



## a beach for everyone

*...the beach is part of a much larger system of interconnected elements and its form and configuration is influenced by a number of urban, environmental and social factors...*



# understanding ocean beach: 7 focus areas

chapter

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Ocean Beach is a complex, multifaceted environment, with a host of overlapping issues and challenges. This plan provides a multi-objective approach to OB, synthesizing a wide range of factors and addressing numerous issues simultaneously. To that end, it necessarily favors breadth over depth, and additional technical work will be required on numerous fronts in order to implement the recommendations.

Specialists in any of the numerous relevant disciplines may therefore find some of the analysis wanting in depth, but, we believe, fundamentally sound. Instead, this document takes an integrative approach to the issues, synthesizing information from a wide variety of fields and presenting solutions that solve many problems simultaneously.

This has been an interdisciplinary process. Specialists in a wide range of fields were employed to ensure the best available technical information informed the problem definition and recommended solutions. However, the project scope allowed only a basic level of technical analysis and engineering.

Implementing the recommendations presented here will necessarily involve significant additional technical studies, environmental analysis, feasibility studies, and cost estimation.



focus area 1 : ecology

aspiration

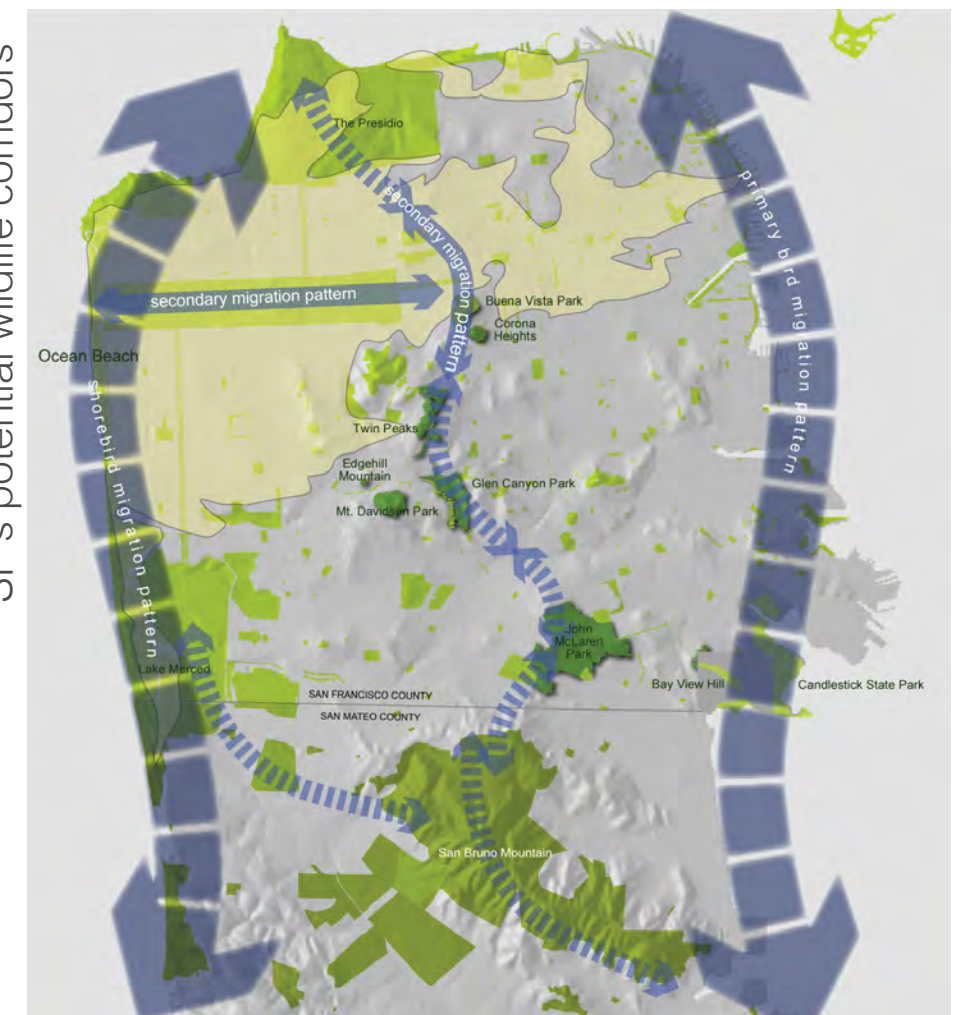
*Restore and establish conditions that support thriving biological communities.*



Although Ocean Beach is very much a managed landscape — the alignment of the coast, the shape of the beach and bluffs, and the form and composition of the dunes are all man-made — important biological communities make their homes there. The beach and dune system provide a corridor of scarce habitat for numerous species and connect adjacent parklands.

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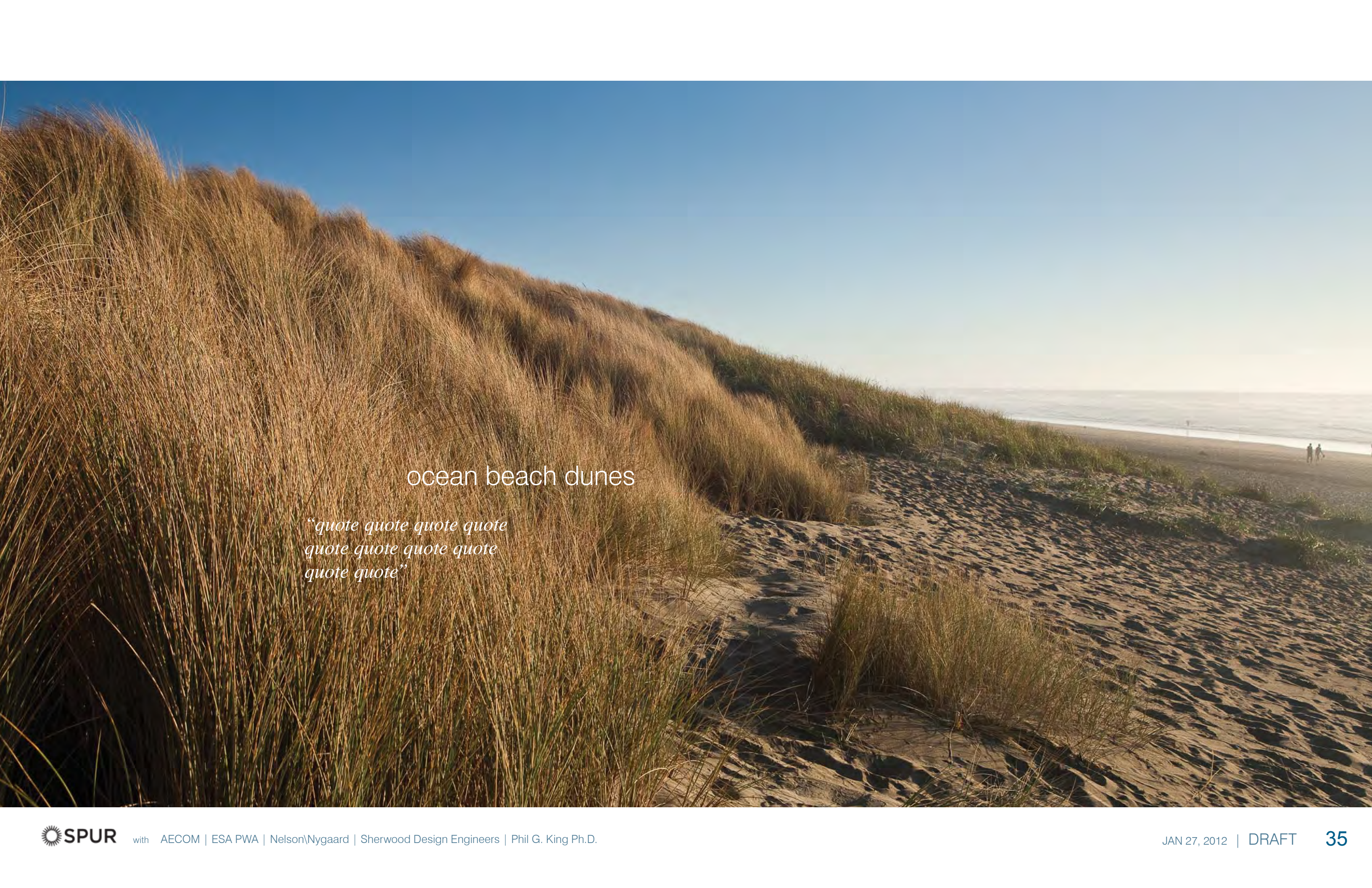
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## SF's potential wildlife corridors



 natural resource area  
 historic sand dunes





ocean beach dunes

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quote quote”*



focus area 1 :  
ecology

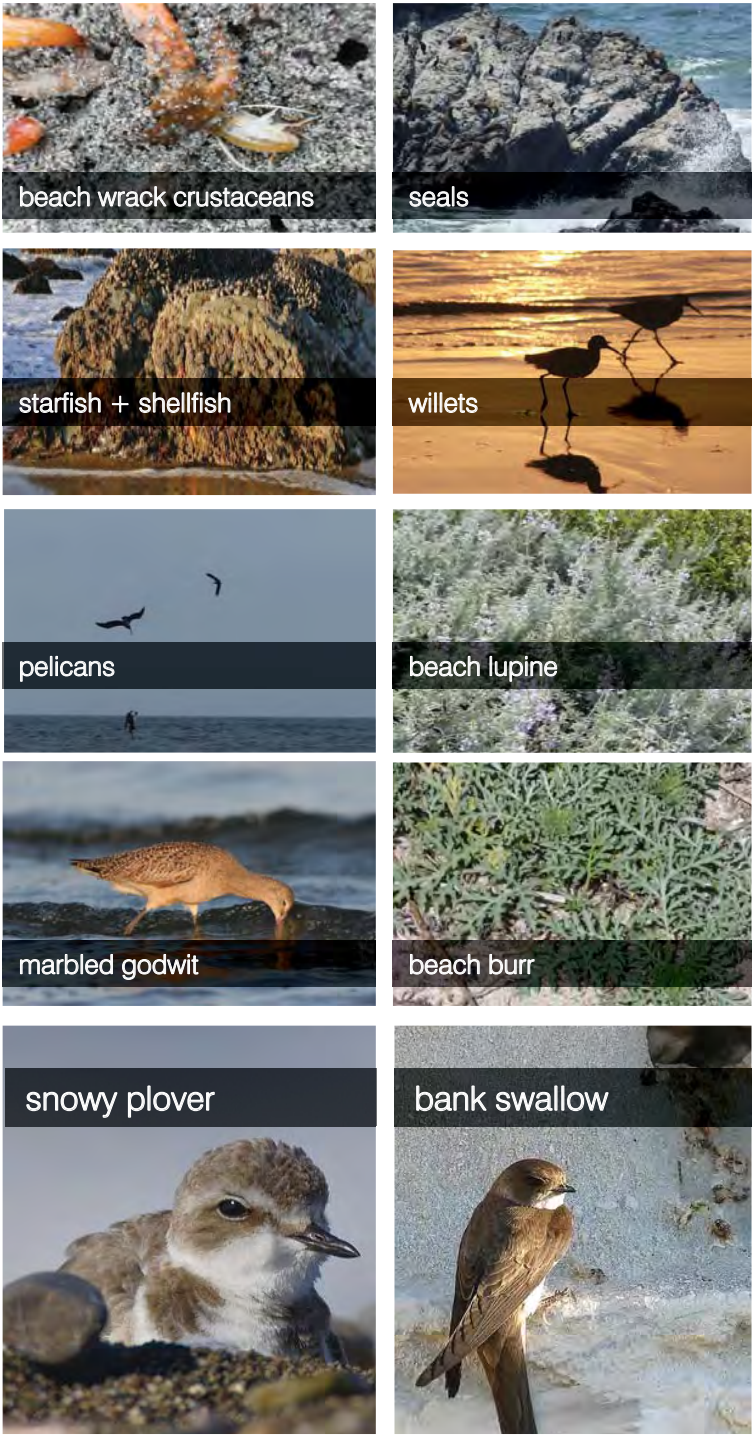


threatened bird species

In particular, there are two threatened bird species at Ocean Beach. The Western Snowy Plover, a federally listed threatened species, inhabits dry back beach, especially in the central part of Ocean Beach. Western Snowy Plovers inhabit Ocean Beach from July to May, using the space between dunes or sea wall and high tide line to forage, rest, and roost. As a result of their reliance on back beaches, the species declines as beaches narrow, suggesting that beach nourishment would help maintain plover habitat, provided it was conducted sensitively.

The Bank Swallow, a state-listed threatened species, burrows in exposed bluffs faces near sources of fresh water (Lake Merced in this case) where it feeds on insects. A colony of Bank Swallow has been observed at the south end of Ocean Beach in recent years, a vulnerable position given ongoing erosion and the installation of coastal armoring. Coastal management in this area should be designed to maximize the erodible bluff face to the extent possible. With that said, the species is opportunistic about its exact burrowing locations, and considerable appropriate habitat remains available immediately to the south at Fort Funston, which lacks the intense constraints of the South of Sloat area.

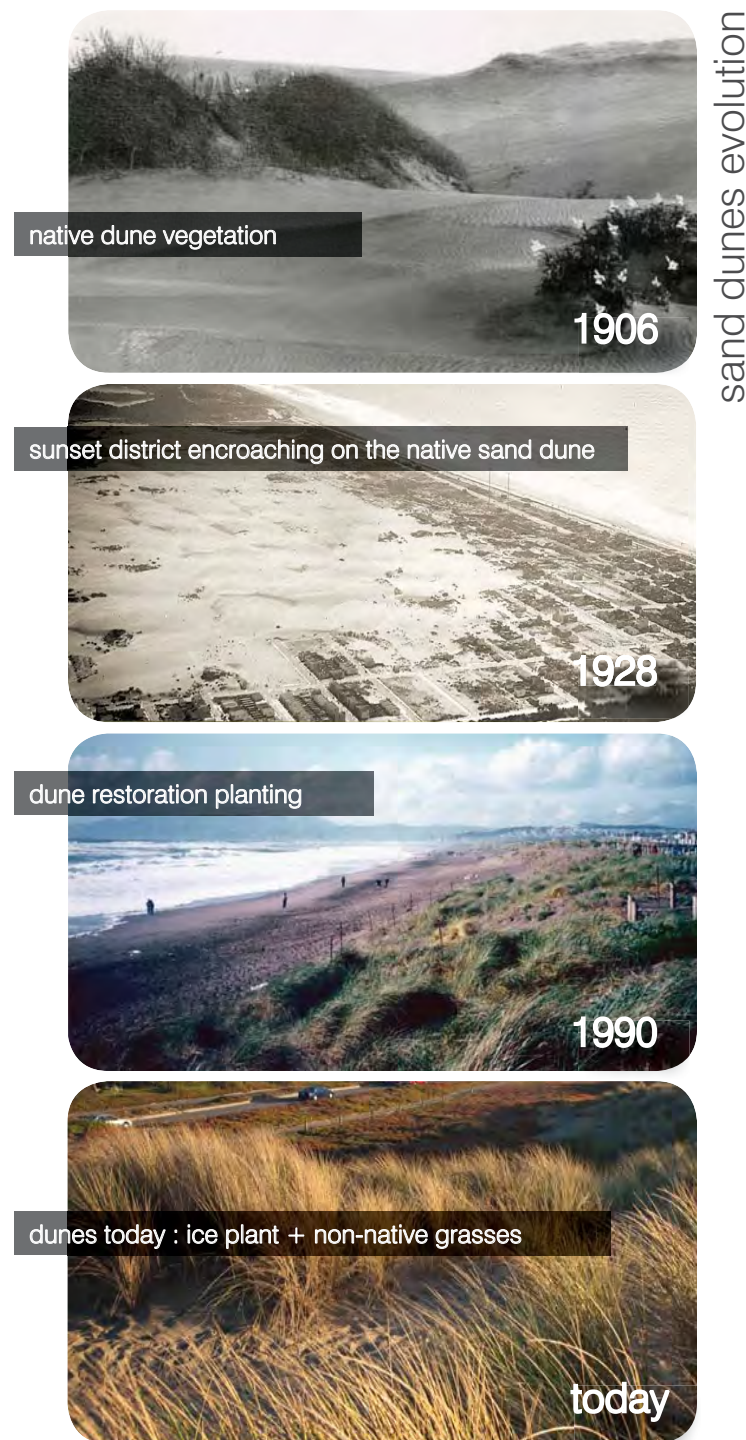
Neither species nests at Ocean Beach and both are protected to some degree by current management practices, including the prohibition on dogs on much of the beach during plover season (July-April) and the cessation of work by San Francisco Department of Public Works (SFPDW) crews during bank swallow season. Concerns about the plover have been a factor in a recent proposal by the GGNRA to further limit dog access to parts of Ocean Beach.



federally-listed threatened species      state-listed threatened species

ocean beach native species





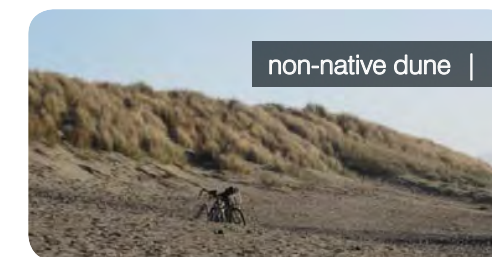
## native dune restoration potential

The “dunes” that predominate from Fulton to Noriega streets (and recurs elsewhere) might be more properly considered a sand embankment rather than dunes per se. It was primarily constructed as part of the Clean Water Program in the 1980s and helps to protect both wastewater infrastructure and adjacent neighborhoods from coastal hazards. Its morphology and plant communities are both non-native, with European beach grass (*ammophila arenaria*) and iceplant (*Carpobrotus* spp) predominating. The deep root system and dense mats of vegetation formed by *ammophila* tend to crowd out the more diverse native vegetation and produce a steep, tall form that launches windborne sand inland over the road.

