Chapter 2: Alternatives

2.1 INTRODUCTION

This chapter presents the alternatives evaluated during the EIS planning process. The following alternatives are described in detail:

- Alternative A: No Action
- Alternative B: Hybrid Mid-Slope Realignment
- Alternative C: Long Tunnel on Minor Realignment
- Alternative D: Mid-Slope Alignment with Short Tunnel

Alternative B is the FHWA and NPS preferred alternative.

This chapter also includes a discussion of how the alternatives were developed and alternatives that were evaluated but eliminated from further consideration. Following the alternative descriptions, a summary table displays the environmental effects of each alternative. Further detail on environment effects is presented in chapter 4.

2.2 ALTERNATIVE DEVELOPMENT

The project alternatives were developed through an interdisciplinary process based on the expertise of planning team members representing the FHWA, the NPS, the DNR, and San Juan County (county) as well as from scoping with interested publics, tribes, and other agencies.

The project team developed alternative methods of meeting the project purpose and need through interdisciplinary discussions and public input. A broad range of possible solutions was considered. During early scoping, the team narrowed the project concepts down to land-based road alternatives, at which time they identified five road corridors for consideration. The corridors consisted of broad areas of land with similar resources and similar environmental effects for analysis. The concept was used to guide the development of numerous potential alternatives within each corridor.

The corridor concept and preliminary alternatives within these corridors were presented at a public scoping meeting on February 18, 2004. It was emphasized that the corridors were broad concepts and that the alternatives were preliminary proposals which the team had developed at that point in the planning process. The corridors included concepts such as alternate road alignments as well as a build-in-place bridge, slope stabilization, and a tunnel option. A total of eight broad alternatives were presented, with possible variations within each alignment. Public attendees were encouraged to devise and submit additional alternatives or comment on the proposals developed by the project team. Based on public comments and interagency discussions, the project team recommended that some of the early proposed alternatives be eliminated from further consideration.

Early in the planning process, a second bluff erosion site located east of the DNR property along Cattle Point Road was also considered for inclusion in this project. Geotechnical analysis determined that the life span of this section of road is at least 50 years; therefore, this section

was dropped from consideration for reconstruction under the current project. None of the proposed action alternatives in this FEIS would preclude or influence a future project on this section of the road should it become necessary.

Following public release of the Cattle Point Road EIS Scoping Document in June 2003, the project team began further evaluation of the preliminary alternatives. The team considered the preliminary alternatives and their likely environmental impacts and benefits. The evaluation assessed the features of the no action, the hybrid alignment, the long tunnel, and the short tunnel alternatives (now alternatives A, B, C, and D respectively), then balanced impacts with cost. Through this analysis it was determined that the hybrid alternative provided the best combination of meeting project purpose and need while minimizing impacts to the natural and human environment. As a result, the team identified alternative B as the preferred alternative.

2.3 TERMINOLOGY USED IN ALTERNATIVE DESCRIPTIONS

The alternatives are described and compared using terms that are defined below.

Area of Temporary Disturbance

The area of temporary disturbance refers to the land area that would be affected during construction of an alternative. It includes the roadway itself, cut and fill slopes, and any other disturbance necessary to construct the road. Except for the actual paved road area, this area would be revegetated following construction.

Area of Permanent Disturbance

The area of permanent disturbance refers to the surface area of roadway within the project area that would be paved. For action alternatives, it is assumed that the existing roadway would be obliterated and the new roadway would be rebuilt in a new location. Please note that a tunnel is a subsurface feature, so the road within the tunnel is not included in the area of permanent disturbance. Obliterated roadway would be restored to the natural contours of the surrounding landscape and revegetated; it would also not be included in this area.

Construction Cost (2009 dollars)

Construction cost is a feature that indicates the size and complexity of an alternative, including the construction effort involved and its feasibility. This rough estimate of construction cost includes building the project, obtaining material, and administering the contract. The additional costs of working in the island environment were taken into consideration, but these can be highly variable. This estimate does not include further project design or future maintenance costs.

Earthwork

Earthwork is the amount of earth that needs to be added or removed from the project area to construct an alternative. It is used to estimate the amount of construction effort necessary for an alternative, including offsite impacts related to the project. When a road is built, construction equipment is used to move earth, including soil, gravel, and rock, to create a level road surface. Where earth is removed, it is called a cut. Where earth is added, it is called a fill. The related terms “cut slope” and “fill slope” refer to the uphill or downhill slopes adjacent to the road that result from these cuts and fills.

Some of the earth removed in cuts can be used in fills to reduce the need to transport the material to or from a project. When material can generally be conserved within the project area, the term "balanced" is used for the project.

When excess material is generated from a project, a "waste site" is required. When additional material is needed for construction, a "material source" is required. Transporting material to and from these locations requires large trucks. These trucks, along with waste sites and material sources, produce impacts to the natural and human environment outside of the project area. To illustrate the amount of offsite impacts to other island resources, the alternatives include a rough estimate of the number of truckloads of transported material involved in the construction activities. A truckload is assumed to have a capacity of 10 cubic yards.

Grades

Grades are a feature used to describe the vertical rise and fall rates of the alternatives. Steeper grades create an impediment to large trucks, reduce sight distance for vehicles, and pose safety issues during adverse weather. Steep grades may also create an obstacle for bicyclists.

Grades are subjectively defined as flat, rolling, or steep based on the frequency and height of hills. Maximum grades are given based on rough design alignments. Figure 2.1 illustrates relative grades.

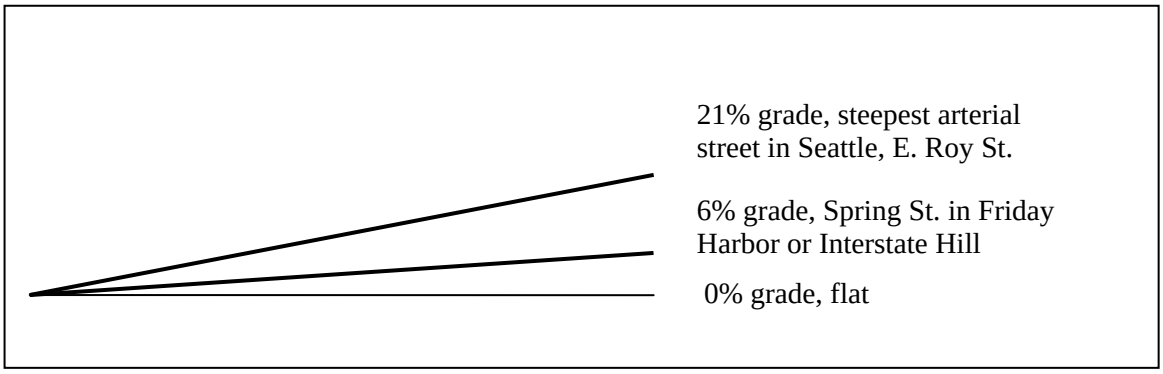

Figure 2.1 - Relative road grades

Implementation Time

Implementation time is the estimated total time needed to design and construct an alternative after full project funding is obtained.

Operating and Maintenance Costs (2009 dollars)

Operating and maintenance costs are the yearly costs to operate and maintain the alternatives. To preserve roadway function, annual maintenance is required on roadway drainage, roadside vegetation, and paved surfaces. Additionally, the tunnels would require substantial operational costs for lighting, as well as fire safety and ventilation systems for the long-tunnel option. There are also maintenance and cleaning costs associated with tunnel systems. The road within the tunnel would require pavement surface maintenance and some cleaning, though vegetation and drainage maintenance costs would not apply.

Predicted Life Span

Predicted life span is a measurement to help determine whether an alternative meets the purpose and need for the project. The measurement is indicated by the estimated number of years (based on the horizontal bluff retreat rate of 1 to 3 feet discussed in chapter 3) it would take for bluff erosion to reach the south edge of the road and create an imminent threat to the stability of the road. Alternatives must meet a life span of at least 50 years in order to meet the purpose and need of the project and to provide an adequate distance from the bluff to effectively remove the threat of erosion. The baseline year for this estimate is 2005. When the lifespan calculation is based on the slow erosion rate and results in an excessively long time span, the number will also include the term "or more" or plus (e.g., 150+ years).

Retaining Walls

Retaining walls are used to hold back earth materials to obtain a level surface for the road. Since they provide a vertical wall, they are beneficial in reducing the need for large cuts and fills that may disturb large areas of land. Like cuts and fills, walls can have aesthetic impacts and create separation between ecosystems. The length and height of walls indicates the level of disturbance an alternative would have.

Retaining walls are described by maximum height and approximate length. Road design and soil information would determine the actual location and size of the walls (figure 2.2).

Figure 2.2 – Examples of retaining walls. Left wall is 10 to 15 feet in height, well vegetated. Right wall is 3 to 6 feet in height with less vegetation

Road Cuts/Fills

Road cuts/fills indicate the maximum height of roadside cuts and fills required for each alternative and indicate the degree of disturbance adjacent to the roadway. Large cuts and fills have aesthetic impacts and can create separation between ecosystems.

Figure 2.3 – Example fill to the left of the roadway and cut to the right of the roadway. Both exceed 40 feet in height

Subjective terms are used to describe the maximum height of road cuts and fills.

Extensive – occurring throughout the road realignment (though likely at much less height); or,

Localized – occurring at few locations on the alignment.

