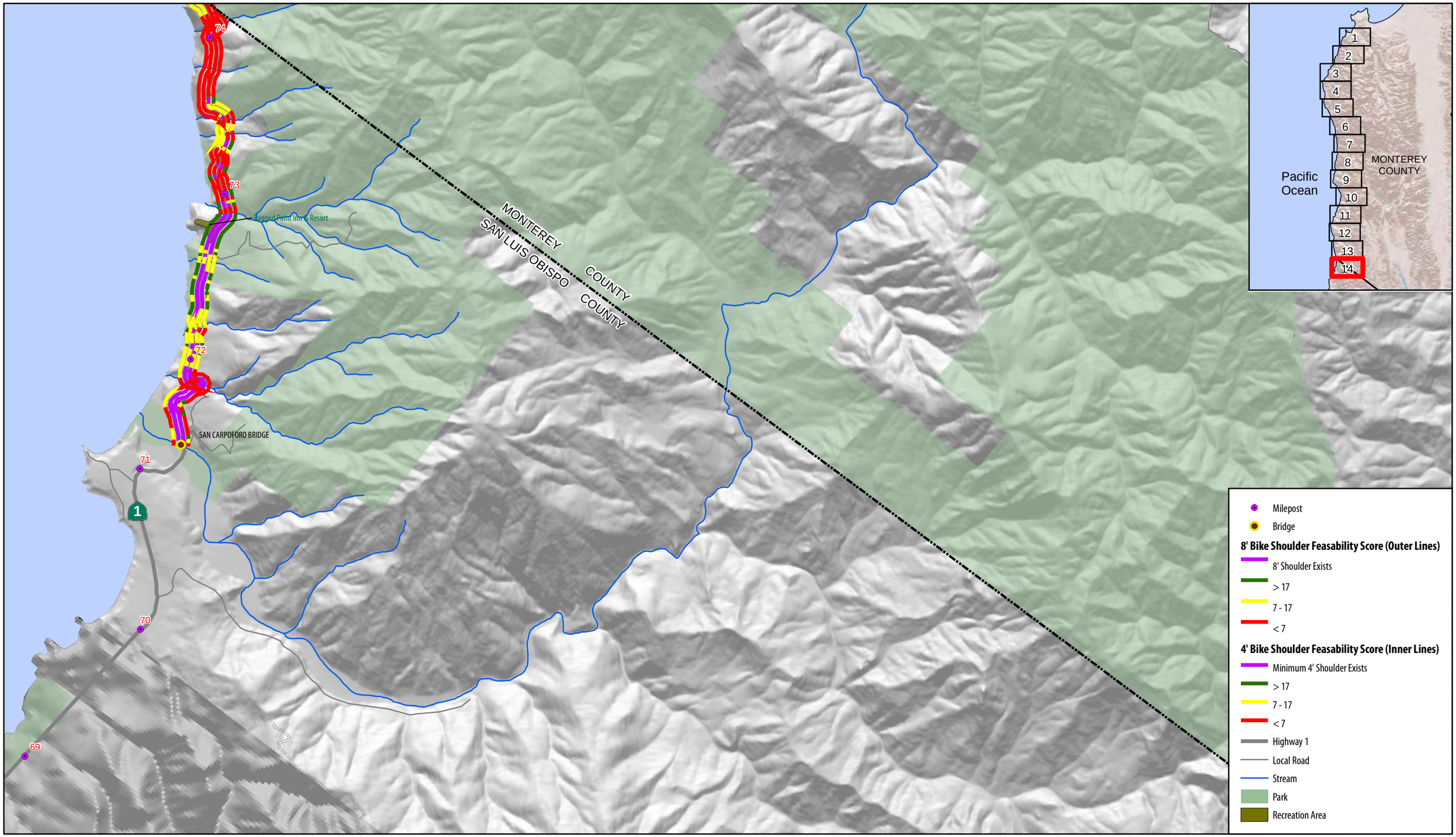
Bike Route Improvements Analysis - Map 13

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles



Bike Route Improvements Analysis - Map 14

Big Sur Coastal Trail Master Plan

Source: Data obtained from Monterey Co., US Forest Service, CA Coastwalk, and Big Sur CHMP
Author: Roy Harju
Date: 11/03/10

0 0.5 1 Mile

1 in = 0.5 miles

Attachment 3 – GIS Data List

GIS files used for Road Shoulder Analysis Maps

Category	File Name	Source
Mileposts	pm.shp	CHMP
Bridges	bridges.shp	CHMP
Hillshade Layer	hillshade.lyr	CHMP, USGS
Ocean	ocean.shp	CHMP
Land Management	PublicLandsNew.shp	CA Coastal Commission
Roads	roads.shp	CHMP
Streams	rivers.shp	CHMP
Recreational Areas	rec_area.shp	CHMP
Counties	counties.shp	CHMP
Road Shoulder Segment Analysis	RoadShoulderAnalysis.shp	Alta Planning
Vegetation Communities	veg_comm.shp	CHMP

Attachment 4 –Bikeway Feasibility Analysis Scoring Summary for Study Area Segments