While the dynamics of a complete native dune system would require extensive space that is unavailable without acquiring private property, but a restoration of native morphology, removal of re-vegetation with native plant materials could provide both ecological and interpretive benefits. Although removing *ammophila* is a significant undertaking, other projects have been undertaken successfully in California, including at Little River State Beach and Freshwater Lagoon Spit in Humboldt County. Such an effort could enhance biodiversity at Ocean Beach, while providing a corridor among adjacent habitats and a recreational and interpretive resource for visitors.



historic native dune | lower profile, more sand transport



non-native dune | steep and dense



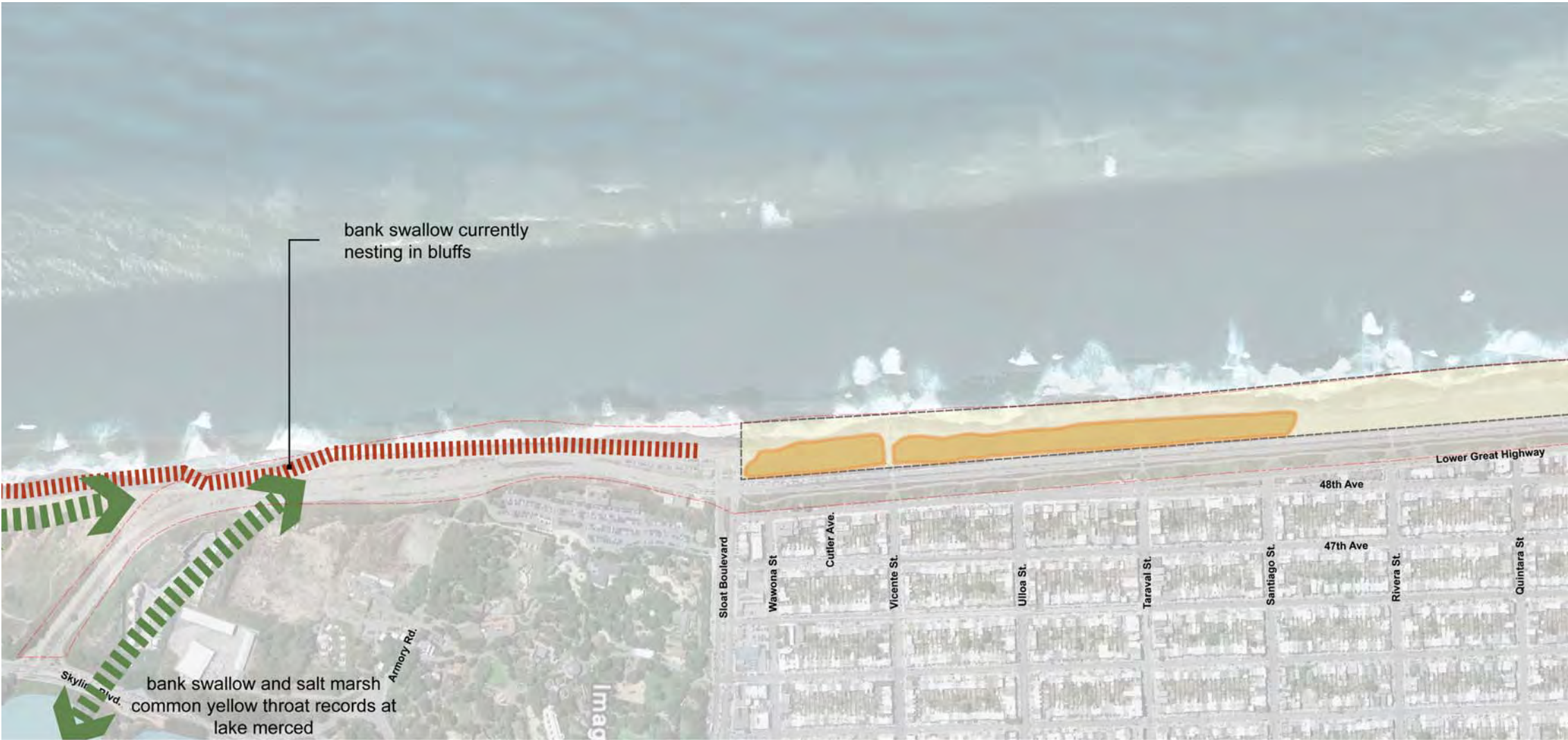
## sand dunes characteristics



focus area 1 :  
ecology

diagram legend

- project boundary
- dunes
- bluffs
- snowy plover protection
- shorebird corridors







existing ecological zones diagram



## focus area 2 : utility infrastructure

aspiration

*Evaluate infrastructure plans and needs in light of uncertain coastal conditions, and pursue a smart, sustainable approach.*

Beginning in the 1970s, under pressure from the Federal Clean Water Act, the SFPUC significantly upgraded the city's combined sewer-stormwater system, especially on the west side, where the ocean was being subjected to 60 to 70 combined sewer overflows each year. The PUC's Clean Water Program completed the current system in 1993 and has reduced the number of overflows to fewer than eight per year.

The system accomplishes this impressive feat through a series of interconnected components. In dry weather, the west side's wastewater (sewage) runs through the network of local pipes to the Westside Transport Box — a large rectangular tube under the Great Highway — then south to the pump station at Sloat Boulevard. It is pumped to the Oceanside Water Pollution Control Plant, from which secondary-treated effluent is released through the Southwest Ocean Outfall, 4.5 miles out to sea.

In wet weather, stormwater runoff surges into the system. When the plant's capacity of 65 million gallons per day is overwhelmed, the transport box and Lake Merced Tunnel — two massive structures designed to store runoff and prevent overflows — fill up and retain the combined flow. Overflow there is decanted and pumped to the deep ocean outfall. Only when that system's capacity is exceeded do combined discharges occur, through two large outfall structures on Ocean Beach.

Parts of the Lake Merced Tunnel – a 14-foot diameter pipe under the Great Highway south of Sloat Boulevard— are immediately vulnerable to erosion, and must be protected or moved to prevent serious sewage spill that would contaminate coastal waters. The Westside Transport runs under the Great Highway from Lincoln Boulevard to Sloat Boulevard, and it may become a significant factor in shaping the beach and dunes as the coastline recedes.

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beach as part of the city's infrastructure

*ocean beach is more than an ecological and recreational resource for San Francisco... it also plays a role as part of its stormwater management system*



focus area 2 :  
utility infrastructure

Wastewater infrastructure is designed for the long haul: Parts of the current system are more than 100 years old. The West Side system is new, expensive and very effective. Unfortunately, it is also exposed to varying degrees of coastal hazard, as recent events have made clear. On two occasions, the City of San Francisco has responded to severe episodes of erosion with emergency armoring in the form of boulder revetments, which, although nominally temporary are difficult to remove, controversial, and degrade ecological and recreation conditions.

At this time, the opportunity exists to protect the protect the Lake Merced in place, while replacing the revetments with low-profile elements covered with cobble and sand, restoring recreational and ecological functions. Eventually, this may become untenable, and we will face a choice

between more intrusive armoring and the strategic relocation of infrastructure elements, beginning with the Lake Merced Tunnel. The cost, complexity, competing priorities, and tight regulatory agreements governing the system's storage make this a challenging prospect, and one which should be examined well ahead of time.

Newer thinking at the SFPUC and elsewhere emphasizes Low Impact Development (LID) and green infrastructure — both terms for modifying urban watersheds to increase stormwater retention and infiltration into the ground. Permeable surfaces, green roofs, swales and the restoration of natural waterways can add up to a significant reduction in stormwater entering the combined system, and help to prevent combined discharges.

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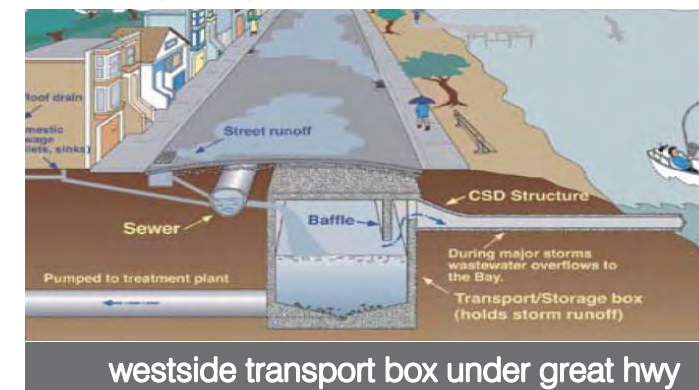
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former water quality issues at ocean beach greatly influence the development of current infrastructure



60-70 CSO's/ yr (before)

water quality



westside transport box under great hwy

<8 CSO's/ yr (after Clean Water Program)



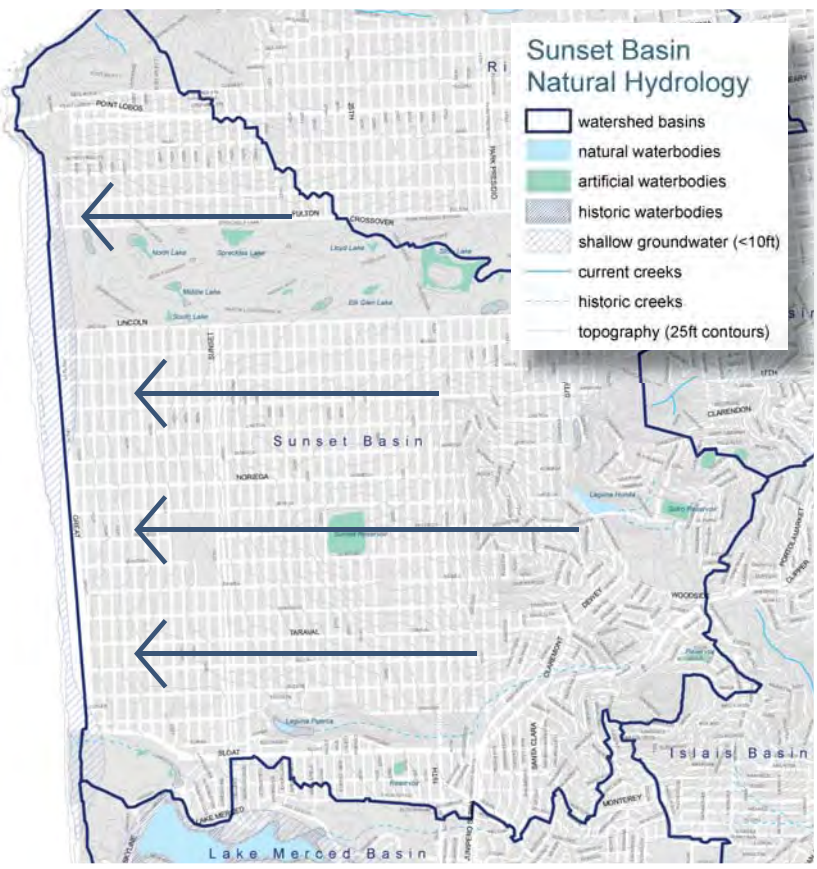
oceanside wastewater treatment p



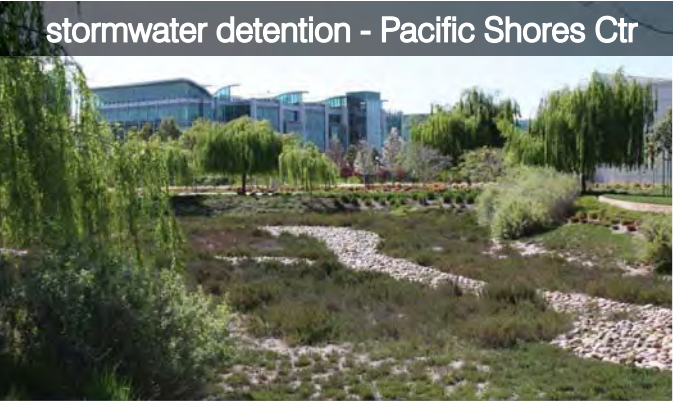
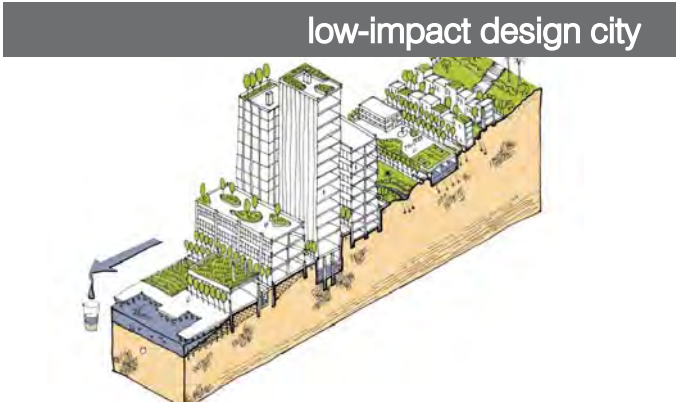
SF stormwater management system



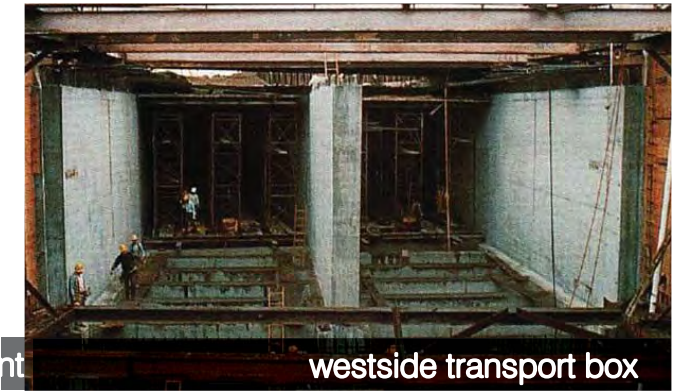
SF watershed management plan



watershed / low-impact design



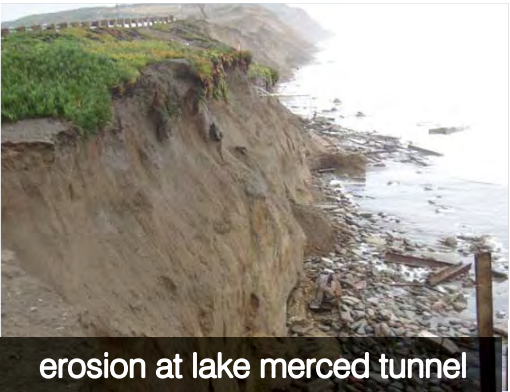
future



westside transport box



westside pump station



erosion at lake merced tunnel

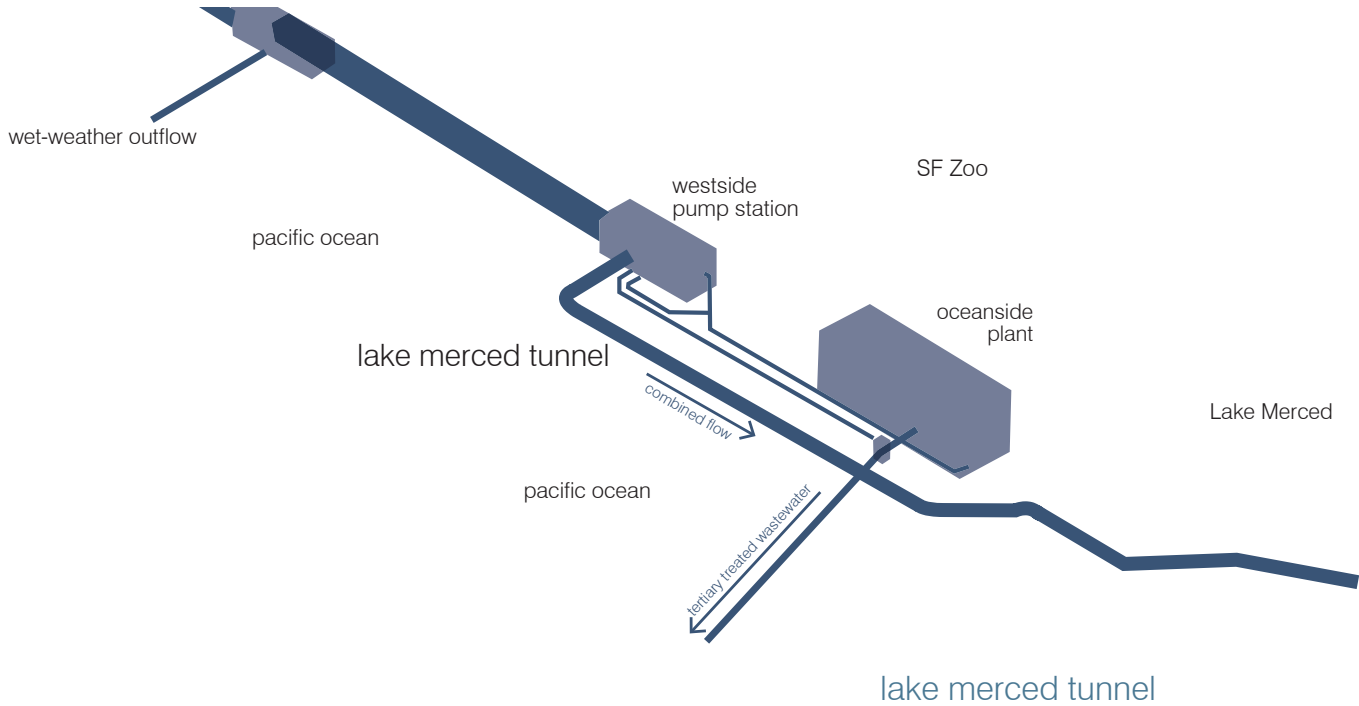


focus area 2 :  
utility infrastructure

diagram legend

- project boundary
- SEWER SYSTEM
  - westside transport box
  - sewer pipe less than 50 years old
  - sewer pipe more than 50 yrs old
  - sewer pipe more than 80 yrs old
  - sewer pipe (unknown age)
  - water infrastructure building
  - wet-weather outfall (combined sewer)
- REVTMENTS
  - rubble
  - emergency repair area

\* CSO's = combined sewer overflow







existing combined sewage system



# focus area 3 : coastal dynamics

## aspiration

*Identify a proactive approach to coastal management, in the service of desires outcomes.*

Ocean Beach is the visible portion of a much larger coastal sand and sediment system. It is an intensely energetic environment, battered by powerful waves and storm surges on a regular basis. South of Noriega Street, and even moreso South of Sloat Boulevard, the beach is subject to erosion, in which more sand is removed than deposited by waves and currents, and the shoreline recedes landward.