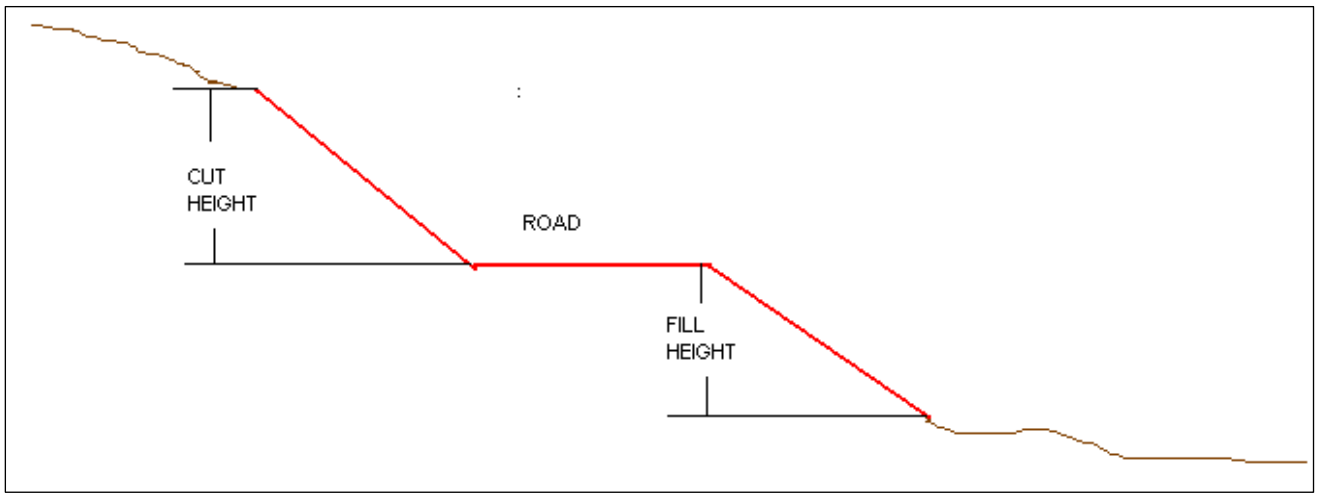

Figure 2.4 - Diagram of cut and fill illustrating height measurement

Road Length

There are two measurements of length to consider for the project:

The overall road length is the length of the alternative within the boundaries of the project limits, from the beginning of the project to the end of the project on project plans and maps. This length includes the existing road alignment as well as the new alignment. The existing road alignment is the transition area needed to connect the existing roadway with the new alignment. The roadway within the transition area would be reconstructed in its current location by repaving and raising the grade as needed to make a smooth connection with the new alignment. Raising the road grade would increase the road footprint, resulting in a small amount of new ground disturbance adjacent to the existing roadway.

The length of new alignment is the portion of the alternative that does not follow the existing road, and illustrates the extent of new construction and new ground disturbance.

2.4 DESCRIPTION OF ALTERNATIVES

The following table summarizes the alternatives analyzed and their comparative features:

Table 2.1 - Summary of road features by alternative

Alternative / Feature	A (No Action)	B (Hybrid Mid-Slope Realignment)	C (Minor Realignment with Long Tunnel)	D (Mid-Slope Alignment with Short Tunnel)
Overall Project Length	**5,060 feet**	**6,050 feet**	**3,150 feet**	**5,800 feet**
New Alignment Length	**N/A**	**4,950 feet**	**2,830 feet (includes 1,600 feet in tunnel)**	**4,700 feet (includes 775 feet in tunnel)**
Grades	**Rolling, to 6%**	**Hilly, to 10.5%**	**Rolling, to 7%**	**Rolling, to 8%**
Earthwork	**N/A**	**Likely Balanced**	**4 to 5,000 loads**	**Likely Balanced**
Maximum Road Cut/Fill Height	**20/10 feet Extensive**	**30/30 feet Extensive**	**90/0 feet Localized**	**50/50 feet Extensive**
Retaining Walls - Max. Height/Length	**None**	**Minimal or None**	**20/800 feet**	**20/800 feet**
Total Temporary Disturbance	**N/A**	**17 acres**	**10 acres**	**20 acres**
Total Permanent Disturbance	**3 acres (Existing Pavement)**	**3 acres**	**1 acre**	**3 acres**
Implementation Time (Design and Construction)	**N/A**	**2 to 3 years**	**3.5 to 5 years**	**3.5 to 5 years**
Predicted Life Span	**15+ years**	**105+ years**	**115+ years**	**155+ years**
Operating and Maintenance Cost	**$10,000/year**	**$10,000/year**	**$65,000/year**	**$35,000/year**
Construction Cost	**N/A**	**$5 to 8 million**	**$55 to 65 million**	**$30 to 40 million**

The action alternatives (B, C, and D) considered in this document all provide an estimated minimum life span of over 100 years and effectively satisfy the need for the project by removing the threat of coastal bluff erosion for the foreseeable future. To varying extents, they also meet the purpose of the project by maintaining safe and pleasant vehicle, bicycle, and pedestrian access to the Cattle Point area.

With all action alternatives, the abandoned road segment would be restored by removing the road pavement, decompacting the road base, reshaping the roadbed to blend with the surrounding landscape, and planting the obliterated road template with native vegetation. The amount of restoration work would vary by alternative depending on the length of road abandoned. The estimated features and costs shown in table 2.1 include restoration of the abandoned road alignment.

For all the action alternatives (B, C, and D), bluff erosion would eventually remove a portion of the restored abandoned road alignment. However, during the next 25 to 80 years, the eroded area would be small (less than 500 feet) compared to the total area restored (3,800 to 5,100 feet). Erosion of the bluff may continue to remove the restored abandoned road area beyond that time period; however, since the abandoned road alignment curves away from the bluff, very small sections would be lost over a long period of time. It is difficult to predict the extent and rate at which the restored abandoned road segment would be removed by coastal bluff erosion over the long term.

2.4.1 Alternative A: No Action

This alternative would continue present road management activities. Cattle Point Road currently provides an adequate level of service for both existing and predicted future traffic conditions for visitors and residents (Shannon Wilbur, San Juan County, personal communication, email September 26, 2009). Under this alternative, no work would be undertaken to address bluff erosion. Current maintenance activities would continue.

The existing roadway features are (approximately):

Overall Project Length:	5,060 feet (existing)
Length of New Alignment:	Not Applicable (N/A)
Grades:	Rolling to 6% maximum (existing)
Earthwork:	N/A
Road Cuts/Fills:	N/A
Retaining Walls:	N/A
Area of Temporary Disturbance:	N/A
Area of Permanent Disturbance:	3 acres (existing pavement)
Implementation Time:	N/A
Predicted Life Span:	15+ years
Operating and Maintenance Costs:	$10,000/year
Construction Cost:	N/A

There would be no construction costs associated with this alternative. Road maintenance activities would continue- including providing adequate drainage, road sweeping and cleaning, mowing, regular light road resurfacing, pavement striping, and repairing road structure failures such as potholes. No major problems currently exist along the road; therefore, maintenance costs for the approximately one-mile stretch of road within the project area would be similar to other county roads at about $10,000 per year (Russ Harvey, San Juan County Public Works, personal communication, email, May 6, 2008).

The existing road provides a pleasant traveling experience for visitors. There are panoramic views of the Strait of Juan de Fuca, the Olympic Mountains, and other islands in the area. The road accesses a widely-used trail system and is popular for bicyclists, pedestrians, and moped users enjoying the features of the park and NRCA.

Current vehicle traffic is relatively light and existing sight distances are adequate, which minimizes the hazard of the narrow road shoulders for mopeds, bicycles, and pedestrians. One crash between a moped and vehicle was reported just west of the project area (MP 6.78) in 2006. However, the cause of the accident was vehicle-driver error. No other accidents have been reported between these road users.

In the future, as bluff erosion encroaches on the roadway, access along this 500-foot section of road may be limited to one-way traffic for an interim period, depending on how rapidly the erosion progresses. Providing continued vehicle access through the impaired or closed road would involve additional road maintenance costs. A catastrophic road failure could pose a considerable safety threat to anyone traveling the road if it occurred before the road could be properly signed or closed.

Bluff erosion would eventually close the road. This would cut off road access to a small portion of the park, the NRCA, the BLM property, and residences in the Cattle Point and Cape San Juan residential areas and would result in a number of long-term impacts. Residents would no longer have vehicular access to the rest of the island, including the ferry terminal at Friday Harbor. Access would continue to be available for pedestrians through the trail network, for boats through private docks, and by air via helicopter or float plane.

Should catastrophic bluff erosion cause the road to be closed, vehicle access would be restored to Cattle Point residents on an emergency basis. Because this type of emergency road repair would not require full environmental clearance, it could result in impacts to the resources in the immediate area. An emergency repair would likely be a temporary solution with potential road safety, access, and stability issues. Although not considered to be within the scope of the no action alternative, any repairs needed to restore safe and secure road access following the road closure would result in a substantial expense of time and money.

2.4.2 Alternative B: Hybrid Mid-Slope Realignment (Preferred Alternative)

Alternative B involves mid-slope realignment of the Cattle Point Road to the north, approximately 300 feet away from the eroding bluff, to increase the life expectancy of the road. The alignment is a compromise between minimizing disturbance to protect resources and providing safe and feasible road access for visitors and residents. The following figures are approximate.

Overall Project Length:	6,050 feet
Length of New Alignment:	4,950 feet
Grades:	Hilly, to approx 10.5%
Earthwork:	Likely balanced
Road Cuts/Fills:	30 feet/30 feet, extensive
Retaining Walls:	Minimal or none
Area of Temporary Disturbance:	17 acres
Area of Permanent Disturbance (New Pavement):	3 acres
Implementation Time:	
Design:	1 year
Construction:	1 to 2 years
Total:	2 to 3 years
Predicted Life Span:	105+ years
Operating and Maintenance Cost:	$10,000/year
Construction Cost:	$5 to 8 million

The preliminary alignment for alternative B is shown on figure 2.5. The project would begin about 0.65 miles east of the Pickett's Lane intersection. At the beginning of the project, the road would be widened and the grade would be raised along the current alignment for about 1,100 linear feet in order to transition with the new road alignment. The new alignment would then leave the current alignment and travel north to follow a natural bench for approximately 1,000 linear feet. From there, the new alignment would climb a moderately steep grade, reaching its high point approximately 300 feet north of the existing bluff erosion site. From there, the new road alignment would descend steeply to connect back to the existing road near where the NRCA trail meets the existing Cattle Point Road. The total length of new road alignment would be approximately 4,950 feet. Realignment of the road upslope from the problem site would protect road access from the threat of coastal bluff erosion for over 100 years. Construction cost for Alternative B would be approximately $5 to 8 million.

Safety concerns would be addressed in the final road design features. Road design would include a wide shoulder, which would provide a minor safety improvement for bicyclists, pedestrians, and special-use vehicles.