The past 15 years have seen several severe erosion episodes, typically during El Nino seasons, which have resulted in bluffs receding seventy feet over a decade in some stretches South of Sloat. In the 2009-2010 winter alone, the coast eroded forty feet inland, undermining parking lots and the shoulder of the Great Highway, and resulting in closure of the Southbound lanes for nearly a year. The City of San Francisco, under a local emergency,

armored the area with boulder revetments for the second time since 1997, to the consternation of critics who have advocated a long-term plan to avoid these sorts of emergency actions.

The ongoing erosion episodes and ad hoc response by city agencies was a major impetus for initiating this plan. Although it considers the full range of issues at Ocean Beach, including access, amenities, natural resources and character, it is driven by the need for a proactive approach to coastal management.

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*“Ocean Beach is the visible portion  
of a much larger coastal sand and  
sediment system.”*



focus area 3 :  
coastal dynamics

history

The western shoreline of San Francisco is artificially maintained about 200 feet seaward of its natural equilibrium. Sand was pushed west in the late 19th and early 20th centuries to create level ground for the construction of the adjacent neighborhoods and the Great Highway, once billed as the widest highway in the Western US. This new land was then stabilized with pavement and seawalls, but erosion has been a recurring issue from the beginning, in part a symptom of the coastal processes seeking that equilibrium.

Between the late 1970s and early 1990s, major sewer infrastructure was installed, including the conveyance structures under the Great Highway, a process that included rebuilding the road and constructing the embankments of fill that were revegetated to create constructed “dunes”.

The Golden Gate Littoral Cell and the Marine Shipping Channel

Ocean Beach is the visible portion of a much larger coastal sediment system, the Golden Gate Littoral Cell. The cell is bounded by a large, semicircular sandbar within which sand circulates with the currents and tides, by turns eroding and nourishing the beach. Within the cell, sand

supply is relatively stable. Average longshore (lateral) currents at Ocean Beach carry sand northward, and it continues to circulate within the bar. South of Noriega, however, currents diverge and southward currents scour sand away and out of the cell, resulting in a net loss of sand and a narrowing beach. This had resulted in an erosion “hotspot” south of Sloat Boulevard. The U.S. Army Corps of Engineers annually dredges a marine shipping channel in the sandbar to allow access by large ships to the Golden Gate. This dredged sand—about 300,000 cubic yards each year, represents a significant opportunity for beach nourishment, in which sand is placed on the beach to counteract the effects of erosion.

The northern end of Ocean Beach has been getting wider since the 1970s because of a combination of sediment management practices (dumping dredged sand within the system rather than in the deep ocean) and natural changes to the sandbars. Meanwhile, the southern end is narrowing as erosive forces scour away sand and bluffs, leaving less and less buffer between waves and critical infrastructure. More recently, sand has been deposited closer to shore off the southern end of the beach, with results that remain uncertain but have not resulted in dramatic improvements in beach width.



seawalls



Taraval Seawall (1941)



Noriega - Rivera Seawall (1980s)



sand placement



O'Shaughnessy seawall (built 1920s)

beach enlargement - north end



1972



sand accretion/beach widening 2009

erosion + emergency revetments



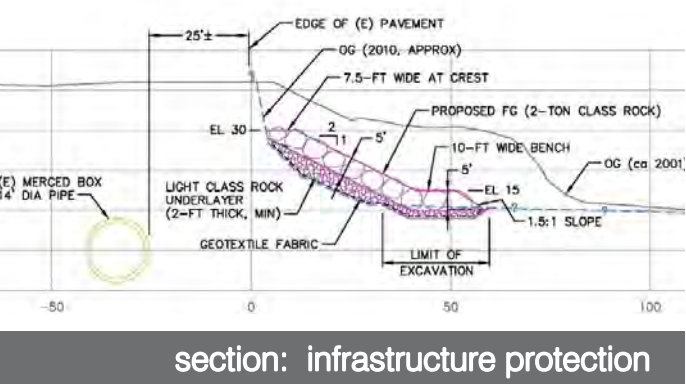
sloat parking lot 1990



erosion early 2000's



emergency repair area 2010



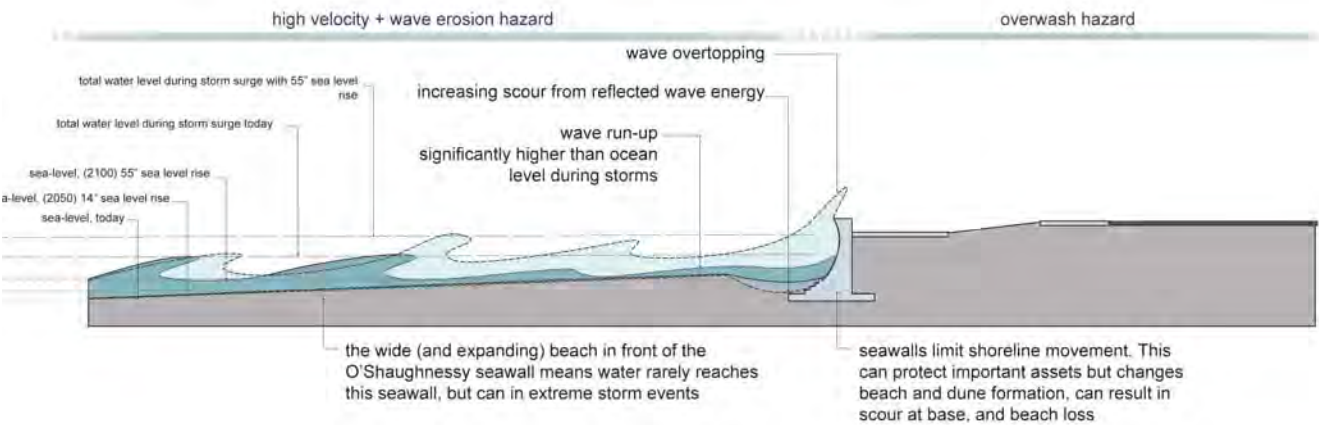
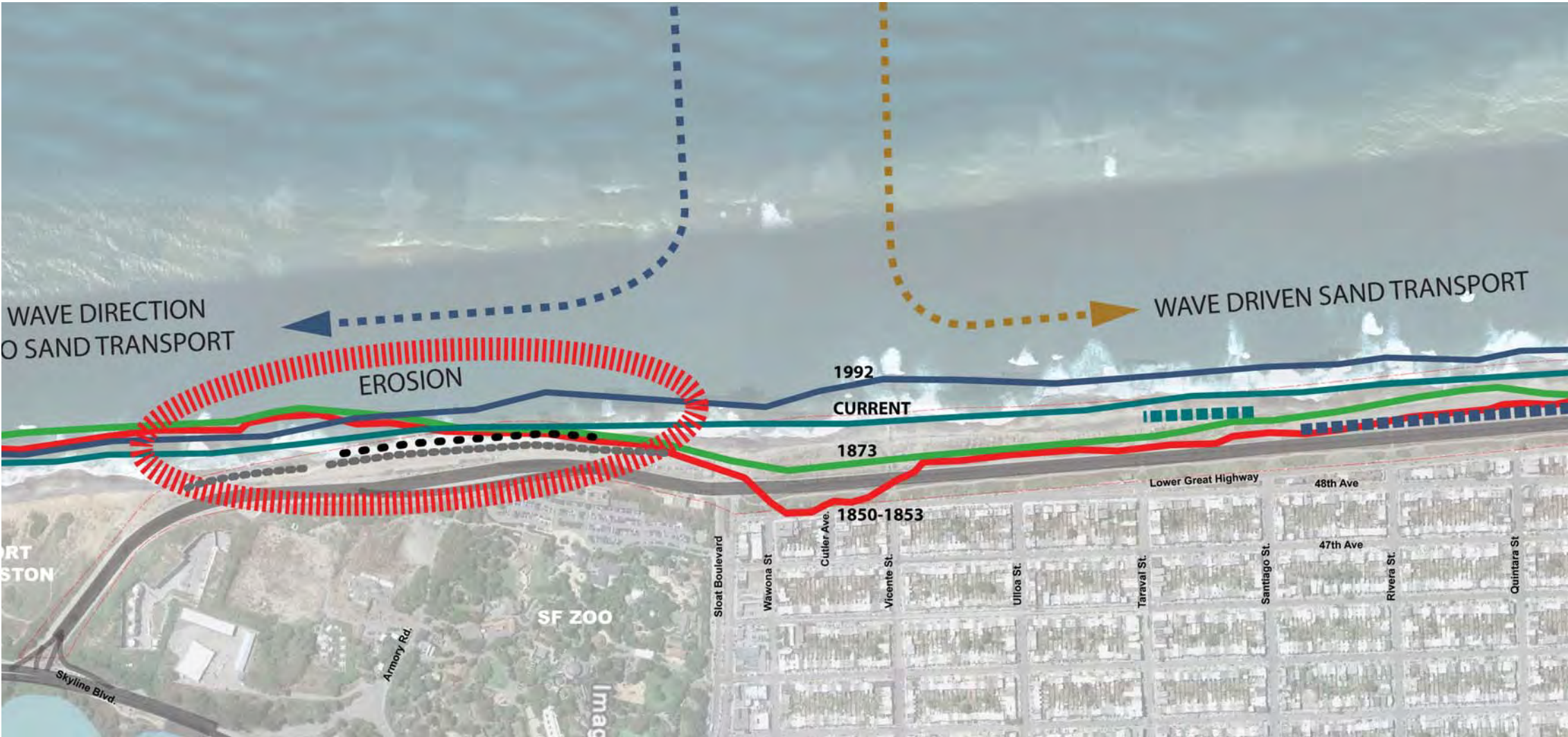
section: infrastructure protection



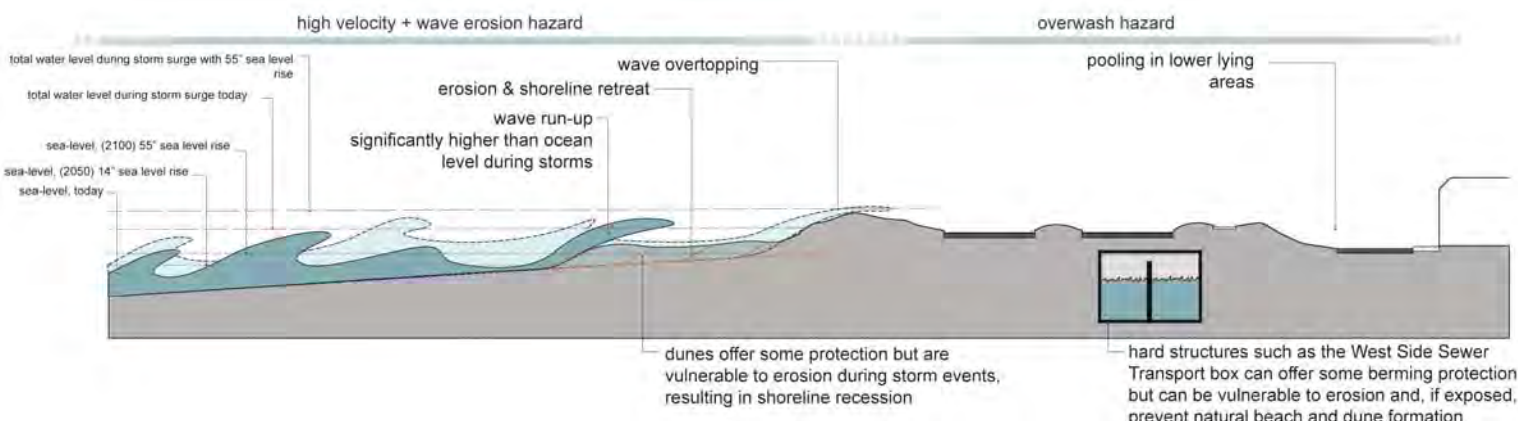
focus area 3 :  
coastal dynamics

diagram legend

- PROJECT BOUNDARY
- HISTORIC SHORELINES
  - CURRENT SHORELINE
  - SHORELINE (1992)
  - HISTORIC SHORELINE (1873)
  - HISTORIC SHORELINE (1850-1853)
- THE GREAT HIGHWAY
  - THE GREAT HIGHWAY (1929)
- SEAWALLS
  - NORIEGA SEAWALL (1988-1993)
  - TARAVAL SEAWALL (1940)
  - O'SHAUGHNESSY SEAWALL (1915-1922)
- REVTMENTS
  - RUBBLE
  - EMERGENCY REPAIR AREA



diagrammatic seawall section

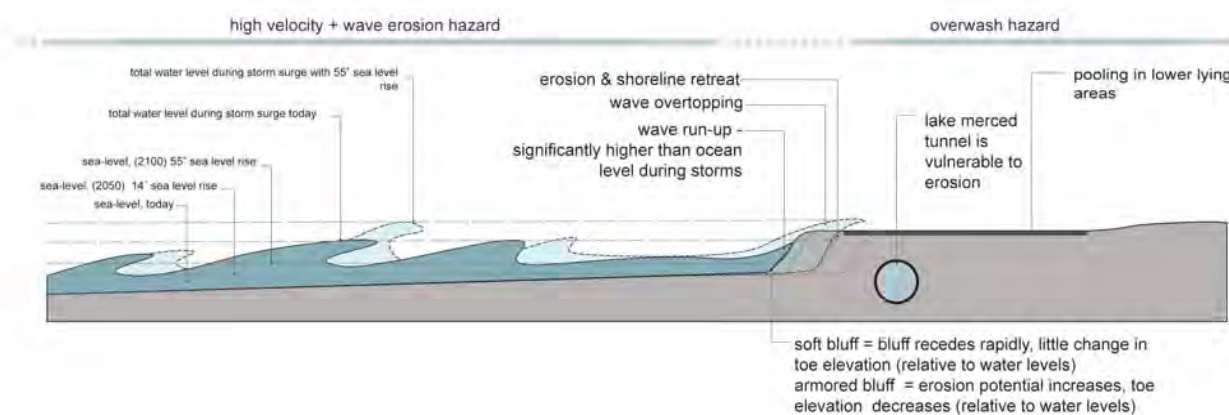


diagrammatic dunes section





coastal dynamics + historic shorelines



diagrammatic bluffs section



seawall overtopping



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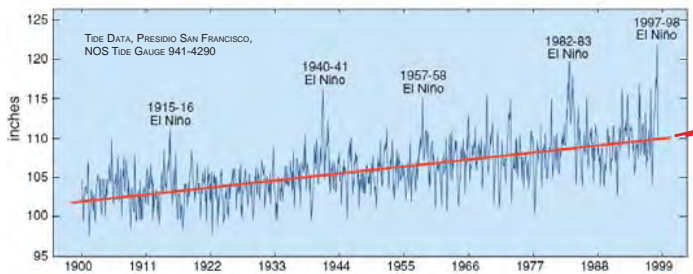


climate change and sea level rise

Sea level rise and its impact are fundamental challenges in planning for the future of Ocean Beach, as they directly inform the management of coastal hazards. As sea levels rise, the coastline recedes inland, except where limited by hard structures. This translates into increased erosive pressure and coastal hazards. Although there is a great deal of uncertainty about the timing and extent of climate-related sea level rise, there is considerable consensus on its general impacts.

The State of California’s Interim Guidance on Sea Level Rise (2010) developed after a considerable interagency examination of the various available climate models, directs State agencies to plan for 14 inches of sea level rise by 2050 and 55 inches by 2100. This process has used that figure, in lieu of the capacity to carry out a separate examination of the data, and to be in sync with public agencies to the degree possible. It is also assumed that California will likely be subjected to an increased frequency and severity of coastal storm surges, which will be exacerbated by higher sea levels. The data on local changes in precipitation—which is critical to understanding future loads on combined sewer infrastructure — remains far less conclusive, and this plan assumes that San Francisco will need to be prepared for a range of possible outcomes.

rate of sea level change measured at san francisco is about 8 inches in last 100 years



the rate of rise is anticipated to go up exponentially

recent sea level rise

Year		Average of Models	Range of Models
2030		7 in (18 cm)	5-8 in (13-21 cm)
2050		14 in (36 cm)	10-17 in (26-43 cm)
2070	Low	23 in (59 cm)	17-27 in (43-70 cm)
	Medium	24 in (62 cm)	18-29 in (46-74 cm)
	High	27 in (69 cm)	20-32 in (51-81 cm)
2100	Low	40 in (101 cm)	31-50 in (78-128 cm)
	Medium	47 in (121 cm)	37-60 in (95-152 cm)
	High	55 in (140 cm)	43-69 in (110-176 cm)

state guidance suggests sea level rise could reach:

14 inches by 2050  
and  
55 inches by 2100

future sea level rise (SLR)

SOURCE: state of california sea-level rise interim guidance document, october 2010



focus area 3 :  
coastal dynamics

## coastal management tools

Sea-level rise and accompanying storm surges will significantly worsen erosive pressures at Ocean Beach in the coming years. Options for the management of this erosion include coastal armoring, beach nourishment and managed retreat:

Coastal armoring seeks to resist erosive forces and the receding shore with hard structures such as seawalls or revetments. Depending on its height, a structure might be overtopped by wave runup during storm surges, inundating inland areas. If the coastline recedes until it reaches a hard structure, the beach may be lost, along with the ecological and recreational functions it supports. Reflected wave energy may worsen erosion in adjacent areas. There are nearly 10,000 linear feet of hard structures at Ocean Beach today, in the form of the three existing seawalls and recent revetments. This does not include the Westside Transport Box, which could end up functioning as a sort of seawall if exposed by beach and dune recession. Additional armoring will likely be necessary south of Sloat, but should be placed as part of a proactive and comprehensive strategy to manage coastal dynamics at Ocean Beach. Its placement and design should reflect consideration of ecological and access needs, as well as potential negative secondary erosion effects.

Beach nourishment, or the deliberate placement of sand to counteract erosion, is a promising option at Ocean Beach,

since 300,000 cubic yards of dredged sand are available annually for beneficial local use. The cost beyond current practices would be shared between local and federal agencies. An effort is underway to retrofit the Essayons, the Army Corps' dredge, to enable it to pump sand directly onto the beach. This could likely reestablish a wide beach north of Sloat and buy considerable time through sacrificial sand placement to the south.

Managed retreat is the gradual reconfiguration or removal of manmade structures in the path of the advancing coastline, according to pre-established triggers. This approach seeks to avoid expending excessive resources defending structures unnecessarily. Managed retreat has been successfully employed in several locations in California, including the acquisition and demolition of private structures in Pacifica, and the phased reconfiguration of parking lots, roads, and trails at Surfer's Point in Ventura. Managed retreat is most readily employed where structures like roads or parking lots are concerned, and space is available. It is significantly more difficult to pursue in a highly constrained setting where expensive publicly funded infrastructure stands in harm's way. This Plan includes major components of managed retreat in combination with other strategies.

All of these management strategies are recommended at Ocean Beach. A key objective for the Ocean Beach Master Plan is to analyze the relative needs, costs and benefits of various approaches, and build consensus around a nuanced, multi-objective approach.

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golden gate littoral cell



focus area 3 :  
coastal dynamics



regulatory actions

In July 2011, the City and County of San Francisco submitted an application to the California Coastal Commission for a Coastal Development Permit, which included making permanent the emergency permit for the 2010 revetment, the installation of additional armoring, and retroactively permitting the 1997 Emergency Quarystone Revetment (EQR). The permit was denied by the Commission, which demanded a long-range coastal management plan be in place before additional permits would be issued. This sent a clear message that a different approach would be required, but also left the City without a near-term approach to some areas of considerable risk to infrastructure, with significant environmental risk. The Commission has since issued an emergency permit for the placement of sandbags (and softer and more patently temporary approach) in the reach of highest risk. It is anticipated that this plan will serve as the basis for a long-term approach, and that City Agencies will be required carry these recommendations forward if the Commission is to issue Coastal Development Permits in future.

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## beach nourishment

Beach nourishment is the act of placing sand to widen the beach. Beach nourishment has occurred frequently at Ocean beach, but typically on a relatively modest and incremental scale by moving excess beach sand on land. The opportunity exists at Ocean Beach to conduct beach nourishment at a much larger scale by pumping dredged sand directly onto the beach from offshore.

The Army Corps of Engineers is working with the City and County of San Francisco to plan and permit the placement of dredged sand from the Marine Shipping Channel directly on Ocean Beach. Up to 300,000 cubic yards per year is available, though existing proposals are for XXXXX. While complex to permit and conduct, most parties are enthusiastic that beach nourishment could have a significant impact at Ocean Beach for near-to-medium term. The recommendations in this plan assume that the program will go forward and be one component of coastal management. Several processes are necessary for beach nourishment to proceed:

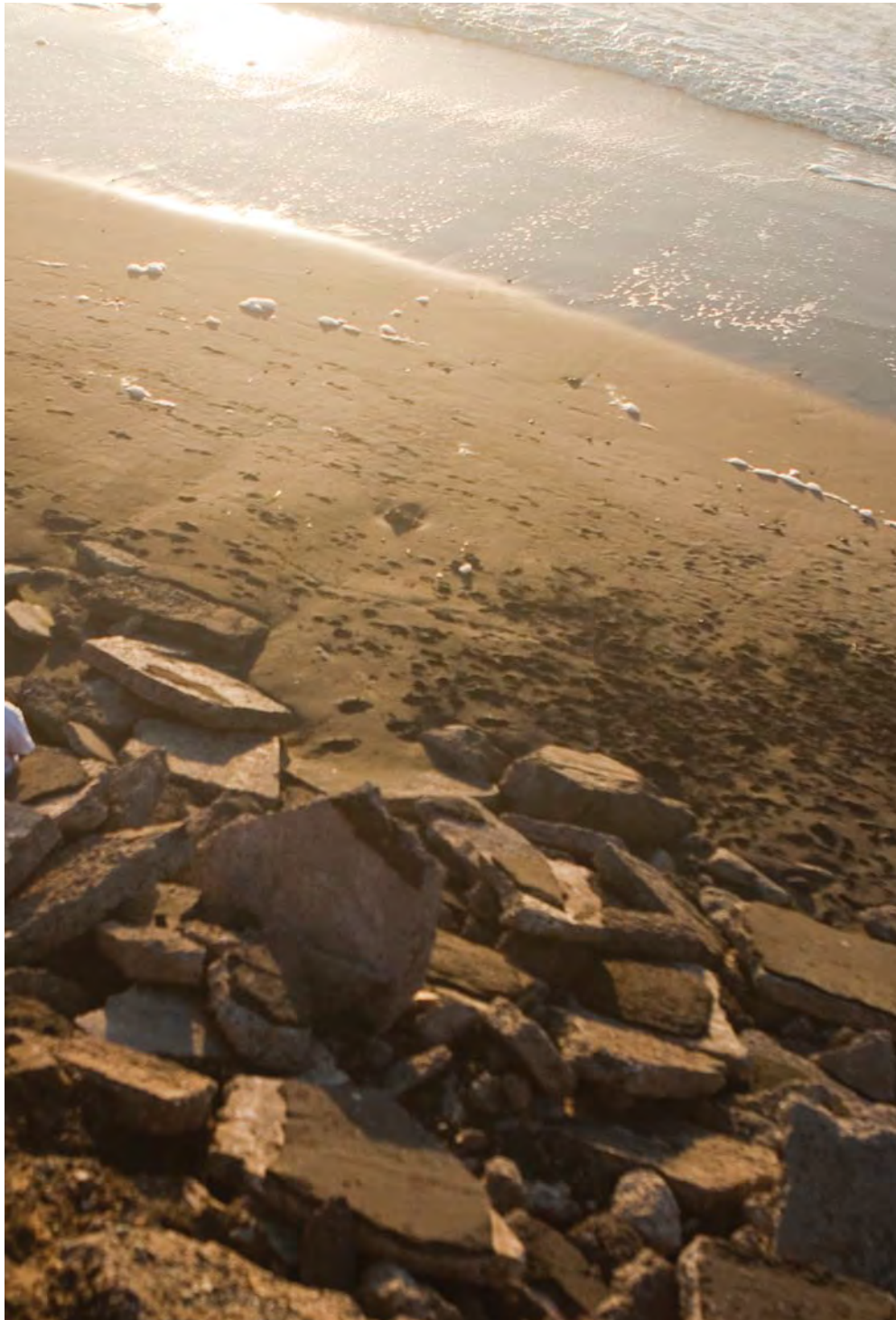
- Environmental Assessment (EA) under NEPA. This process is underway, with assessment of direct placement being conducted concurrently with that for near-shore placement at the SF-17 site.
- Beneficial Use Plan (Section 2037). The process allows the Corps to partner with local agencies to use dredged materials in beneficial local projects. The local partner must provide 35% of the project cost over and above the current practice. This plan is in draft form and is proceeding in partnership with local City agencies.
- Dredge Availability/Retrofit. The Corps hopper dredge Essayons is one of the only vessels capable of completing the dredging at Ocean Beach, but it must be fitted with the pumping equipment to allow direct placement of sand on the beach. Efforts to secure Federal funds to that add have not been successful to date, and city agencies are investigating bringing a private contract dredge through the Panama Canal to conduct the work.

Beach nourishment should be conducted using the best available practices to protect and support the ecological functions of the beach and dunes, particularly with respect to the Federally-listed threatened Western Snowy Plover. This would mean nourishment activity would best be conducted between May and July of each year when the bird is absent. Although extensive beach nourishment may have some impacts on the beach ecosystem, for example by covering beach wrack that feeds invertebrate detritivores, the existence of a wide beach and improved dunes likely far outweigh such concerns.

The long-term sand supply is another concern. Increased sea levels coupled with the Ship Channel side slopes reaching an equilibrium could mean that the availability of sand will decline, as dredge records suggest may already be occurring. This would make it increasingly difficult to rely on beach nourishment to counteract erosion over the long term.



## why not relocate the lake merced tunnel today?



Many advocates and concerned citizens feel strongly that the Lake Merced Tunnel be relocated immediately or in the near future. This Plan does not propose to do so, for the following reasons:

### Opportunity to Protect in Place

The analysis of the project team indicates that it is possible to protect the Lake Merced Tunnel (and with it the public's investment in coastal water quality) for several decades while also dramatically improving the recreational and ecological functions of the coastline South of Sloat Blvd. This "win-win" approach is the best way to secure a significant shift coastal protection practices and a significant investment in conditions in the area.

### Environmental and Regulatory Challenges

The West Side infrastructure complex is permitted through a very complex and constrained agreement with the US EPA, predicated on system's capacity to store stormwater and allow fewer than eight combined discharges per year. Modification of the system, while not impossible, entails significant regulatory complexities.

### Cost

The Lake Merced Tunnel was built as part of the SFPUC's Clean Water program, a costly investment of ratepayer funds, only completed in 1993. Not only is it early in its functional life, it would be quite expensive to reconfigure, with estimates varying from \$90 to \$190 Million, depending on which elements were reconfigured. A more comprehensive reconfiguration would be the most cost-effective, but also the most expensive.

### Limited Benefit

Relocating the Lake Merced Tunnel would allow the coastline to recede naturally through erosion, but only a short distance, as other structures, including the existing force mains and pump station, the Fleishhacker Pool building and the Oceanside Treatment Plant, lie immediately behind the Tunnel, limiting the benefits of relocation, or necessitating the relocation of additional elements relatively soon.

### Other Pressing Needs

Whatever the merits of relocating the Lake Merced Tunnel, the city and SFPUC are responsible for the whole city, including areas, such as the Southeast, with antiquated infrastructure, frequent combined discharges, and economically disadvantaged communities. Major investments on the West Side will need to be considered in light its recent upgrades, city-wide needs, and environmental justice considerations.

### Long-Term Prospects/2030 Adaptive Revision

The Ocean Beach environment is highly constrained. It shares with many urban beaches the presence of dense settlement along the coast with many owners and users. But Ocean Beach has additional challenges as well: ongoing erosion, minimal space between the coast and significant features, and the presence of new, high-value, publically-financed infrastructure that is delivering important environmental services. Two major features -- The Lake Merced Tunnel and West Side Transport -- run along the coast, limiting the natural evolution of the coast by creating a fixed boundary.



## strategic relocation

These structures represent major and successful new investments in water quality protection, and their near-term relocation is not being contemplated by decisionmakers.

However, as sea-level rise sets in, it is likely to become increasingly difficult to maintain all existing structures in their current locations without an unacceptable degradation of environmental , recreational, and aesthetic conditions.

This Plan recommends a major reevaluation of its assumptions and reexamination of the space of possibilities at that time in light of the following factors:

- Better information about the impacts of sea level rise and associated coastal hazards
- Improved policy and technical tools for climate adaptation and coastal management
- Broader awareness by the public and decisionmakers about climate impacts and possible responses

In particular, two assumptions should be revisited:

- Strategic Relocation/Replacement of Infrastructure. As it becomes increasingly difficult and expensive to protect infrastructure in place without unacceptably compromising environmental and recreational conditions, as the SFPUC completes pressing capital improvements to improve environmental performance in other parts of the combine sewer system (such as the Southeast Treatment Plant) and with the existing Westside system having provided a greater portion of its design life, it will be essential to consider relocating elements of the system away from coastal hazards. Clearly, the first component that should be considered is the Lake Merced Tunnel, followed by the West Side Transport and Pump Station. A long-term approach that considers other coastal management objectives , sites for all components, and ongoing water quality protection will be required.
- Acquisition of private property. As coastal hazards increasingly threaten private homes at Ocean Beach, and both Federal and private insurance become more limited, the gradual acquisition of private land through rolling easements, public right of first refusal, or even eminent domain may become prudent. This is not considered in this plan, although is explored in Test Scenario A, “Maximum Retreat”.

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focus area 3 :  
coastal dynamics

coastal hazards: today and tomorrow  
storm surge and coastal inundations

ESA PWA estimated the limits of extreme wave runup for existing and future conditions as part of the analysis of the coastal physical dynamics. Wave runup was modeled using a program developed by PWA. The program uses several published methods to assess the extent of wave runup on beaches and shores with irregular topography and surface conditions.

In addition to the profile analysis discussed above, PWA will also calculate the landward extent of wave runup during an extreme event approximating a recurrence frequency of 1% per year (i.e. the 100–year runup event). The limits of runup will provide a sense of coastal flooding potential landward of the coastal dunes and bluffs. These data may be used to estimate potential flood damages or used as a qualitative estimate of damage hazard.

In other words, the increased wave runup elevations are substantially higher than the Great Highway and it probably isn't publically acceptable to raise the roadway to an elevation necessary to prevent increased flood and damage risk.