Figure 2.5 - Alternative B preliminary alignment

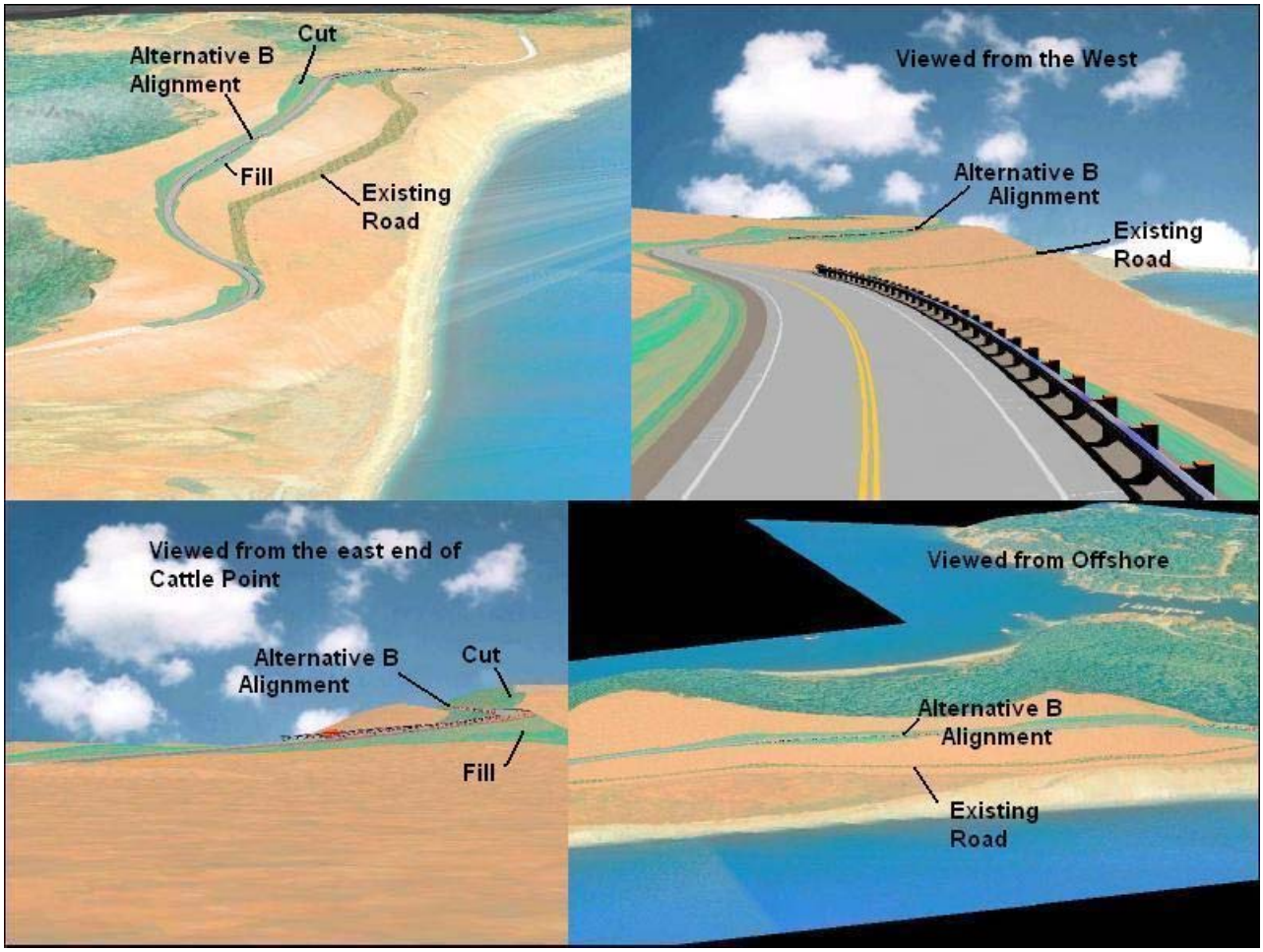

Figure 2.6 - Alternative B visual simulation

Figure 2.6 is a visual simulation illustrating how the alternative B road alignment would appear on the landscape.

The east end of the Mt. Finlayson ridgeline presents a road design challenge. The ridgeline descends steeply and is bordered on the north by an informal trail and a forested area. Earlier designs featured gentle road grades, which resulted in high cut slopes that extensively opened up the ridgeline resulting in substantial visual, habitat, and trail impacts. The most recent design features steepen the road grade (up to approximately 10.5 percent) and add curves on the east end, which allows for a large reduction in the size of the cuts and fills and associated impact areas.

The new alignment would be constructed to a total width of 28 feet, consisting of two 10-foot travel lanes with two 4-foot paved shoulders. A typical road cross section is shown on figure 2.7.

Final project development and design of this alternative are not anticipated to be complex, and could be completed within 1 year. Road construction would take 1 to 2 years depending on work timing restrictions.

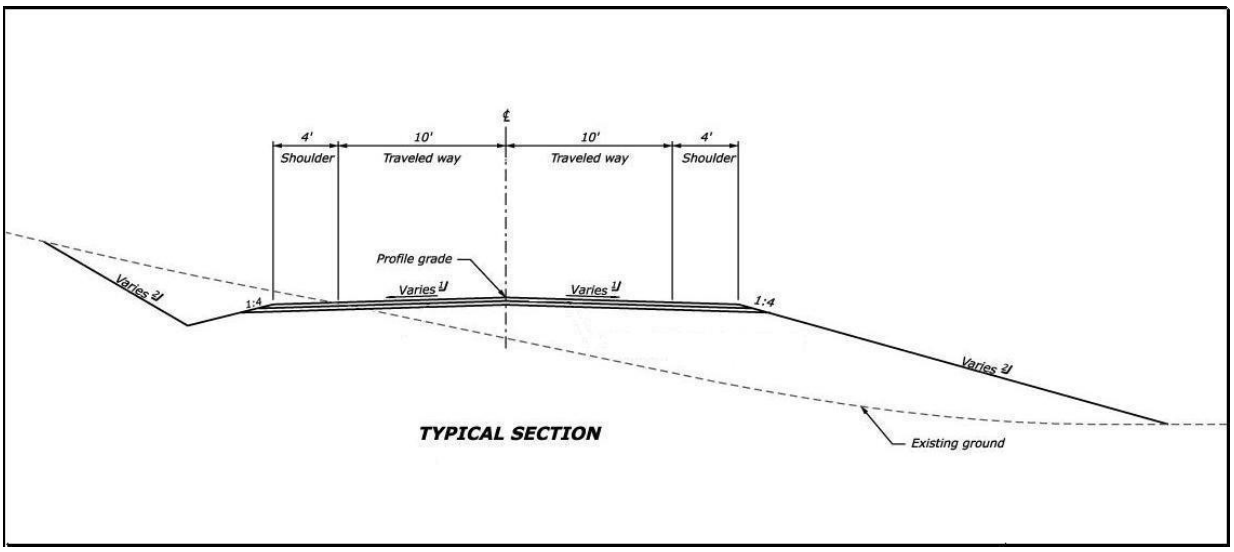

Figure 2.7 - Alternative B typical road cross section

Construction of this alternative would initially disturb an area of approximately 17 acres. Disturbance would occur from construction of the new road alignment, new road cuts and fills, construction equipment staging areas, earth stockpiling, and restoration activities along the abandoned road segment. Of the 17 acres of ground disturbance, about 13 acres would be restored and revegetated. Revegetated areas would include road cuts and fills and restoration of the abandoned road segment. The remaining 4 acres would be permanently covered by road pavement.

Cuts and fills along the new alignment would reach maximum heights of approximately 30 feet. Preliminary design does not show the need for retaining walls. The main function of retaining walls is to stabilize hillsides, but in steep terrain they can also be used to reduce the size of roadside cuts and fills. If final design factors determine that retaining walls are necessary, they would be designed to blend as unobtrusively as possible into the natural setting.

During final design, the road alignment would be adjusted to minimize ground disturbance and the need to transport excess earth offsite. This would correspondingly reduce the cost of construction. Though the transport of earth outside of the project area is anticipated to be minimal, there would still be a need to transport construction materials along local roads and perform construction-related activities outside of the project area.

Following construction of the new road alignment, approximately 4,200 feet of the existing Cattle Point Road would be abandoned. The abandoned road segment would be restored by removing the road pavement, decompacting the road base, reshaping the roadbed to blend with the surrounding landscape, and planting the obliterated road template with native species. The area restored along the abandoned road segment would be about 3 acres

Maintenance of the new roadway would include maintaining adequate drainage, roadway sweeping and cleaning, regular light resurfacing, pavement striping, repairing structural failures, and roadside mowing. Initially, maintenance costs for the new roadway would be lower than maintenance of the existing road; however, over time, maintenance of the new road alignment would average approximately the same as the existing road at $10,000 per year. With maintenance and minor resurfacing, the new road structure is expected to last at least 20 years

before requiring any substantial rehabilitation efforts. With occasional repairs and resurfacing, the road would remain in place for over 100 years.

2.4.3 Alternative C: Minor Realignment with Long Tunnel

This alternative would be built on a short realignment, almost entirely within a tunnel, with the intention to minimize surface ground disturbance while avoiding the bluff erosion area. Based on preliminary design, the tunnel would be about 1,600 feet long and nearly 100 feet deep at its maximum depth. The following figures are approximate.

Overall Project Length:	3,150 feet
Length of New Alignment:	2,830 feet (1,600 feet in tunnel)
Grades:	Rolling, to 7% max
Earthwork:	4,000 to 5,000 truckloads of excess earth
Road Cuts/Fills:	90 feet, localized
Retaining Walls:	20-foot maximum height, 800 feet long-at portals
Area of Temporary Disturbance:	10 acres
Area of Permanent Disturbance	
(New Pavement):	1 acre (above-ground)
Implementation Time	
Design:	2 years
Construction:	1.5 to 3 years
Total:	3.5 to 5 years
Predicted Life Span:	115+ years
Operating and Maintenance Cost:	$65,000 per year
Construction Cost:	$55 to 65 million

The preliminary alignment for alternative C is shown in figure 2.8. The project would begin about 1.0 mile east of the Pickett's Lane intersection. At the beginning of the project, the road would be widened and the grade would be raised along the current alignment for about 320 linear feet in order to transition with the new road alignment. The new alignment would then leave the current alignment and travel north, entering the tunnel about 675 feet from the beginning of the realignment. The tunnel would be approximately 1,600 feet in length. From its highest point, the tunnel would be approximately 320 feet to the north of the bluff erosion site. The road would exit the tunnel and curve down the ridge, rejoining the existing road alignment near where the NRCA trail meets the existing Cattle Point Road. The cost for construction of this alternative would be approximately $55 to 65 million.