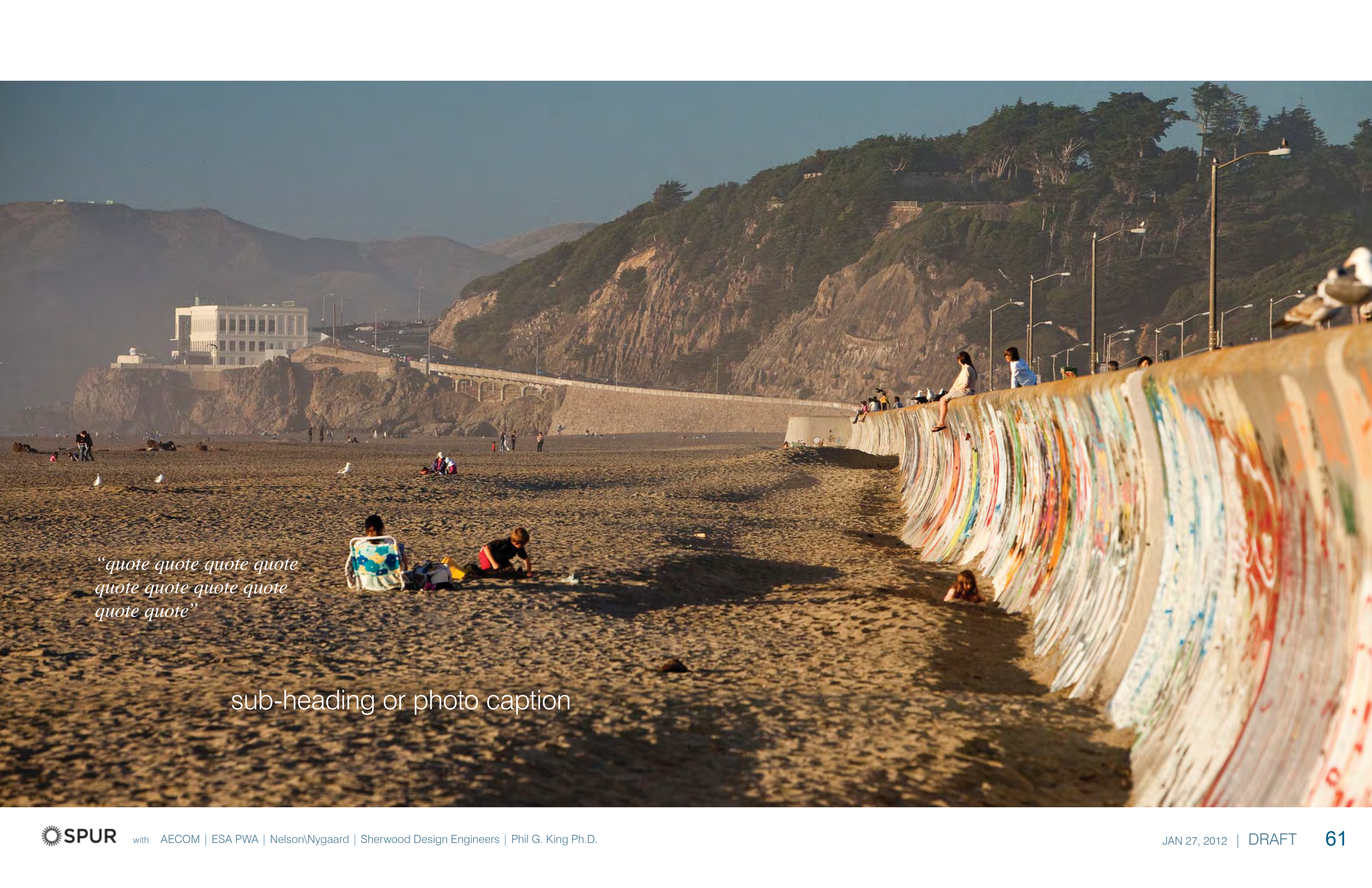
The Figure in the next page presents a graphical map of the approximate wave runup limits from extreme coastal flooding events for existing and future conditions. We consider the wave runup limits presented here to be superior to previous estimates of coastal flooding and erosion including those available via the Pacific Institute and FEMA.

While these maps are the best available mapping of coastal flood hazards, they are still approximate and not intended to assess property values, insurance rates or development potential.

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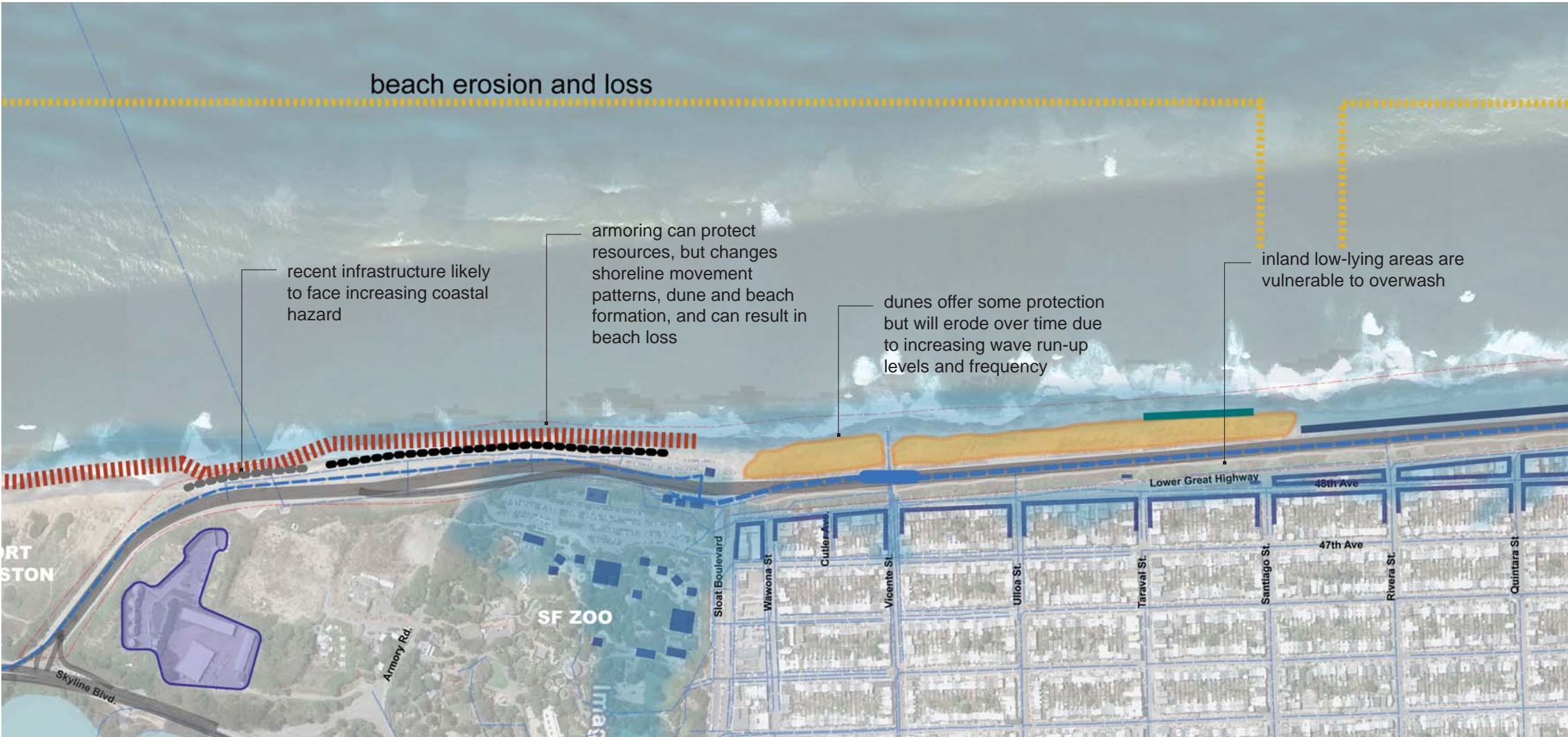
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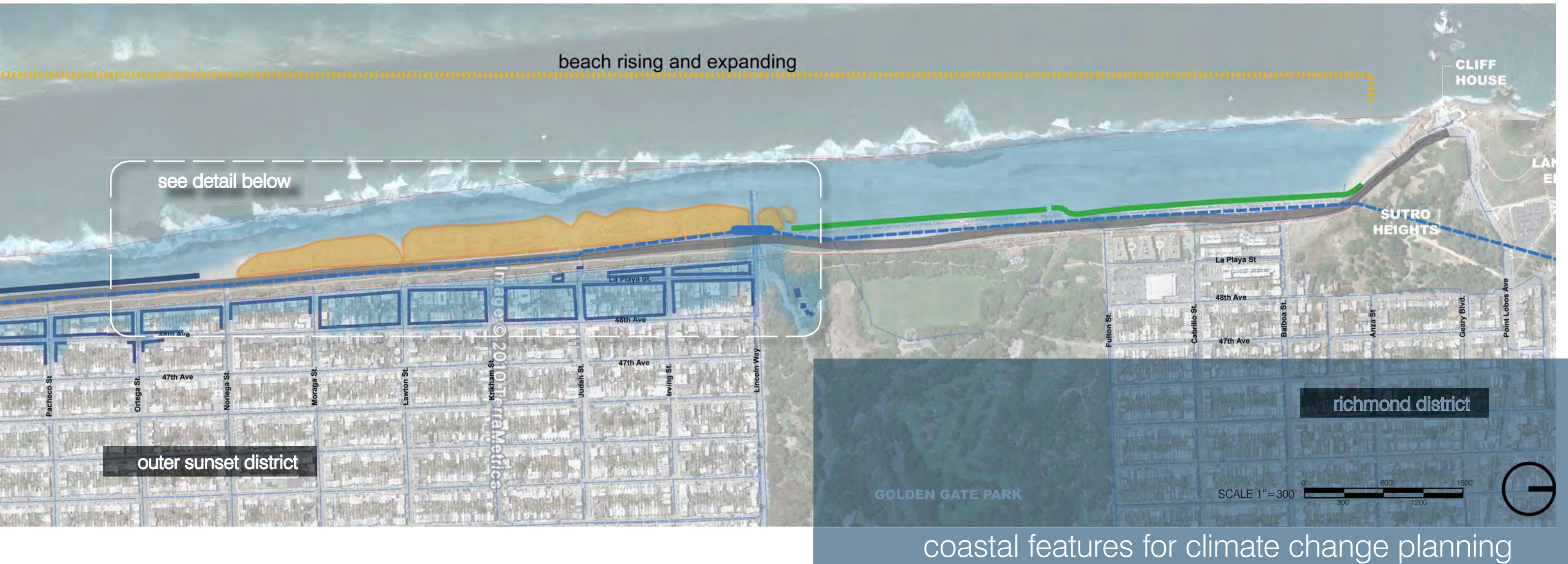
focus area 3 :  
coastal dynamics

diagram legend

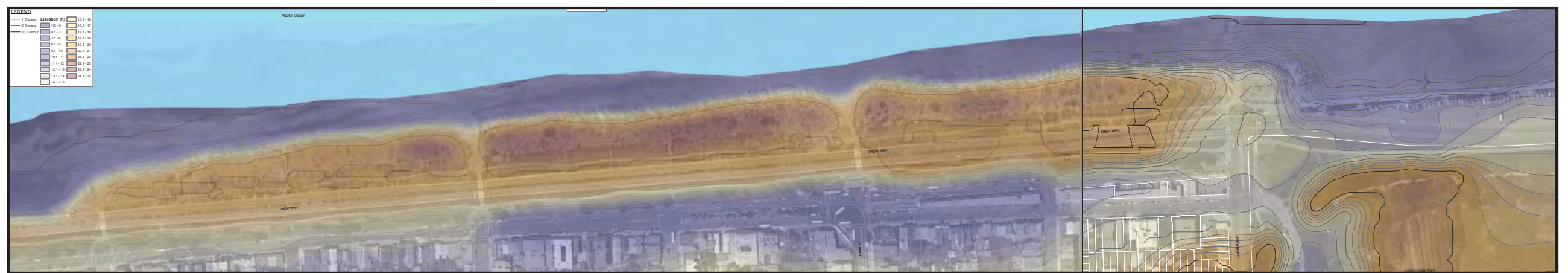
- project boundary
- ROADS + PATHS
  - the great highway (1929)
- SEAWALLS
  - noriega seawall (1968-1993)
  - taraval seawall (1940)
  - o'shaughnessy seawall (1915-1922)
- REVETMENTS
  - rock stabilization treatment
  - emergency repair area (2010)
- TOPOGRAPHICAL FEATURES
  - dunes
  - bluffs
  - low-lying areas
- STRUCTURES
  - sewer pipes
  - major sewer infrastructure
  - wastewater treatment facility
  - buildings







elevation map of  
central dunes area





## focus area 4 : image + character

### aspiration

*Preserve and celebrate the beach's raw and open beauty while welcoming a broader public.*

Although Ocean Beach is in the city, its urban setting is dwarfed by the vastness of the natural context. Like many of San Francisco's best open spaces, it offers a portal to the regional landscape. But both its wild and urban aspects are decidedly less genteel than those of other natural places in the city. The environment — built and natural — shows the elemental scour of wind and waves, and is known for its dense and persistent fog. The local culture has developed an edge that mirrors the environment: Most days, even a stroll on the sand demands a bit of ruggedness, and the surf's frigid rip currents have regularly threatened and even taken lives.

- / *Ocean Beach (OB) has a rich and unique history integrally linked to San Francisco and the Pacific Ocean. Remnants of this history are still visible today.*
- / *OB is a place of multiple, distinct characters ...from the ocean to the bluff trails, from the northern open beach to the southern beach dunes, OB provides opportunities for outdoor recreation and to enjoy the Pacific Ocean vast and dramatic landscape.*





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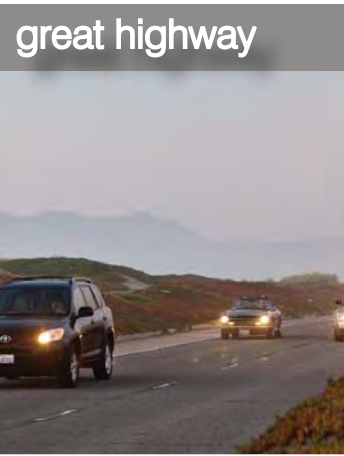
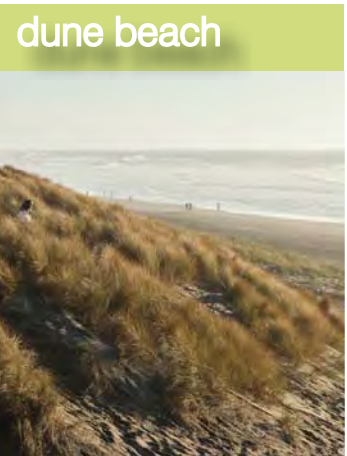
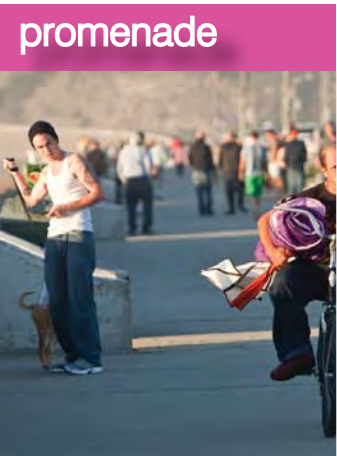
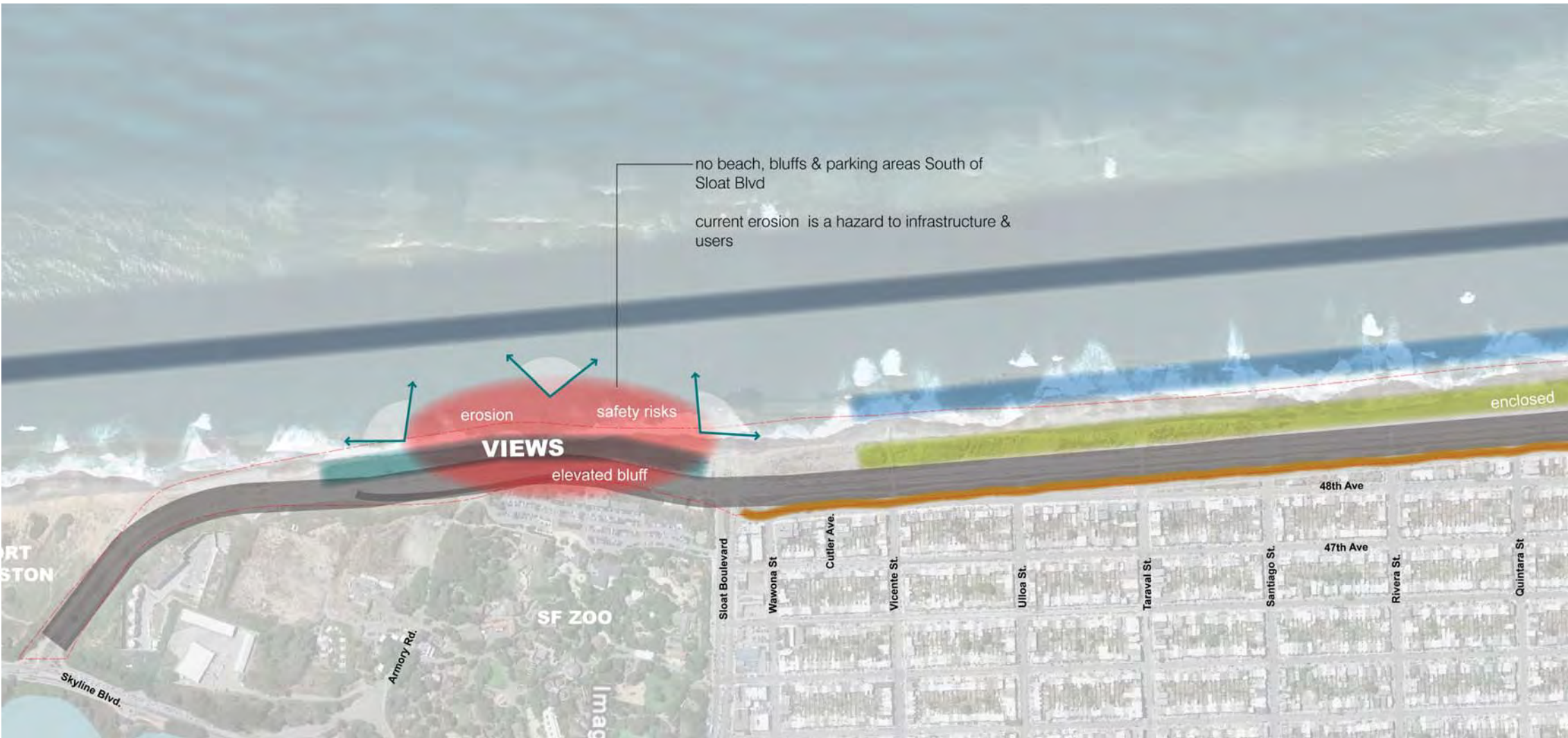
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focus area 4 :  
image + character

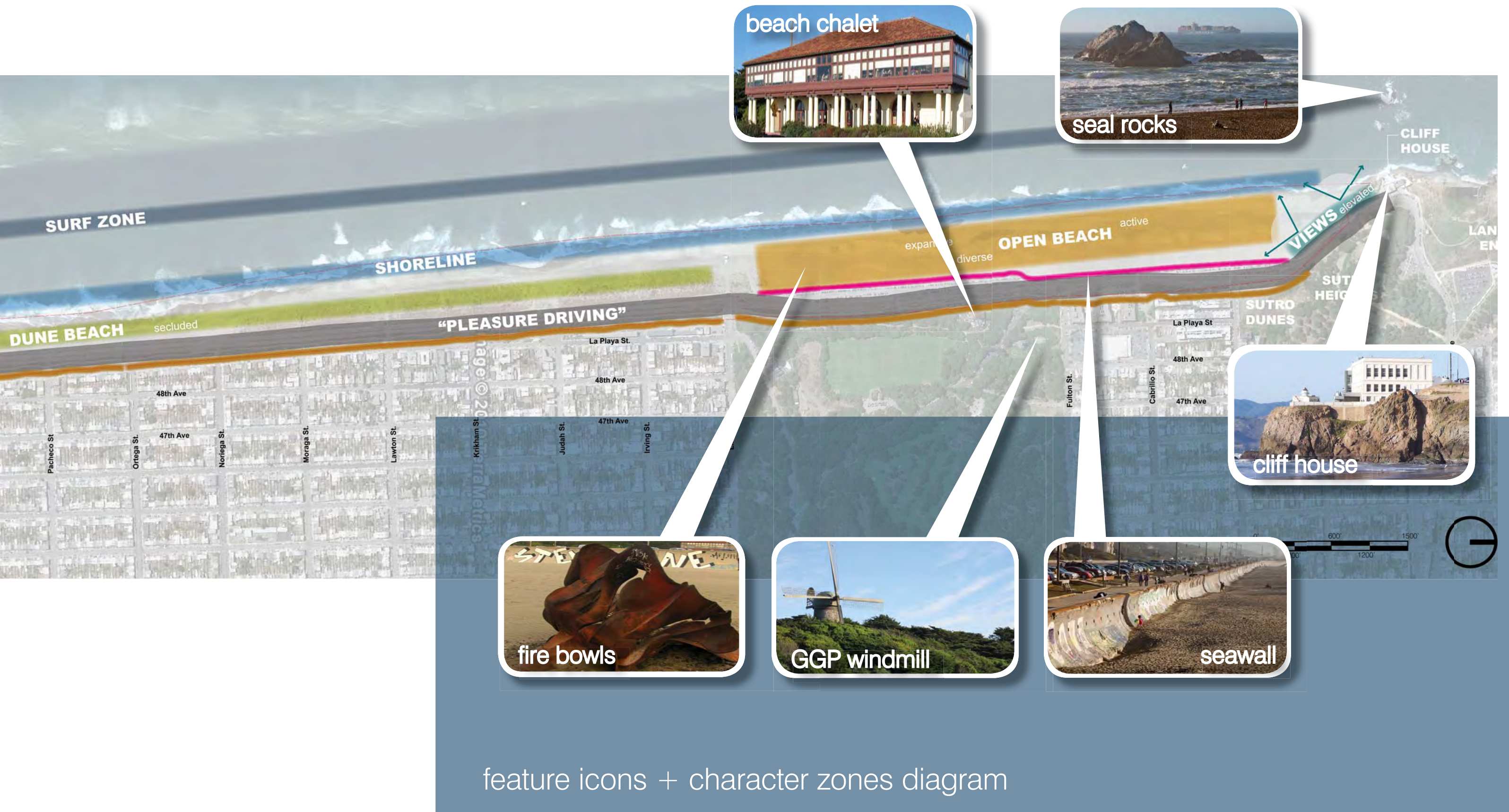
diagram legend

- project boundary
- great highway
- existing promenade
- lower great highway (pedestrian walk)
- key views



linear zones



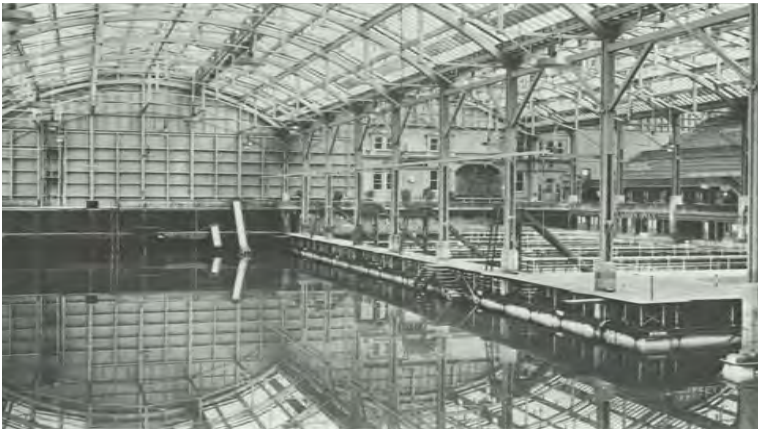




focus area 4 :  
image + character

A century ago, Ocean Beach was a very different kind of place, more Coney Island than wilderness. Before the Richmond and Sunset districts took shape, Adolph Sutro's steam railway drew day-trippers through the dunes to his gardens and baths, and to nearby Chutes-at-the-Beach (later Playland). A settlement built of decommissioned horsecars offered a destination for bohemians and bicycle clubs. As the automobile came to prominence, the soft sand was pushed seaward to create a "Great Highway" for Sunday drivers, all the way south to Fleishhacker Pool, near the current site of the San Francisco Zoo. A massive saltwater rec center built in 1924, the decrepit poolhouse today offers a tempting opportunity for adaptive reuse.

sutro baths



1896

windmill / life station



1903

cliff house



1904

seawall at kelly's cove



1920

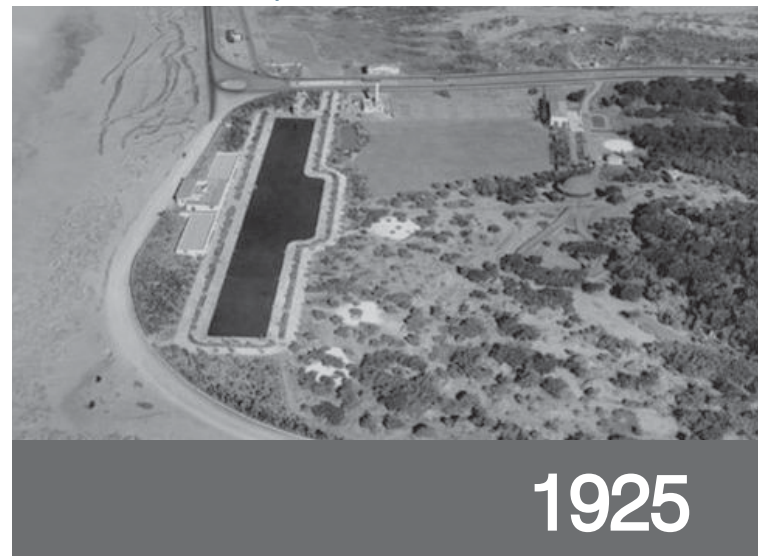
a rich history of public recreation... still visible today



Today, when those few sweet warm days arrive, Ocean Beach again becomes a retreat for the whole city. A festival atmosphere prevails as a crush of cars, bikes and Muni riders descends, and the shortage of services becomes acute as trash piles up, bikes are heaped up and locked together, and dunes become restrooms of last resort.

It would be wrong to ignore the basic needs of the more than 3 million annual visitors to Ocean Beach. But as many in the community have expressed, “prettying up” is not what the beach needs, either. The Master Plan team is taking that observation to heart. Good landscape design has the power to strike that balance — to solve problems and serve needs while speaking to the soul of a place.

leishhacker pool



beach chalet



great highway



lorel line pier





## focus area 5 : program + activities

aspiration

*Accommodate diverse activities and users, managed for positive coexistence.*

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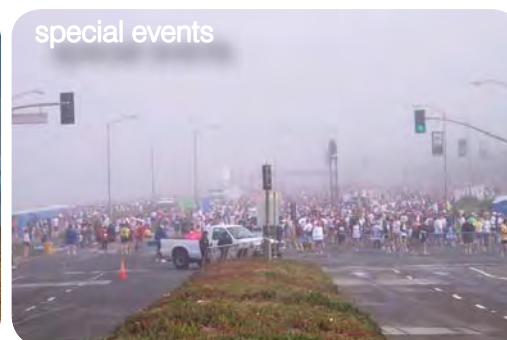
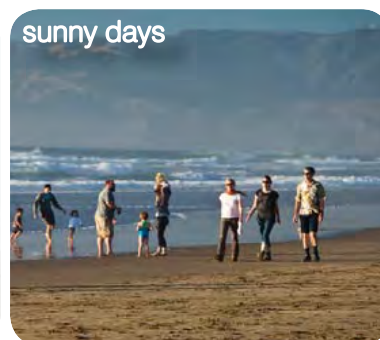
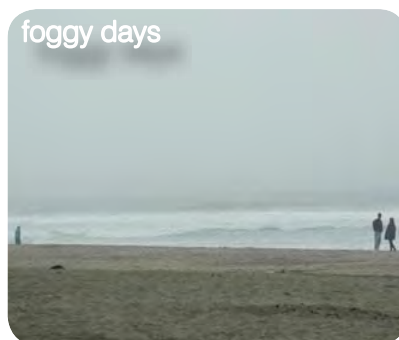
To be successful, improvements at Ocean Beach will need to accommodate and balance a wide range of users, from surfers to families, birdwatchers to cyclists. For the most part, activities sort themselves into linear zones that can inform the approach to design and programming: joggers and cyclists on the multiuse path, walkers on the dune trails, promenades and (along with anglers) on the wet sand, and surfers in the water. Basic amenities — such as restrooms, waste collection and food — are in limited supply, and jurisdictional challenges complicate their siting, funding and operation.

As in most open spaces, there are conflicting ideas about which uses belong where, and which are worthy of accommodation. Pedestrians and cyclists get tangled on

the multiuse path, birders raise an eyebrow at dog-walkers, and night-time bonfires are a grand tradition to some and a messy nuisance to others.

In January 2011, the National Park Service issued its Draft Dog Management Plan for the Golden Gate National Recreation Area. In its preferred alternative, the northern end of Ocean Beach would remain an off-leash area but much of the beach would be entirely off-limits to dogs. Much of that area is already off-limits for nine to 10 months of the year (plover season), and the GGNRA would remain the only National Park to allow dogs at all. Still, the proposal has rankled many dog owners and remains controversial. The NPS is accepting public comment on the Draft until May 29.

One key challenge is the distinctive pattern of use over time. Most of the time, the beach and promenades are used by relatively few people, many of whom are locals and regular users: walkers and joggers, surfers and cyclists. This “baseline” condition (with its own seasonal and diurnal variations) holds sway until one of those rare hot, sunny weekends, when the beach experiences an enormous spike of visitors from around the city and region.



visitation “spikes”



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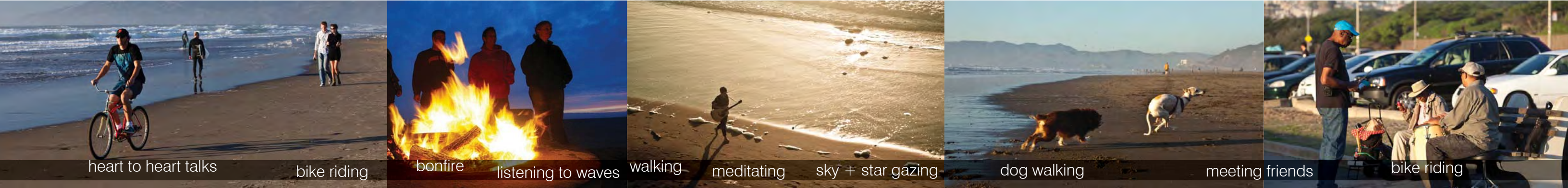
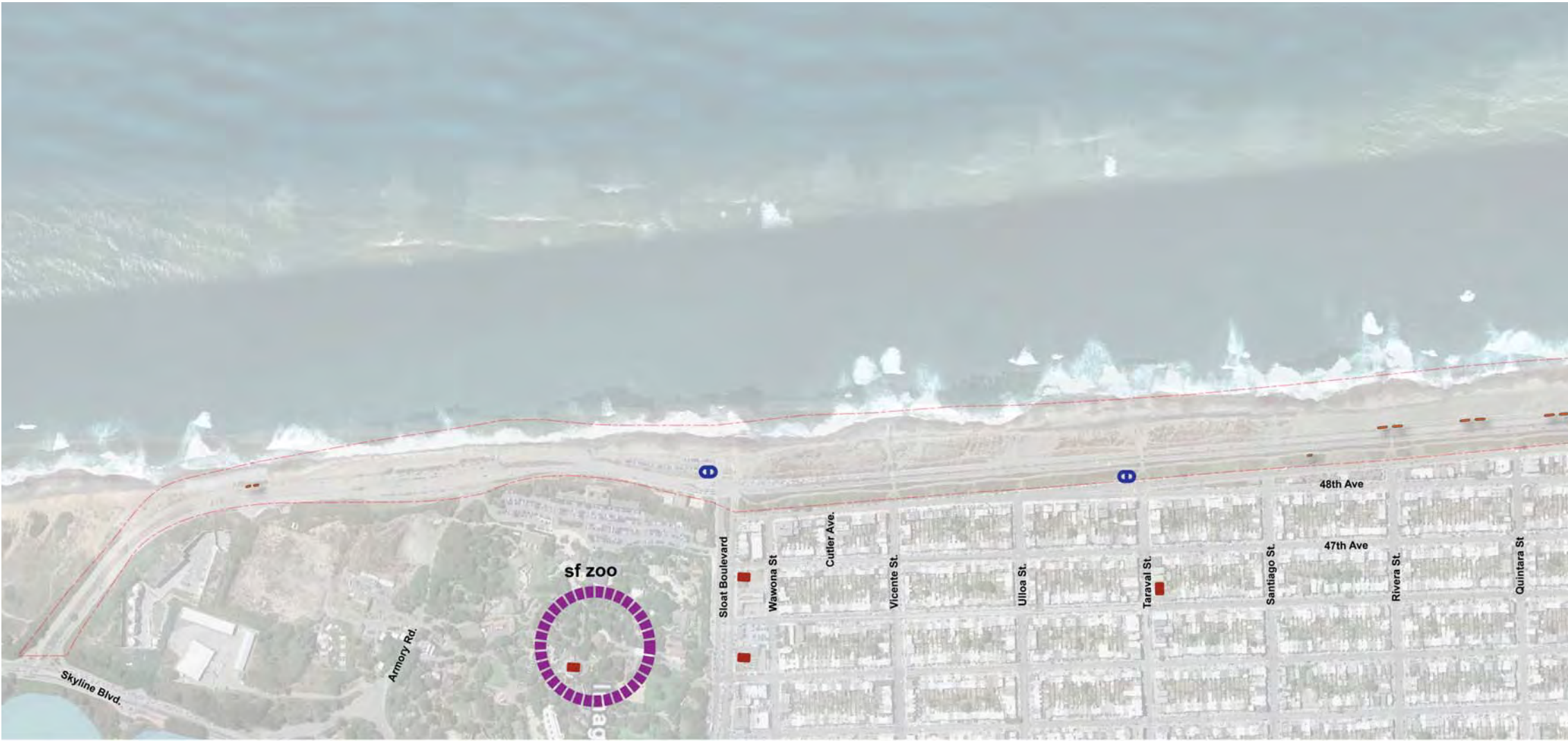




focus area 5 :  
program + activities

diagram legend

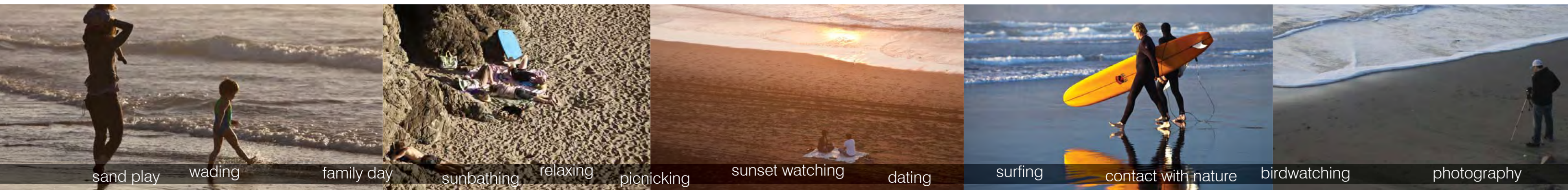
-  existing restroom
-  existing cafe/restaurant
-  existing bench
-  existing stairwell
-  approximate firebowl location
-  visitor attraction element or node







existing elements + facilities diagram





## focus area 6 : access + connectivity

aspiration

*Provide seamless and fluid connections to adjacent open spaces, the city and the region.*

Ocean Beach is not only a destination in itself. It is also a key corridor connecting Land's End and Sutro Heights at its north end to Golden Gate Park, the Zoo and Fort Funston to the south. While movement along Ocean Beach is fairly easy, it offers much weaker connection to adjoining open spaces, neighborhoods and other amenities. In general, Ocean Beach could be integrated much more effectively with its surroundings, particularly for pedestrians, transit riders, and cyclists.