This alternative was proposed to minimize impacts to prairie habitat and other resources on the ground surface. The tunnel would change the road user's experience by restricting views as well as affecting pedestrian and bicycle use. Ground disturbance and associated impacts would be avoided in the tunnel section, though construction of the tunnel portals would still require considerable ground disturbance. Relocation of the road into a tunnel and away from the eroding coastal bluff would remove the threat of erosion to the road for over 100 years.

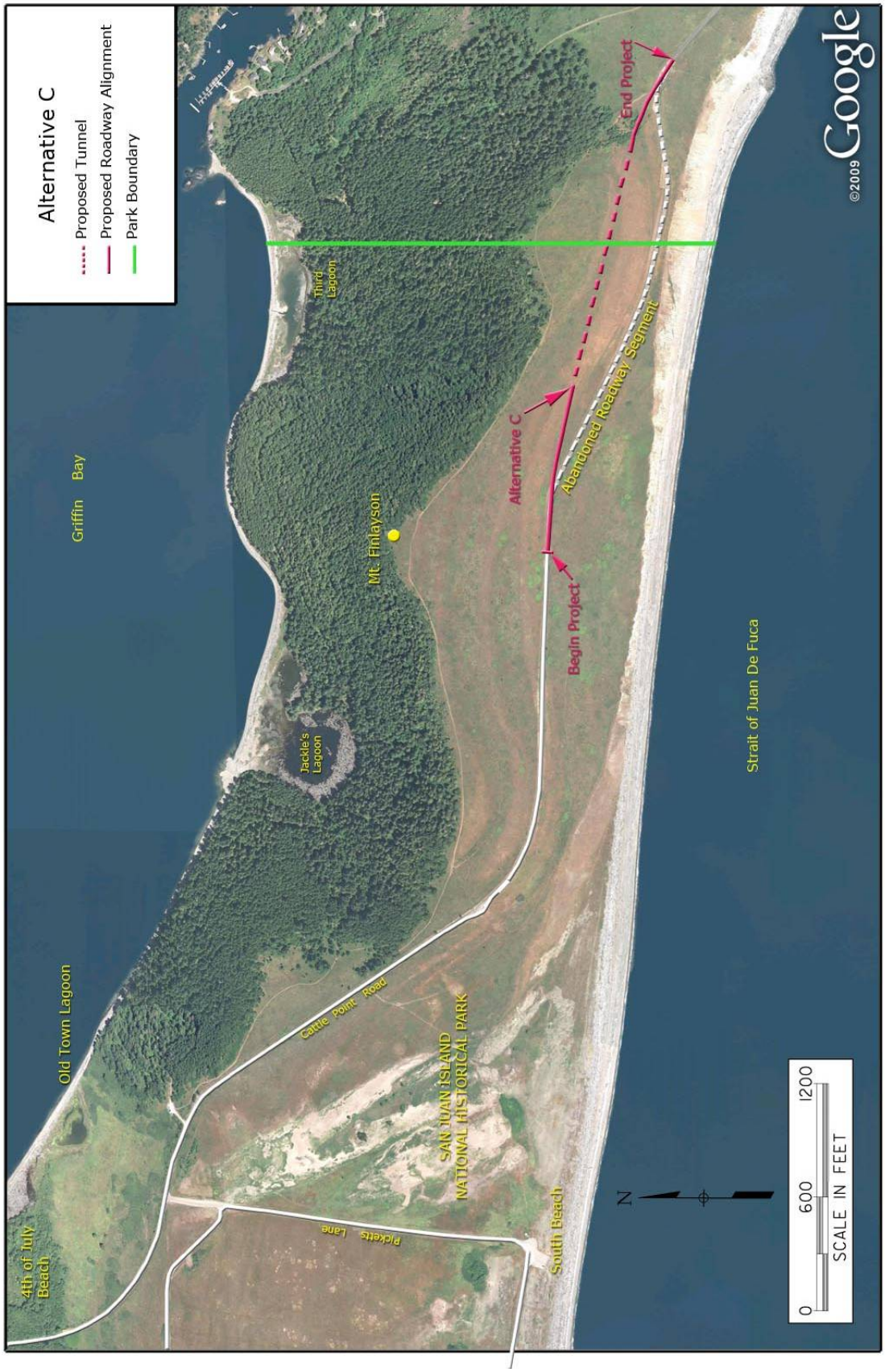

Figure 2.8 - Alternative C preliminary alignment

Figure 2.9 is a visual simulation illustrating how the alternative C road and tunnel alignment would appear on the landscape.

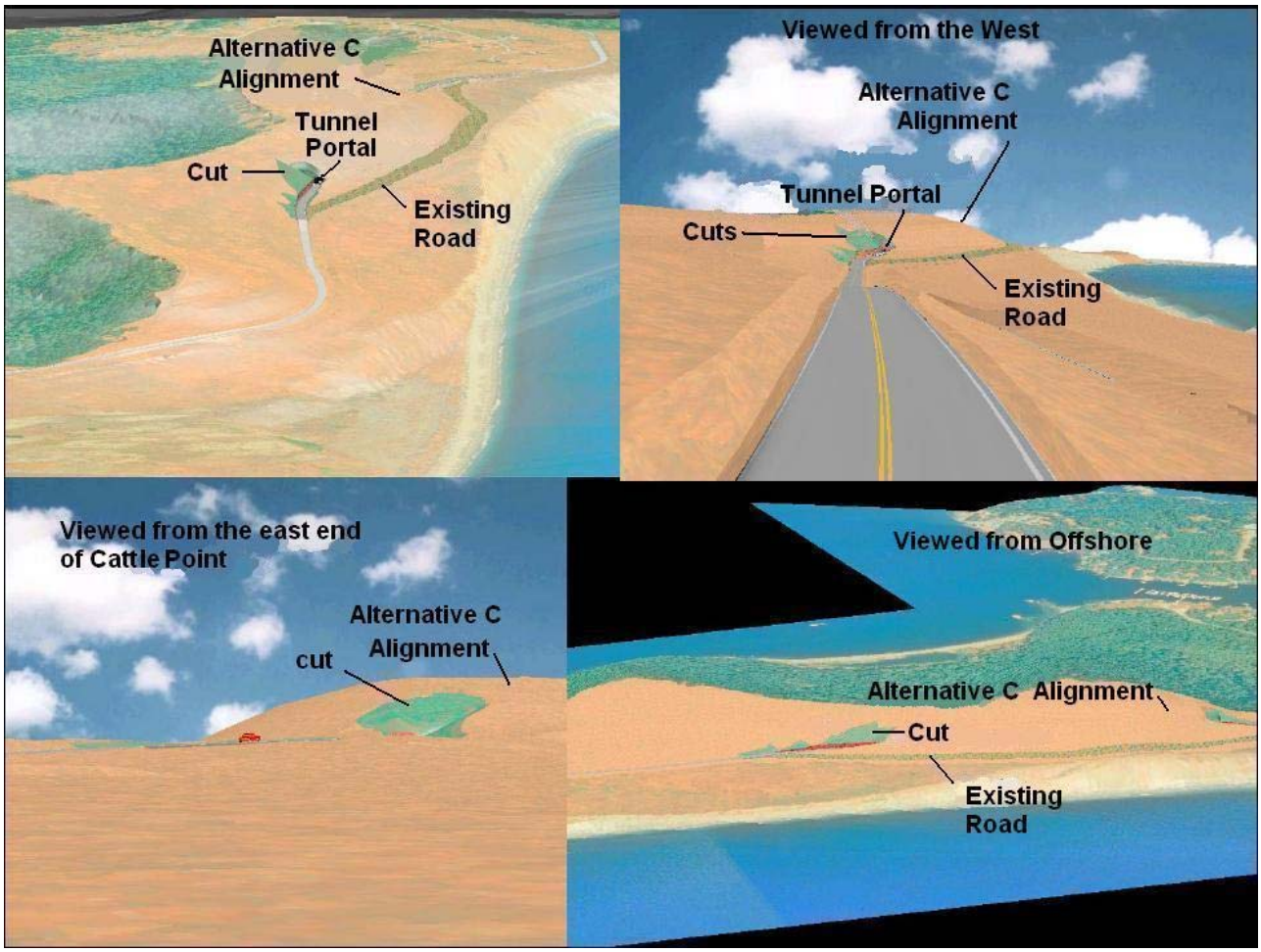

Figure 2.9 - Alternative C visual simulation

The new road would be constructed to a total width of 28 feet, consisting of two 10-foot travel lanes and two 4-foot paved shoulders. In addition, the tunnel section would include a 2-foot raised walkway. Typical road cross-sections inside and outside of the tunnel are shown in figure 2.10.

This alternative would require a fairly complex design that would likely take at least 2 years to complete. Construction of this alternative would likely last 1.5 to 3 years. Obtaining funding could be a lengthy process due to the high estimated cost of construction.

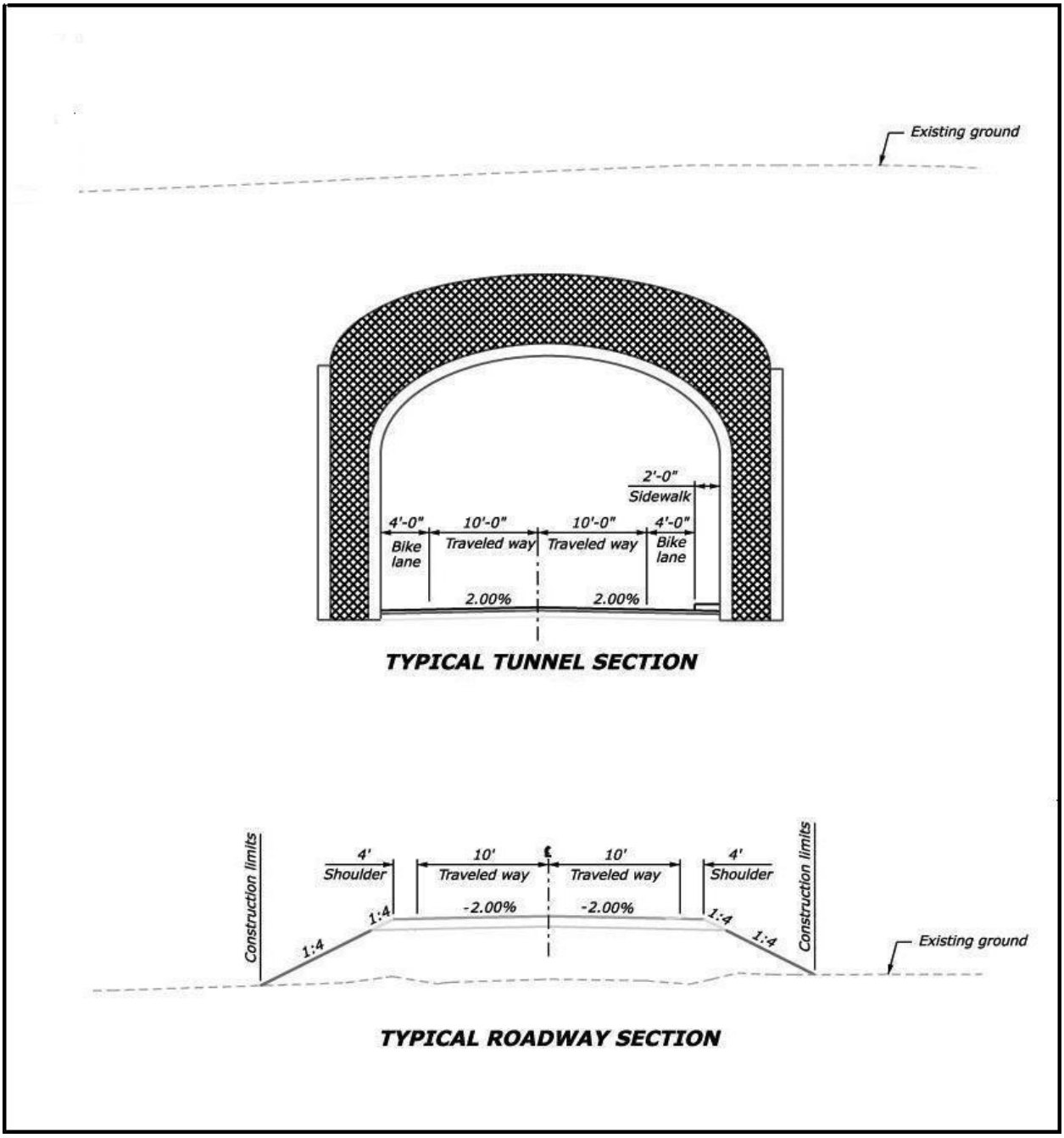

Figure 2.10 - Alternative C typical cross section

Tunnel construction requirements would be more complex than standard road construction because of overhead tunnel excavation and the need to support the soils at the tunnel portals. Grouting would likely be needed to stabilize the soil so that a tunnel could be excavated without the soils collapsing. Temporary shoring and ground reinforcement would be used to support the excavated tunnel until a permanent tunnel structure could be constructed. If large boulders or rock sections were encountered, blasting could be necessary, though based on limited geologic research, this is unlikely to occur. The gravelly soils at the project site and the costs for transporting and operating tunnel boring machinery make it likely that the tunnel would be constructed by conventional earth moving equipment.

Surface ground disturbance associated with this alternative would be approximately 10 acres, since a large portion of the construction would take place underground. Disturbance would occur from construction of the new road alignment, new road cuts and fills, tunnel portal excavation, construction equipment staging areas, earth stockpiling, and restoration activities along the abandoned road segment. The cuts at the tunnel portals would be large (up to 90 feet in height) and would require retaining walls in order to construct the road into the hillside. Of the 10 acres of ground disturbance, about 9acres would be restored and revegetated. Approximately 1 acre of above-ground surface would be permanently covered by pavement (road pavement within the tunnel would cover an additional 1 acre below-ground).

Following construction of a new road alignment, approximately 2,600 feet of the existing Cattle Point Road would be abandoned. The abandoned road segment would be restored by removing the road pavement, decompacting the road base, reshaping the roadbed to blend with the surrounding landscape, and planting the obliterated road template with native species. The area restored along the abandoned road segment would be about 2 acres.

Due to the length of the tunnel, lighting and ventilation would be needed. Power for lighting and ventilation motors would likely be provided by tapping into the existing infrastructure or by construction of a solar generation system. The tunnel systems would also require a back-up power generator.

Fire safety standards in highway tunnels are governed by the National Fire Protection Association 502, *Standards for Road Tunnels, Bridges, and Other Limited Access Highways*. For a tunnel of this length, the standards require the installation of a fire safety system. The system would include fire alarms, fire detection, fire extinguishers, and closed circuit TV (Shannon and Wilson 2004). Fire hose connections would require a water source. Currently there is no readily available water supply to the road, so either a new source would need to be developed or a piping system would need to be constructed to an existing source. The nearest existing water systems are for the residential area at Cattle Point.

To allow for emergency access in case of accidents, an emergency walkway on a raised curb would be included in the tunnel design. Although a shoulder would be provided for bicyclists, pedestrians, and special-use vehicles, the restricted space in the tunnel would offset the safety benefits of the shoulder. With maintenance, the tunnel would be built to a design life of over 100 years.

The large construction effort involved with this alternative would also require a substantial amount of materials and support. Although some excess earth would be used to return the existing road to a natural condition, the tunnel would still produce a large amount of excess excavated soil and cobbles. It is estimated that 4,000 to 5,000 truckloads of excess material would need to be transported and disposed of outside of the construction site.

Following construction, maintenance activities would include routine road and tunnel maintenance including tunnel cleaning and inspection as well as maintenance and operation of the light, ventilation, and fire systems. The estimated cost of maintenance for San Juan County would be about $65,000 per year. Since there are currently no tunnels on the island, the county does not have the equipment or expertise to perform tunnel inspection and maintenance. Start-up costs would be associated with training personnel and obtaining proper equipment. Project funding may absorb some or all of these costs to reduce impacts to the county's budget.

2.4.4 Alternative D: Mid-Slope Alignment with Short Tunnel

This alternative involves mid-slope realignment of the Cattle Point Road to the north, approximately 470 feet away from the eroding bluff area. Based on preliminary design, the tunnel would be about 775 feet long and 65 feet deep at its maximum depth. The following figures are approximate.

Overall Project Length:	5,800 feet
Length of New Alignment:	4,700 feet (775 feet in tunnel)
Grades:	Rolling, to 8% max
Earthwork:	Likely balanced
Road Cuts/Fills:	50 feet/50 feet, extensive
Retaining Walls:	20 feet max height, 800 feet long-at portals
Area of Temporary Disturbance:	20 acres
Area of Permanent Disturbance (New Pavement):	3 acres (above-ground)
Implementation Time:	
Design:	2 years
Construction:	1.5 to 3 years
Total:	3.5 to 5 years
Predicted Life Span:	155+ years
Operating and Maintenance Cost:	$35,000/year
Construction Cost:	$30 to 40 million

The preliminary alignment for alternative D is shown on figure 2.11. The project would begin about 0.65 miles east of the Pickett's Lane intersection. At the beginning of the project, the road would be widened and the grade would be raised along the current alignment for about 1,100 linear feet in order to transition with the new road alignment. The new alignment would then leave the current alignment and travel north to follow a natural bench for approximately 1,000 linear feet. From there, the new alignment would climb a moderately steep grade for approximately 1,500 feet where it would enter a tunnel. The tunnel would be approximately 775 feet in length. From its highest point, the tunnel would be located approximately 470 feet to the north of the coastal bluff erosion site. On exiting the tunnel, the road would curve down the ridge to the southeast where it would connect back to the existing road near where the NRCA trail meets the existing Cattle Point Road. The cost for construction of this alternative would be approximately $30 to 40 million.

The tunnel was proposed to lower the road profile through the top of the ridgeline of Mt. Finlayson and to avoid the steep grade at the east end of the ridge. The tunnel would be built by excavating a large cut, constructing the tunnel structure, and filling in material on top of the structure to restore the natural ground surface. This "cut and cover" method would be the most efficient way to construct a tunnel of this length and depth. Construction would involve removal and stockpiling of a large amount of excavated material outside of the project area, which would require large truck transport along local roads. Tunnel construction would create

Figure 2.11 - Alternative D preliminary alignment

a large area of temporary disturbance, but once completed and revegetated, it would reduce the total amount of permanent disturbance.

This alternative would provide more gradual road grades and yield minimal excess soil and cobble material. Relocation of the road away from the problem area would remove the threat of bluff erosion for over 150 years.

The realigned road section of this alternative is similar to the location of alternative B except that it would require slightly more extensive small earth fills. Figure 2.12 is a visual simulation illustrating how the road and tunnel alignment would appear on the landscape.