Significant gaps include:

Ocean Beach to Fort Funston, the GGNRA's next major park to the south. Trails and promenades peter out South of Sloat, due in part to erosion and the installation of revetments. Pedestrians are often forced to walk in the roadway and jump a guardrail to access Fort Funston via informal trails.

Ocean Beach to Lake Merced. The Great Highway south of Sloat offer no pedestrian or bicycle access, and there is no crosswalk at Skyline allowing access the Lake Merced's popular trails.

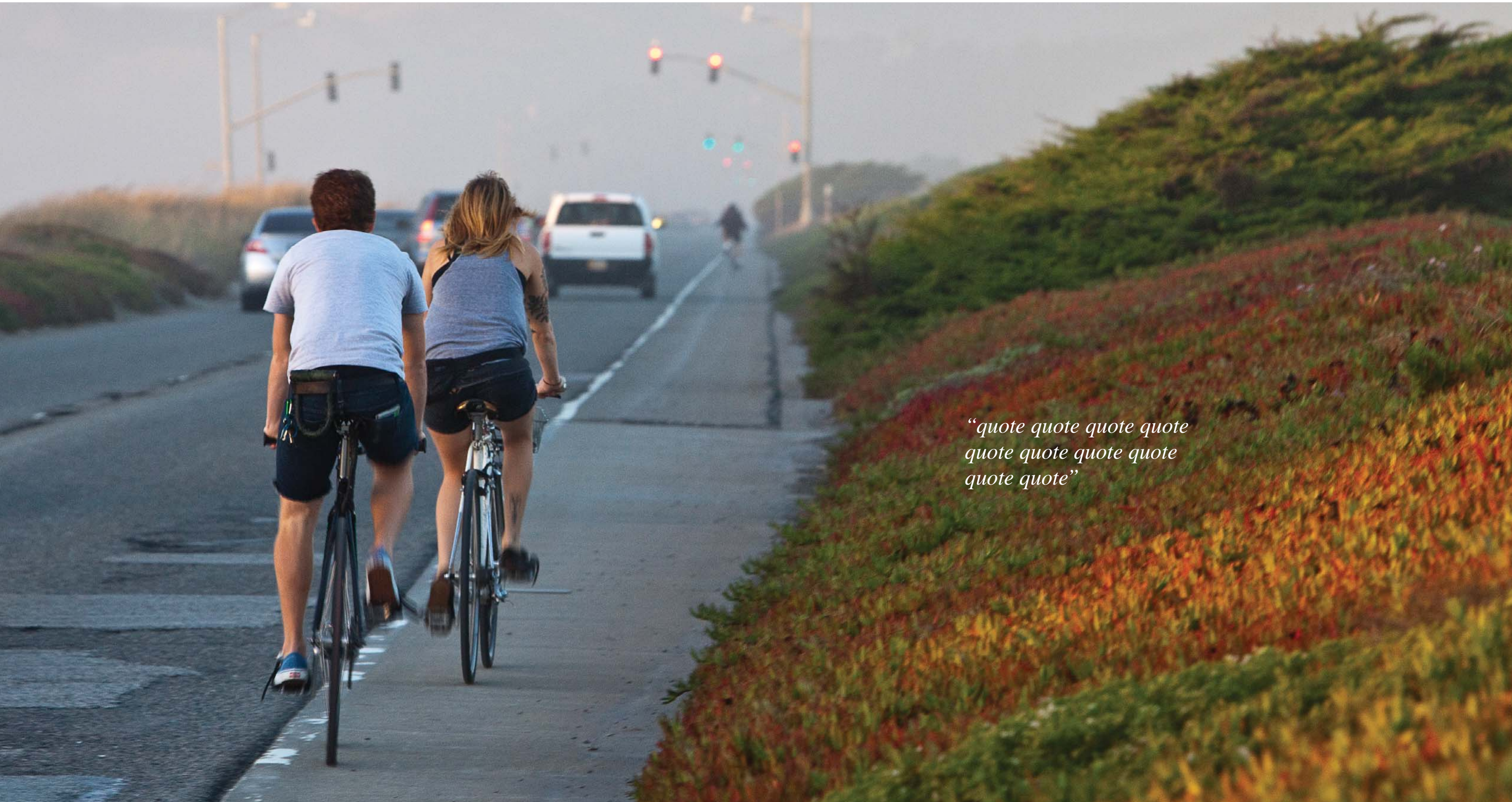
Connection to Golden Gate Park, which could and should be spectacular, offers little sense of arrival and is challenging to navigate for pedestrians and cyclists.

Promenade Transition at Lincoln. The O'Shaughnessy Seawall promenade offer a grand strolling experience from the Cliff House to Lincoln, the suddenly peters out into intermittently visible trails in the dunes. A clear connection is needed.

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focus area 6 :  
access + connectivity

traffic capacity

Many of the streets surrounding Ocean Beach are wider than necessary and have more vehicular capacity than actual demand under most conditions. [N/N diagram] These include the Great Highway from Lincoln to Sloat, and to a greater degree South of Sloat, and Sloat boulevard from Great highway to Skyline. Both intersections and roadway configurations are non-standard in some locations. These include:

Sloat Boulevard Corridor, with six lanes of auto traffic and angle parking in the median, which impedes traffic flow and pedestrian access. This segment is slated for narrowing with painted bicycle lanes, a project which, along with Caltrans' similar effort farther East, could provide important data on traffic flow.

Sloat/Skyline intersection, which is quite oversized and features free-right-turn channels that are problematic for pedestrians and cyclists.

Great Highway and Skyline, which lacks a crosswalk to the multi-use trail at Lake Merced, a major recreational amenity.

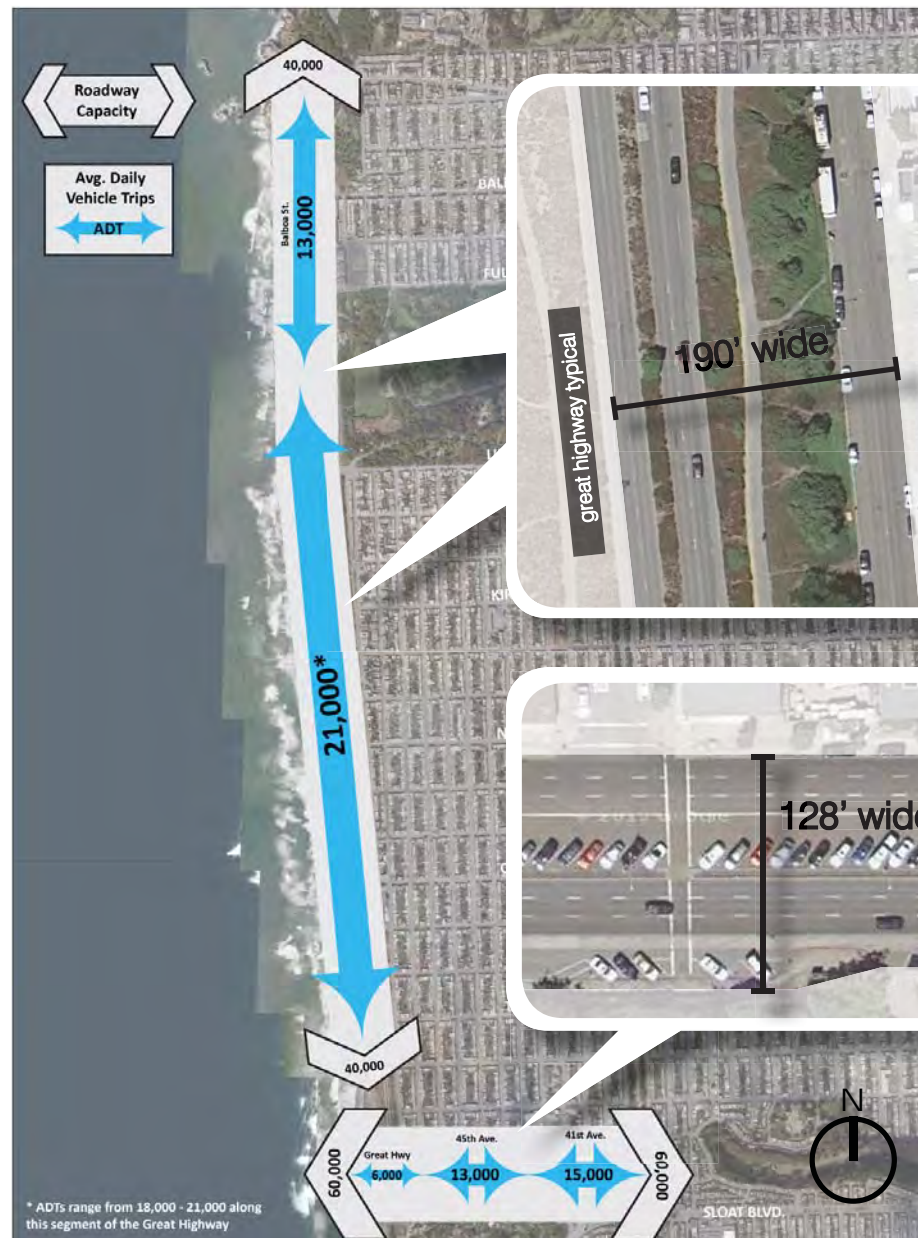
Great Highway at JFK/Beach Chalet/Fulton, which includes a large concentration of intersections, with long and ambiguous pedestrian crossings.



regional connectivity



traffic volumes | great highway + sloat blvd.



road dimensions

Great Highway at Balboa, which include a six-lane intersection controlled by a stop sign.

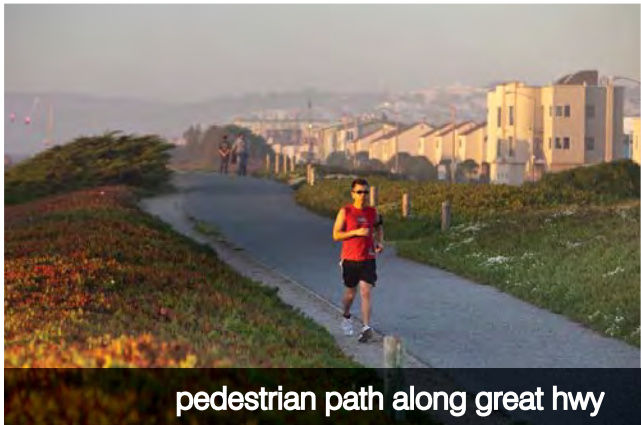
In addition, the Great Highway is frequently closed for special events or due to blowing sand or flooding. The Great Highway South of Sloat Boulevard was closed southbound for nearly a year after the severe erosion episode in 2010, with only limited congestion impacts despite minimal management of temporary circulation. The segment from Lincoln to Sloat is unusual in that it lack any vehicular intersections and is signalized only at pedestrian crossings. This both allows precise signal timing and limits spillover impacts on surrounding residential districts, which nevertheless do occur during periods of heavy use. Residents and Supervisor Chu's office have identified the unmanaged impacts of Great Highway closures as a problem and have been working with the MTA to address the problem by installing flip-down signs advising other routes, such as Skyline Boulevard during Great Highway closures. Any steps that would limit traffic throughput on the Great Highway should be accompanied by mitigation measures to limit impact s on adjacent neighborhoods.



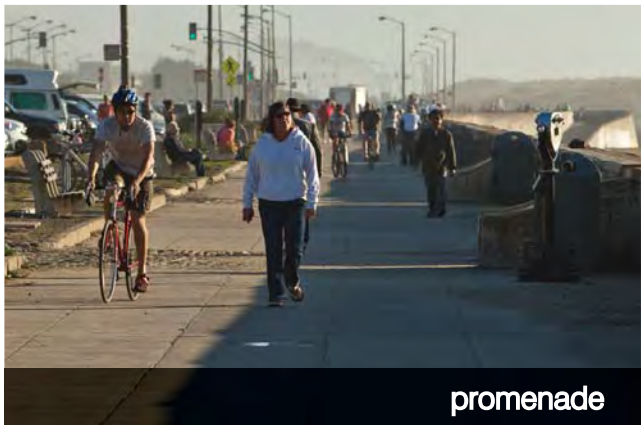
focus area 6 :  
access + connectivity



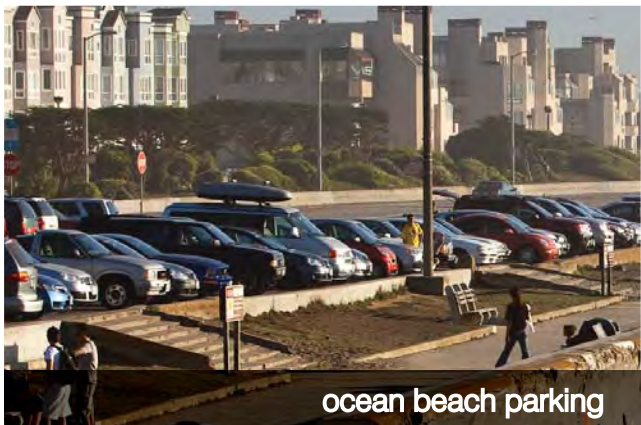
bus stop at la playa street



pedestrian path along great hwy



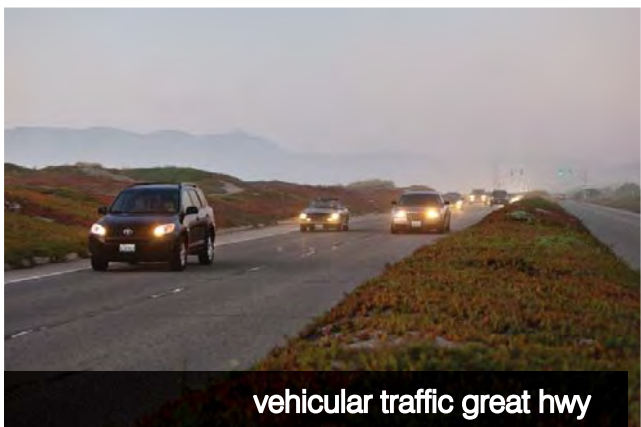
promenade



ocean beach parking



bike route on great hwy



vehicular traffic great hwy

local connectivity

transit

Several major transit lines terminate at or near Ocean Beach, providing good connectivity to the rest of the city. These include the L-Tarava,l, N-Judah , and 38-Geary. Other lines include the 31, 18, 48, and 23, among others.

Although both the L-Taraval and N-Judah streetcar terminate near the beach, there is little sense of arrival at a major open space resource and a National Park. These termini could do more to inform and facilitate coastal access.

bicycle

Ocean Beach is a major destination for recreational cyclists, many of whom ride to Ocean via Golden Gate Park, a major bicycle route that is being upgraded extensively. The Great Highway and its multi-use trail are also an important cycling route, and constitute a segment the Pacific Coast route from Canada to Mexico, as well as important regional connections.

Ongoing Efforts. Several important bicycle improvement projects are planned in the vicinity of Ocean Beach, including striped lanes on Sloat Boulevard and improvements in Golden Gate Park. Improvements should be coordinated with these.

Inadequate bicycle parking. Although some bike rack have been added in the O'Shaughnessy lot in recent years, they are frequently over-full, indicating considerable unmet demand, and most of the beach lacks any bike parking at all.





the great highway

Conflicts with other users. The Multi-Use trail combine joggers, walkers, skaters and cyclists of different speeds, resulting in frustrating and potentially dangerous conflicts.

Hazardous Condition North of Balboa. As the Great Highway ascends Sutro Heights adjacent to the cliffhouse, several factors—a lack of designated lanes, a steep grade, a lind curve, and diagonal parking – combine to create a hazardous condition. This segment connect to important cycling routes through Lands End and the Presidio.