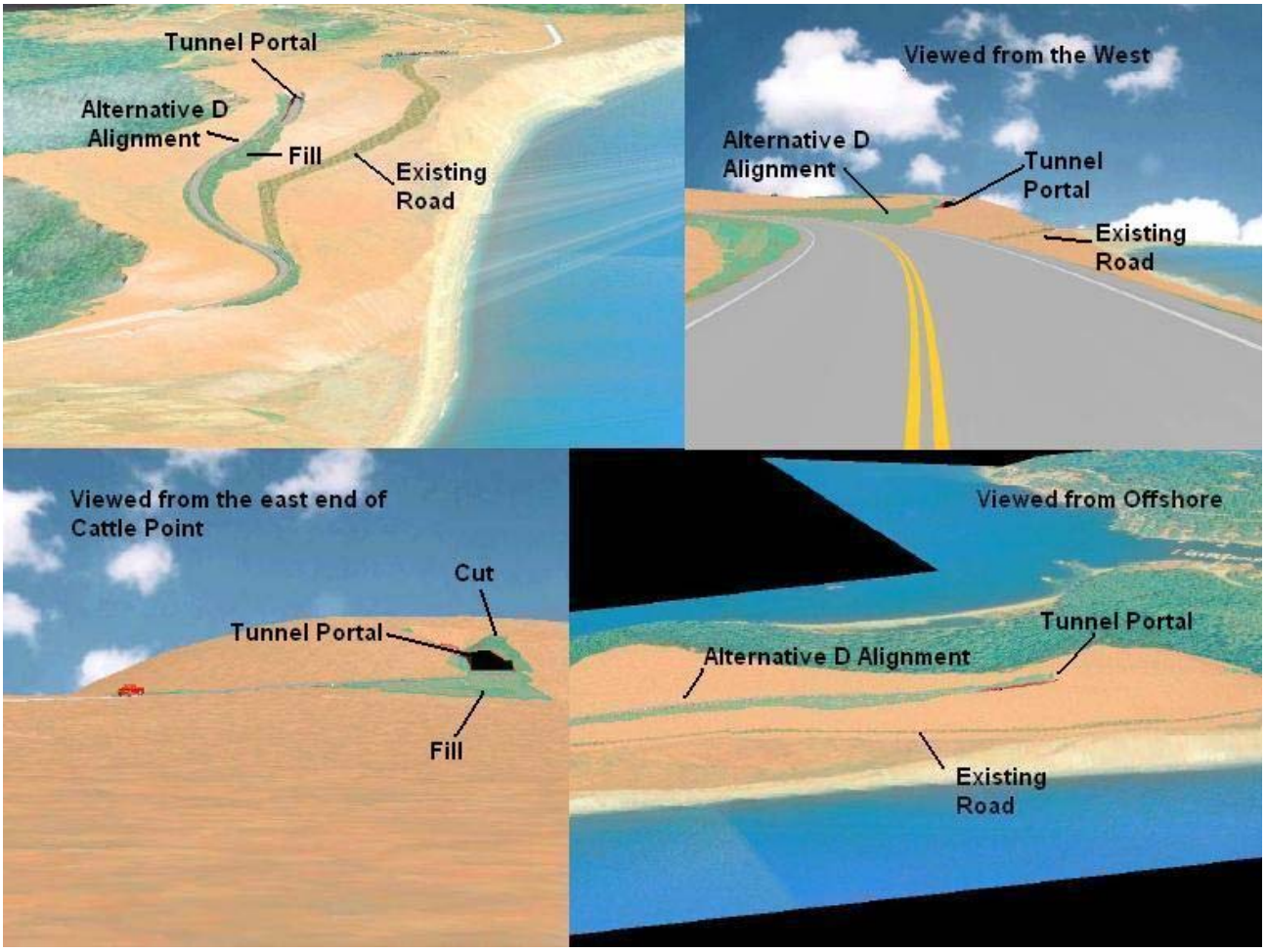

Figure 2.12 - Alternative D visual simulations

The new road would be constructed to a total width of 28 feet, consisting of two 10-foot travel lanes and two 4-foot paved shoulders. In addition, the tunnel section would include a 2-foot raised walkway for emergency access. Typical road cross-sections inside and outside of the tunnel would be the same as alternative C (figure 2.9).

Design of this alternative would be fairly complex, likely taking at least 2 years to complete. Construction would likely last 1.5 to 3 years depending on soils encountered and work restrictions. Obtaining funding could be a lengthy process due to the high estimated cost of construction.

Due to the extent of the actions in this alternative, construction impacts would be more intensive than those in alternative B. Construction would disturb approximately 20 acres. Disturbance would occur from construction of the new road alignment, new road cuts and fills, tunnel construction, construction equipment staging areas, earth stockpiling, and restoration activities along the abandoned road segment. Cuts and fills along the road alignment and at the tunnel portals would be large (up to 50 feet in height) and would require large retaining walls to stabilize the earth around the tunnel portals. Of the 20 acres of ground disturbance, approximately 17 acres would be restored and revegetated. The restored areas would include about 2 acres of ground surface covering the tunnel. About 3 acres of above-ground surface would be permanently covered by pavement (road pavement within the tunnel would cover an additional 0.5 acres below-ground). This alternative involves a wider and slightly longer road than currently exists; however part would be located in a covered tunnel section.

A lighting system would need to be provided in the tunnel section. Due to its shorter length, fire safety and ventilation systems may not be necessary (Shannon and Wilson 2004). Power for lighting would likely be provided by tapping into existing infrastructure or by construction of a solar generation system. The tunnel system would also require a back-up power generator. To allow for emergency access in case of accidents, an emergency walkway on a raised curb would be included in the tunnel design. Although a shoulder would be provided for bicyclists, pedestrians, and special-use vehicles, the restricted space in the tunnel would offset the safety benefits of the shoulder. With maintenance, the tunnel would be built to a design life of over 100 years.

During final design, the road and tunnel alignment would be adjusted to the extent possible to minimize ground disturbance and excess material generated, thus reducing construction costs. Although some excess earth would be used to return the existing road to a natural condition, the tunnel would still generate some excess soil and cobbles that would need to be transported off the construction site. The amount of excess material is anticipated to be far less than alternative C. The large construction effort involved with this alternative would require a substantial amount of offsite materials and support.

Following construction of a new road alignment, approximately 4,350 feet of the existing Cattle Point Road would be abandoned. The abandoned road segment would be restored by removing the road pavement, decompacting the road base, reshaping the roadbed to blend with the surrounding landscape, and planting the obliterated road template with native species. The area restored along the abandoned road segment would be about 3 acres.

Maintenance issues and costs for the road realignment would be similar to those in alternative B. The tunnel section would have similar maintenance, operations, and costs as alternative C. Since the tunnel section in alternative D is shorter, there would be a slight reduction in maintenance effort and costs because the tunnel would not require a ventilation or fire system. Start-up costs associated with training personnel and obtaining proper equipment for tunnel operations and maintenance would be the same as alternative C, although annual costs would be slightly less. Overall, the estimated yearly operations and maintenance cost for this alternative would be approximately $35,000 per year for San Juan County. Project funding may absorb some or all of these costs to reduce impacts to the county's budget.

2.4.5 Activities Common to All Action Alternatives (B, C, and D)

A number of considerations and activities are common to alternatives B, C, and D. These include utilities and easement/ROWs, proposed road design (e.g., lane width, grades, and shoulder width), general construction, and revegetation.

Construction of a new road alignment would require a new construction easement or right-of-way through the park and NRCA. The buried utility lines along the existing road corridor would need to be moved from the failing road section and placed along the new road alignment. The county would be responsible for maintaining the new road section and its features, including any pullouts and tunnel structures. The utility would be responsible for relocation activities and maintenance of utilities.

Road Design Considerations

The road realignment would be designed to meet both the NPS design standards for Rural Major Collectors as well as appropriate American Association of State Transportation Officials (AASHTO) standards referenced in the NPS standards. The NPS road design standards were developed for use in national parks in order to minimize impacts to park resources while maintaining safe access for park road users.

In all action alternatives, the overall length of the realigned road section would be essentially the same as the existing road that it would replace. The distance to the nearest residences to the east would not change.

Design parameters for the action alternatives were developed by the project team to balance safe, efficient road travel with aesthetic and resource impacts. Balancing resource concerns with road design considerations, the project team selected the following design parameters to ensure that the action alternatives provide an efficient, safe, well-constructed road for transportation while minimizing resource impacts in the park and NRCA:

Design Vehicle:	SU-30
A 30-foot-long single unit truck with two or more axles (e.g., a local delivery truck or a recreational vehicle)	
Design Speed:	35 miles per hour (mph)
Design Standards:	NPS/AASHTO
Traveled Way Width (2 lanes):	20 feet
Shoulder Width:	4 feet each side
Grades:	12% maximum

If an action alternative is implemented, these parameters would be further refined to determine the most appropriate road standards while minimizing surrounding resource impacts.

Road Shoulder

The project team determined that safety concerns associated with road use by pedestrians, bicycles, and special-use vehicles justified a wide shoulder, even though it would increase the area of ground disturbance. A recent county project northwest of the park added 3-foot shoulders to Cattle Point Road. When other sections of the road in the park require repair, a wider shoulder would likely be considered in these locations in order to improve continuity.

Although the adjoining road sections do not have paved shoulders, the new alignments would have a 4-foot paved shoulder, which would create a discontinuity. The shoulders would continue through the tunnel alternatives. Additionally, the tunnel design would include a 2-foot-wide emergency walkway on a raised curb.

Grade

Steep grades can become impassable for vehicles in snow and icy conditions. The eastern end of the project area contains a steep and narrow ridgeline, bordered on the north by the forest and trail. The action alternatives include a road design that balances the need to minimize impacts to forest, trail, and aesthetic resources with efforts to avoid overly steep road grades. These efforts would continue as the road design is refined.

Design Life

A bluff retreat rate of 1 to 3 feet per year was used to estimate design life for the alternatives. The range in rates results in a corresponding range in design life for the existing road and action alternatives. Since the purpose of the project is to address the threat of road failure due to bluff erosion, the action alternatives were designed to meet a minimum life of 50 years using the highest erosion rate. This time-frame was selected to allow for potential changes in the bluff erosion process over time as well as standard road structure deterioration rates. The minimum life span standard requires that the action alternatives be an adequate distance from the bluff to effectively remove the threat of erosion.

All action alternatives far exceed the 50-year minimum design life with an anticipated life span of over 100 years. The design life of each alternative assumes routine maintenance would continue to maintain the pavement surface and drainage, and to address safety issues.

Construction

Construction of any of the action alternatives would have temporary impacts. The design and specifications for construction of the road would be developed to ensure that a quality project would be constructed and all mitigation measures would be implemented. At the same time, the design would be crafted to allow flexibility and to limit restrictions on construction operations to the extent possible to maximize construction efficiency. Efficient operations minimize cost and time of construction, resulting in lower expenditure of funds and a shorter duration of temporary construction impacts.

In all of the action alternatives, the existing road would be left open during construction to maintain access to the east end of Cattle Point. Some traffic delays would be experienced due to construction traffic and associated construction activities. Traffic delays would probably be limited to 30 minutes or less, except during construction of the connections between the realignment and the existing road. Construction of these short road segments may require full road closure for up to 4 hours at a time during approximately 1 to 2 weeks at both ends of the connection. Road closure and delay schedules would be announced ahead of time through public outreach efforts.

Construction of the action alternatives would require the use of heavy equipment as well as operators and laborers. Construction equipment could include dump trucks, excavators, loaders, bulldozers, scrapers, compactors, paving equipment, support vehicles, water trucks, and other similar equipment. Construction operations would produce localized noise and visual disturbance.

The tunnels proposed in alternatives C and D would likely be excavated using conventional earthmoving equipment because the tunnel lengths would probably not warrant use of a tunnel boring machine. Blasting would be needed if bedrock was encountered during tunnel excavation. Preliminary studies have located no bedrock in the project area. It is also possible, though unlikely, that pile driving would be necessary to install shoring around tunnel portals and retaining walls. Any blasting or pile driving would generate pronounced loud impact noise as opposed to the steadier noise produced by other heavy equipment.

Construction of the action alternatives would require the following additional sites, sources, and services:

- Staging area(s) to store vehicles, materials, and equipment;
- A material source (borrow site) for rock needed to construct the road base;
- A source for the pavement surface material;
- Construction materials from a variety of vendors;
- Water for compaction of earth and dust control;
- A site to permanently store excess soil and rock (waste or spoils storage site);
- Temporary storage site for topsoil;
- Transportation of materials to and from these sites by barging, trucking, and the state ferry system.

Some of these activities would take place within the construction area, which would lessen offsite impacts and minimize transportation costs. No construction staging, borrow, or waste sites would be allowed within the park and NRCA outside of the immediate road construction area.

Some construction activities that could require ground disturbance, occupation, and clearing may take place outside of the construction area. These activities could include material extraction, material wasting, water retrieval, and staging. These activities would take place at either commercial or non-commercial sites. Commercial sites are defined as established sites that have provided material to public and private entities on a regular basis over the last two years, have appropriate state and local permits, and do not require expansion outside of their currently established and permitted area.

An existing commercial pit that could provide material for the project is located on the island about 10 miles from the project area. Local restrictions on barge landings make it likely that sites on San Juan Island would be used or that the existing ferry service would be used for off-island material and equipment transport.

Should a non-commercial site be selected, the contractor would be required to provide the following environmental clearances:

- Cultural Resources - Use of the site would have no more than a *no adverse effect* determination for properties on or eligible for listing to the National Register of Historic Places (NRHP) and a *de minimis* determination if Section 4(f) applies;
- Threatened and Endangered Species - Use of the site would have a determination of no more than *no effect* to species or habitat listed as threatened or endangered under the Endangered Species Act (ESA); and
- Waters of the U.S. - Use of the site would not encroach into waters of the U.S. or wetlands protected under Executive Order 11990.

- Remnant Prairie Habitats – Use of the site would have no adverse affect on the remnant prairie habitats of San Juan Island.

FHWA will not approve use of any non-commercial materials source until these conditions are met.

2.4.6 Comparison of Alternatives

The following table is a comparison matrix showing the effects of each alternative on the physical, biological, cultural, and social resources in the project area. Detailed discussions of the environmental effects of each alternative are presented in chapter 4.

Table 2.2 - Resource impact summary

RESOURCE	ALTERNATIVES			
	A (No Action)	**B** (Hybrid Mid-Slope Realignment)	**C** (Minor Realignment with Long Tunnel)	**D** (Mid-Slope Realignment with Short Tunnel)
Topography and Geology	No effect	Moderate adverse effect, short term and long term	Minor adverse effect, short term Minor adverse effect, long term	Minor adverse effect, short term Moderate adverse effect, long term
Soils	No effect	Minor adverse effect, short term Negligible adverse effect, long term	Minor adverse effect, short term Minor beneficial effect, long term	Minor adverse effect, short term Minor beneficial effect, long term
Air Quality	Negligible beneficial effect locally, no effect regionally	Negligible adverse effect locally, short term No effect long term	Negligible adverse effect locally, short term No effect long term	Negligible adverse effect locally, short term No effect long term
Floodplains, Wetlands and Water bodies	No effect	No effect	No effect	No effect
Hydrology	Negligible beneficial effect	Negligible adverse effect, short term and long term	Minor adverse effect, short term and long term	Minor adverse effect, short term and long term
Water Quality	Negligible adverse effect	Negligible adverse effect, short term and long term	Negligible adverse effect, short term and long term	Negligible adverse effect, short term and long term
Visual Quality	Negligible adverse effect	Moderate adverse effect, short term and long term	Minor adverse effect, short term Minor beneficial effect, long term	Moderate adverse effect, short term Minor adverse effect, long term
Vegetation	No effect	Minor adverse effect, short term and long term	Minor adverse effect, short term Minor beneficial effect, long term	Minor adverse effect, short term Negligible adverse effect, long term

RESOURCE	ALTERNATIVES			
	A (No Action)	**B** (Hybrid Mid-Slope Realignment)	**C** (Minor Realignment with Long Tunnel)	**D** (Mid-Slope Realignment with Short Tunnel)
Wildlife	Minor beneficial effect	Moderate adverse effect, short term Minor adverse effect, long term	Moderate adverse effect, short term Minor beneficial effect, long term	Moderate adverse effect, short term Negligible beneficial effect, long term
Fish	No effect	No effect	No effect	No effect
Federally-Listed Threatened, Endangered, and Protected Species	Federal TES: No effect Federally-Protected: No effect	Federal TES: No effect Federally-Protected: Minor adverse effect, short term Negligible adverse effect, long term	Federal TES: No effect Federally-Protected: Minor adverse effect, short term No effect, long term	Federal TES: No effect Federally-Protected: Minor adverse effect, short term Negligible adverse effect, long term
State-Listed Threatened and Endangered Species	No effect	Minor adverse effect, short term Minor beneficial effect, long term	Minor adverse effect, short term Minor beneficial effect, long term	Minor adverse effect, short term Minor beneficial effect, long term
Other Special Status Species	No effect	Minor adverse effect, short term Negligible adverse effect, long term	Minor adverse effect, short term Negligible adverse effect, long term	Minor adverse effect, short term Negligible adverse effect, long term
Essential Fish Habitat	No effect	No effect	No effect	No effect
Cultural, Historic, and Archaeological Resources	No effect	Negligible adverse effect, short term and long term	Negligible adverse effect, short term and long term	Negligible adverse effect, short term and long term
Land Use	No effect	No effect	No effect	No effect
Local Plans	Does not comply with access guidelines in local land management plans	Follows applicable guidelines and desired conditions of local land management plans	Follows applicable guidelines and desired conditions of local land management plans	Follows applicable guidelines and desired conditions of local land management plans
Visitor Uses	Minor adverse effect locally; negligible effect county-wide.	Moderate adverse effect short term No effect long term	Moderate adverse effect short term No effect long term	Moderate adverse effect short term No effect long term

RESOURCE	ALTERNATIVES			
	A (No Action)	**B** (Hybrid Mid-Slope Realignment)	**C** (Minor Realignment with Long Tunnel)	**D** (Mid-Slope Realignment with Short Tunnel)
Trail System	No effect	Moderate adverse effect on Mt. Finlayson Trail, short term. Minor adverse effect on overall trail system, short term. Minor adverse effect on Mt. Finlayson Trail, long term. Negligible adverse effect on trail system, long term.	Moderate adverse effect on Mt. Finlayson Trail, short term. Minor adverse effect on overall trail system, short term. Negligible adverse effect on Mt. Finlayson Trail and overall trail system, long term	Moderate adverse effect on Mt. Finlayson Trail, short term. Minor adverse effect on overall trail system, short term. Minor adverse effect on Mt. Finlayson Trail, long term. Negligible adverse effect on trail system, long term.
Transportation and Road System	Major adverse effect locally; negligible effect county-wide.	Moderate adverse effect, short term No effect, long term	Moderate adverse effect, short term No effect on road system, long term. Moderate adverse effect on county maintenance budget, long term.	Moderate adverse effect, short term No effect on road system, long term. Moderate adverse effect on county maintenance budget, long term.
Special Vehicles, Bicycles, and Pedestrians	Minor adverse effect locally; negligible effect county-wide.	Moderate adverse effect, short term Minor beneficial effect, long term	Moderate adverse effect, short term Minor adverse effect, long term	Moderate adverse effect, short term Minor adverse effect, long term
Road Safety	Minor beneficial effect locally; negligible beneficial effect county-wide.	Negligible adverse effect, short term No effect, long term	Negligible adverse effect, short term No effect, long term	Negligible adverse effect, short term No effect, long term
Population and Demographics	Locally noticeable but minor county-wide adverse effect	No effect, short term and long term	No effect, short term and long term	No effect, short term and long term
Local Industry	Negligible adverse effect	Minor beneficial effect, short term No effect, long term	Minor beneficial effect, short term No effect, long term	Minor beneficial effect, short term No effect, long term
Employment and Income	Minor adverse effect	Minor beneficial effect, short term No effect, long term	Minor beneficial effect, short term No effect, long term	Minor beneficial effect, short term No effect, long term
Environmental Justice	No effect	No effect	No effect	No effect
Relocation	No effect	No effect	No effect	No effect
Public Health and Safety	Major adverse effect locally, no effect county-wide	Negligible adverse effect, short term No effect, long term	Negligible adverse effect, short term No effect, long term	Negligible adverse effect, short term No effect, long term

RESOURCE	ALTERNATIVES			
	A (No Action)	**B** (Hybrid Mid-Slope Realignment)	**C** (Minor Realignment with Long Tunnel)	**D** (Mid-Slope Realignment with Short Tunnel**)**
Utilities	Utilities would eventually need to be relocated as separate project	No effect, short term and long term	No effect, short term and long term	No effect, short term and long term
Hazardous and Solid Waste and Materials	No effect	No effect	No effect	No effect
Energy	Negligible beneficial effect locally; no effect regionally	Minor adverse effect, short term Negligible adverse effect, long term	Minor adverse effect, short term Negligible adverse effect, long term	Minor adverse effect, short term Negligible adverse effect, long term
Noise	Negligible adverse effect	Moderate adverse effect, short term No effect, long term	Moderate adverse effect, short term No effect, long term	Moderate adverse effect, short term No effect, long term
Light	Negligible beneficial effect	Negligible adverse effect, short term No effect, long term	Negligible adverse effect, short term Minor adverse effect locally, long term. No discernible effect on overall night sky	Negligible adverse effect, short term Minor adverse effect locally, long term. No discernible effect on overall night sky
Prime and Unique Farm Lands	No effect	No effect	No effect	No effect
Coastal Zone	Not applicable	In compliance	In compliance	In compliance
Section 4(f)	No effect	De minimis effect	De minimis effect	De minimis effect

2.5 OTHER ACTIONS AND ALTERNATIVES CONSIDERED

According to the NPS Director's Order 12 Handbook, alternatives may be eliminated from detailed study based on the following reasons (NPS 2001):

- Technical or economic infeasibility;
- Inability to meet project objectives or resolve need for the project;
- Duplication of other less environmentally damaging alternatives;
- In conflict with an up-to-date valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement;
- Environmental impacts are too great.