Ocean Beach is not only a destination in itself; it is the connective tissue that links an embarrassment of open space riches on the city’s west side. From Land’s End and Sutro Heights at its north end to Golden Gate Park, the Zoo and Fort Funston to the south, Ocean Beach is a key corridor. While movement along Ocean Beach is fairly easy, it offers much weaker connection to adjoining open spaces, neighborhoods and other amenities. In particular, arriving at the beach from Golden Gate Park, which ought to be one of the great landscape experiences in San Francisco, is an anticlimax for pedestrians and cyclists, who are dropped into a sea of asphalt roadway and parking, with little sense of how to proceed. Another significant gap is from Ocean Beach to Fort Funston, the GGNRA’s next major park to the south, where pedestrians must walk the highway shoulder and hop the guardrail to access the trails and beach.

Ocean Beach is well-served by the Muni transit system, but while the 38-Geary, N-Judah and L-Taraval lines each terminate within easy walking distance of the beach, the pedestrian connections are weaker than they might be if welcoming transit users were made a priority.

The Great Highway was built in the 1920s as a grand vehicular promenade, the widest stretch of pavement for its length in the world. Its reconfiguration in the 1990s narrowed it by nearly half, but it remains a traffic artery first and foremost, with a capacity that exceeds its actual usage. South of Sloat Boulevard, the Great Highway is squeezed between the eroding bluffs and inland structures, with traffic capacity to spare.

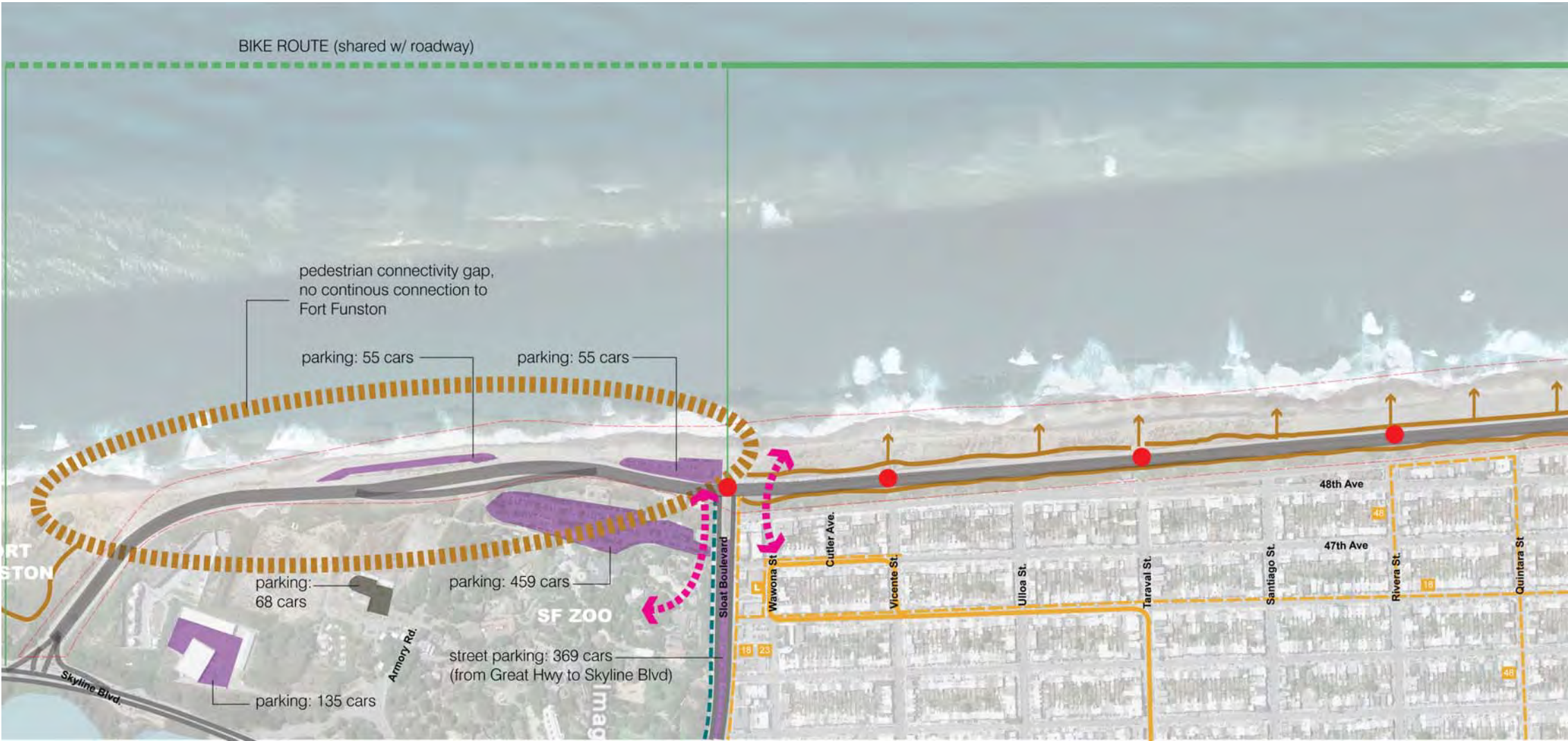
The City of San Francisco’s Sunday Streets program has closed the road to cars a few times, showing us a tantalizing multimodal vision, more “great” than “highway.” Meanwhile, a campaign by the San Francisco Bicycle Coalition to build a physically separated bikeway from San Francisco Bay to the ocean is highlighting Ocean Beach as a major cycling destination with significant shortfalls in connectivity. As our ideas about multimodal streets and recreational waterfront access evolve, it may be time to reevaluate the vehicular emphasis on the city’s only oceanfront street.



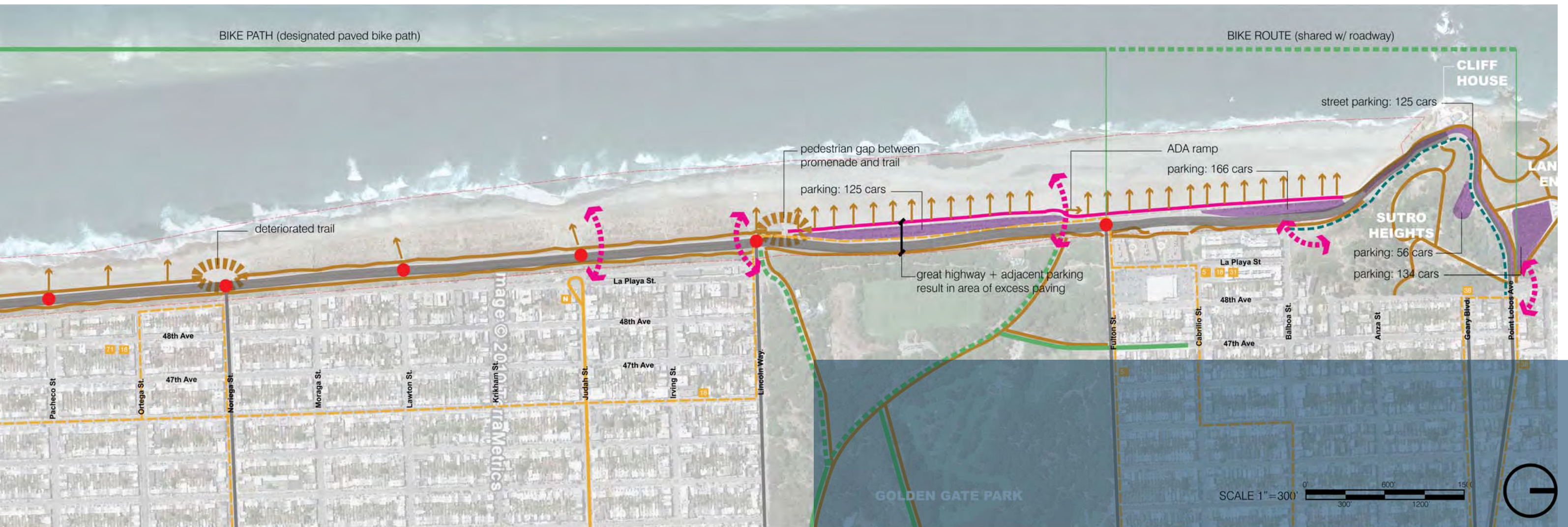
focus area 6 :  
access + connectivity

diagram legend

- project boundary
- great highway
- major arterial road
- muni metro
- muni bus
- promenade
- pedestrian connection
- bike path / lane / route
- planned bike lane
- traffic light
- muni line number
- pedestrian connectivity gap
- beach access (path, stair, ramp)
- key pedestrian connections
- parking







existing circulation diagram



focus area 7 : management + stewardship

aspiration

*Provide an approach to long-term stewardship across agencies, properties and jurisdictions.*

Although visitors experience Ocean Beach as a whole place, it is administered by an alphabet soup of federal, state and local agencies. The beach, dunes and promenades are mostly federal GGNRA parkland, while the Great Highway, multiuse trail and most parking lots are owned by the San Francisco Recreation and Park Department. The SFDPW provides maintenance and emergency repairs on both city and federal property, while the SFPUC owns and manages underground wastewater infrastructure and the Oceanside Water Pollution Control Plant. Dredging and sediment management by the Army Corps of Engineers shape the beach. The California Coastal Commission is the permitting authority at the beach. Further inland within the coastal zone, the San Francisco Planning Department oversees development decisions through the City's Coastal Commission-approved Local Coastal Program (the Western Shoreline Plan).

With so many agencies involved, it's not hard to understand why problems as simple as managing litter can be challenging — never mind protecting infrastructure while managing a habitat for threatened birds. Not only are these agencies administratively distinct, they often have

conflicting priorities, as well. For example, National Park Service policies favoring natural resources and processes may conflict with the needs of the PUC's infrastructure, although both serve environmental imperatives. The Ocean Beach Master Plan is a major first step in coordinating the activities of these agencies. Several of the recommended implementation steps involve interagency cooperation, including the creation of joint management agreements around both open space and coastal management.

Could Ocean Beach be managed as a single unit? What form would that take? Simply having a consensus vision in place will provide a basis for improved interagency cooperation. A joint operating agreement clearly defining responsibilities, or even the creation of a new management entity or park boundary, could provide the kind of integrated management to see Ocean Beach through the challenges we know are coming.

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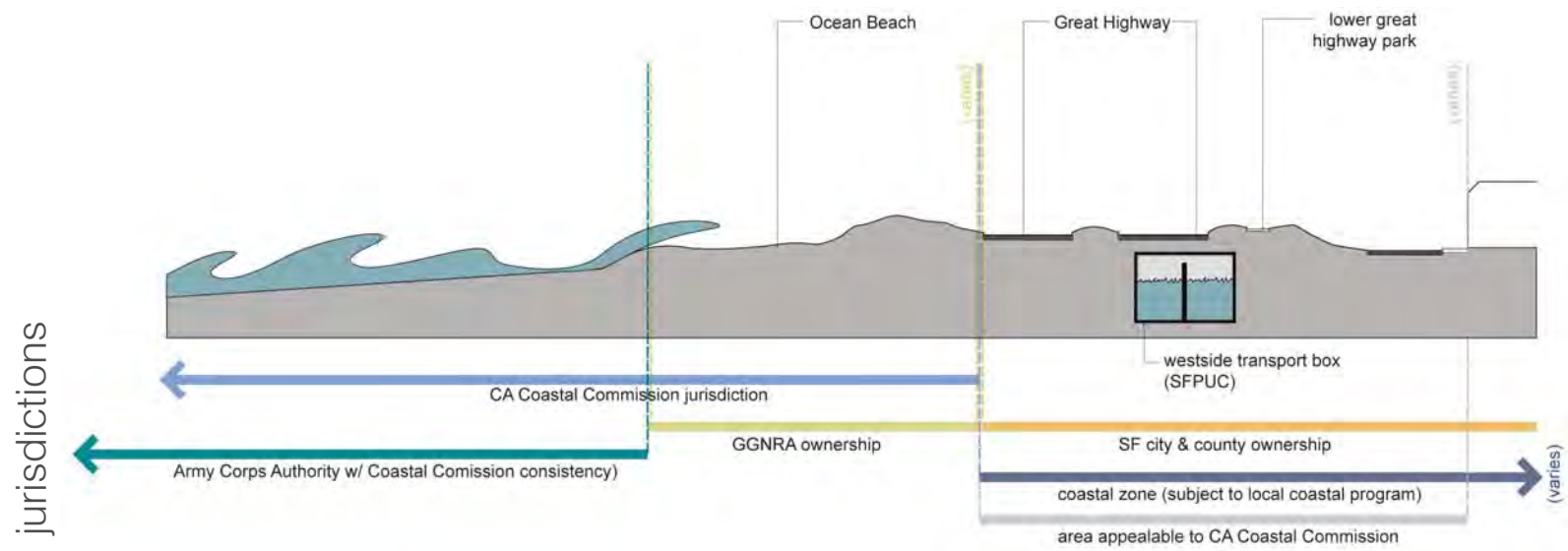
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focus area 7 :  
management + stewardship

diagram legend

- PROJECT BOUNDARY
- Golden Gate National Recreation Area (GGNRA) ownership
- SF city & county ownership (excludes private property)
- CA Coastal Commission jurisdiction & Army Corps Permitting Authority
- coastal zone subject to local coastal program







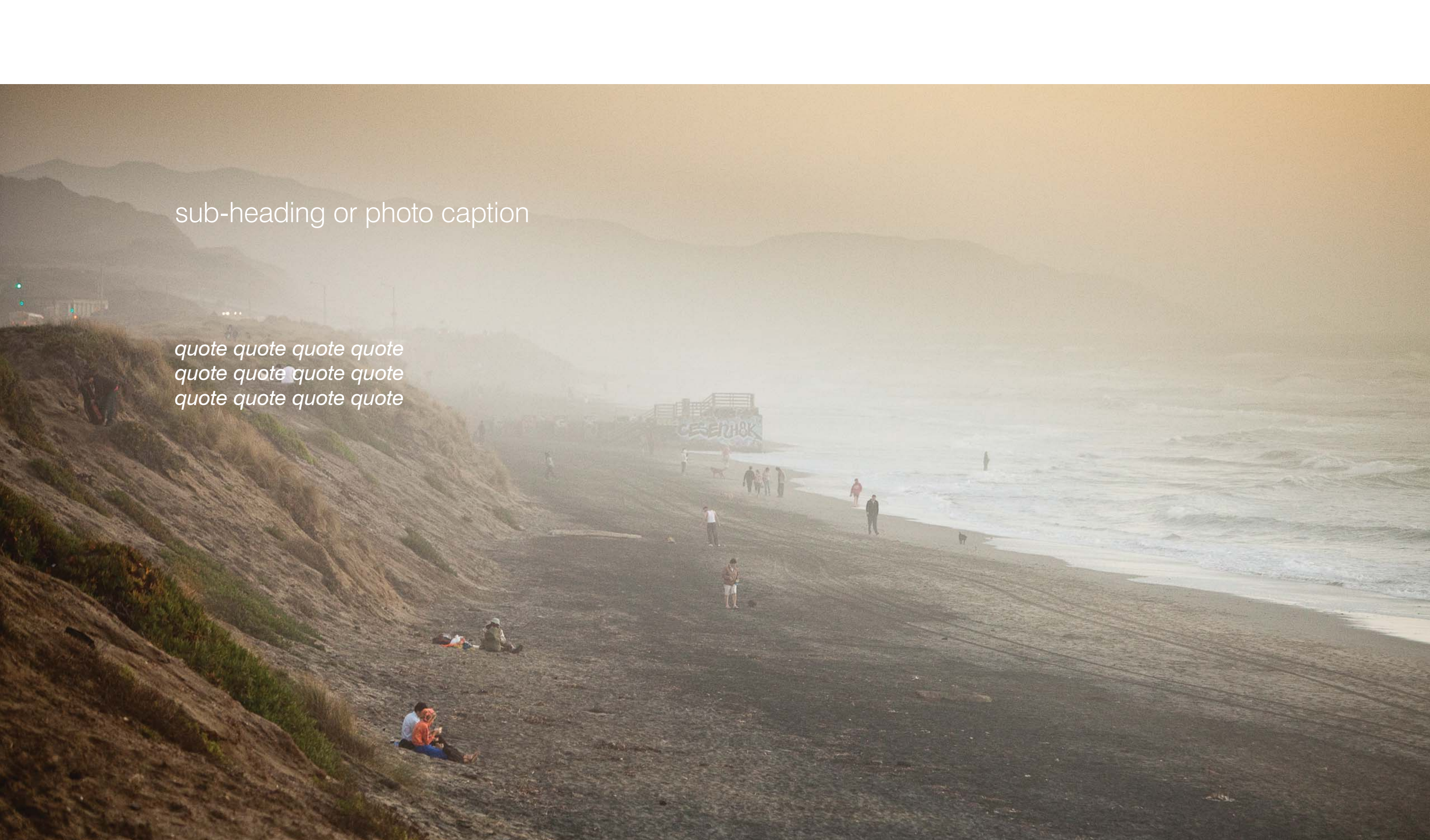
## sand transport by wind



## maintenance + stewardship







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