2.5.1 Alternatives Eliminated from Further Consideration

The following alternatives were considered in the project planning process but have been eliminated from further analysis. The names of these alternatives are carried over from previous project scoping documents.

Alternative 2RA and 3RA: Mid-Slope Realignments

Alternatives 2RA and 3RA were identified as separate alignments in the scoping document, with 2RA being a shorter realignment around the problem area. This alignment would rise steeply on the west end upslope of the problem area, approach the ridgeline, and drop back steeply on the east end to connect back to the existing road. Alternative 3RA would take a longer realignment, gradually climbing up a natural bench to the west, cresting over the ridgeline, before dropping steeply off the east end.

During the evaluation of the alternatives, participants recognized that there was little benefit to the steeper, shorter west end of 2RA. Although it impacted less area, the extensive cuts required to fit the road into the hillside resulted in more intensive effects in the affected area along with increased visual impacts. The east end of 3RA cut through the top of the ridge and presented a greater impact on trails and view-sheds than 2RA, which would be contoured to the south with smaller cuts or retaining walls. Being closer to the problem erosion area, the 2RA alignment had a slightly shorter but acceptable predicted life.

These issues resulted in a modified (or hybrid) version of alternative 3RA that utilized the west end of 3RA and the east end of 2RA. Since the hybrid alignment would substantially reduce the impacts of the original alternatives, they were subsequently dropped from consideration in favor of alternative B.

Alternative 1SS: Slope Stabilization

Under this alternative, hard bluff and shoreline stabilization techniques such as riprap retaining walls, bulkheads, and revetments would be used to stabilize the top and toe of the bluff and the existing road alignment. In addition, planting vegetation on the upper slopes of the bluff was considered in order to stabilize soils and absorb precipitation and runoff. This "bioengineering" technique would be used in combination with hard stabilization at the toe of the bluff to avoid undercutting of the slope. Stabilization of the bluff would allow the road to remain at or near its existing location with little increase in disturbance area. With this alternative, the life of the road would be dependent on the success of the stabilization methods used and how effectively they would prevent the advance of bluff erosion.

This alternative was eliminated from further consideration for the following reasons:

- Bluff erosion is a natural process formed in a dynamic coastal environment. Hard stabilization along the toe of the bluff and shoreline could adversely interrupt natural shoreline processes and sand movement that could lead to increased erosion adjacent to the structures. In addition, shoreline hardening would impact the sensitive intertidal environment and areas immediately offshore.
- Bluff stabilization would require construction of a structure on the shoreline large enough to change the shoreline erosion process. A large structure would negatively impact the visual quality of the shoreline when viewed from offshore.
- Section 4.8.1.1 (Shorelines and Barrier Islands) of the NPS 2006 Management Policies discourages modification of shoreline processes and requires conformance with state coastal

zone management plans (CZMP). The Washington CZMP also discourages modification of shoreline processes.

- The only access to shoreline construction would be by water or by traveling a distance along the shoreline. This would pose construction operational challenges, increase construction costs, and increase impacts to coastal resources.
- Experience in coastal areas of the U.S. has shown that stabilizing an erosion-prone slope provides only short-term relief to coastal erosion. This alternative would not adequately meet the project purpose and need to provide long-term protection of road access.

Alternative 1BR: Bridge

Under this alternative, the threatened section of road would be replaced with a bridge located close to the road's existing alignment and would include the following features:

Bridge/road grades:	Existing
Bridge length:	Over 1,500 feet
Bridge construction material:	Unfinished concrete
Estimated life of the bridge/road:	100+ years

The bridge would be designed to include a pedestrian and bicycle lane or non-motorized traffic would use other trails.

Initially, this alternative would cause little disturbance to areas outside of the existing alignment. However, as bluff erosion continued, the large bridge supports would eventually become exposed.

This alternative was eliminated from further consideration for the following reasons:

- Initial geotechnical investigations found no evidence of bedrock in the area, which would necessitate the use of excessively deep bridge supports (at least 200 feet deep). The need for deep supports would increase the complexity of bridge design and construction, and greatly increase costs.
- As natural bluff erosion continued, the bridge structure and deep bridge supports would be exposed over time. The large structure would negatively impact the natural and historic views of the coastline when viewed from offshore.
- Substantial time would be involved in securing funding for such a large project as well as intricate design factors involving seismic issues and complex construction efforts.
- Following construction, substantial funds would be needed to maintain the structure as bluff erosion continues.

Alternative 4RA: Ridgeline Alignment

This alternative would realign the road along the ridgeline south of Mt. Finlayson. The road alignment would be located near the Mt. Finlayson Trail and would pass through fringe/transitional habitat between the prairie and forest. Road features would include:

- Road grades: Hills (+8% to -7%)
- Length of realigned road section: 6,800 feet

- Estimated life of the road: 150+ years

This alternative was eliminated from further consideration for the following reasons:

- This road alignment would have required substantial exposed cuts to gain elevation on both the west and east ends of the ridge. While relocating the road to the ridgeline would shield the road from some view-sheds, the view from the historic redoubt at American Camp would be marred by the large excavations.
- A large area of the Mt. Finlayson Trail would be directly impacted by this alternative. The trail would likely be rerouted along the shoulder of the new road alignment, which would negatively impact the solitude of the trail. Public concern was voiced regarding extensive impacts to the Mt. Finlayson Trail.
- The long road realignment would create a new linear barrier which would disturb the established natural resources along the prairie and forest fringes on the ridgeline. The alternative would involve over 10 acres of permanent disturbance.

Alternative 5RA: North Side Alignment

Under this alternative, the road would be realigned to the north side of Mt. Finlayson, well beyond the foreseeable influence of bluff erosion. Road features would include:

- Road grades: Flat (vary 1% to 4% with an isolated 7%)
- Length of realigned road section: 11,000 feet
- Estimated life of the road: 200+ years

This alignment would provide the greatest life expectancy of any alternate by completely removing the road from the influence of coastal bluff erosion. The location would avoid impacts to the prairie grassland habitat but would impact the adjacent forest habitat. Road user experience and views would differ from the existing road because most of the alignment would be located within a forested area. The new road grade would be relatively flat and require minimal cuts and fills.

This alternative was eliminated from further consideration for the following reasons:

- This alignment would create new forest wildlife habitat fragmentation. Forested areas include habitat for bald eagle and federally-listed marbled murrelet.
- Forest trails would need to be relocated.
- The watershed and subsurface flows into the lagoons located at the base of the forest slopes would be impacted. The Third Lagoon was purchased, in part, with Washington Wildlife and Recreation Program funds. Impacts to this unique resource could involve a lengthy easement petition process.
- Public comments were largely unsupportive of the forest alignment.

A second option on the north side of Mt. Finlayson involved realigning the Cattle Point Road onto the old logging road that is currently being used as a trail. Major road improvements would be needed to make the road usable for vehicular traffic. This alternative was eliminated from further consideration because it would involve extensive impacts to trail users and forest resources.

2.5.2 Design Options Eliminated from Further Consideration

The following are design options, not specific to any alternative, which were considered during early planning but are no longer included in the analysis:

Narrow Shoulders

The benefit of narrow road shoulders would be to reduce overall road width, which would in turn reduce temporary and permanent environmental disturbance. This feature would also reduce construction costs, particularly in tunnel options. Narrow road shoulders would prohibit safe use by bicyclists and pedestrians in the tunnel sections; however, these uses could be accommodated by constructing a multi-use trail bypassing the tunnel. Construction of an additional trail would produce its own environmental impacts, which may offset any gains made from the reduction in road shoulders. Use of existing pedestrian trails as multi-use trails could detract from the hiking experience. Special licensed vehicles would be required to use the road, which could create a safety hazard in the tunnels. Therefore, the design option of narrow road shoulders was removed from consideration in project design.

Use of the Existing Road Alignment as a Trail

Following construction of a new road alignment, the abandoned road could be narrowed and used by non-motorized traffic. This was not an acceptable option due to safety considerations from continued bluff erosion.

Use of State or Local Road Design Standards

The NPS Park Road Standards were selected as the road design standards for the proposed project because of the sensitivity of the natural surroundings and the allowances made in the NPS standards for minimizing environmental impacts while providing safe vehicular access. The state and local design standards were not chosen because they focus on addressing transportation needs over environmental and recreational issues.

2.6 ENVIRONMENTALLY PREFERRED ALTERNATIVE

Council on Environmental Quality (CEQ) regulations for implementing NEPA require that the environmental document specify "the alternative or alternatives which were considered to be environmentally preferable" (40 C.F.R. §1505.2(b)). The environmentally preferred alternative has been interpreted to be the alternative that would promote the national environmental policy as expressed in NEPA. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; and best protects, preserves, and enhances historic, cultural, and natural resources. The environmentally preferred alternative is not necessarily the same as the agency preferred alternative.

The environmentally preferred alternative for this project is alternative B. This alternative provides for continued road access to visitors and residents of Cattle Point while minimizing impacts to the prairie vegetation, visual resources, recreational trails, and historic resources.

For this project, the environmentally preferred alternative is the same as the agency preferred alternative.