

# Common Elements

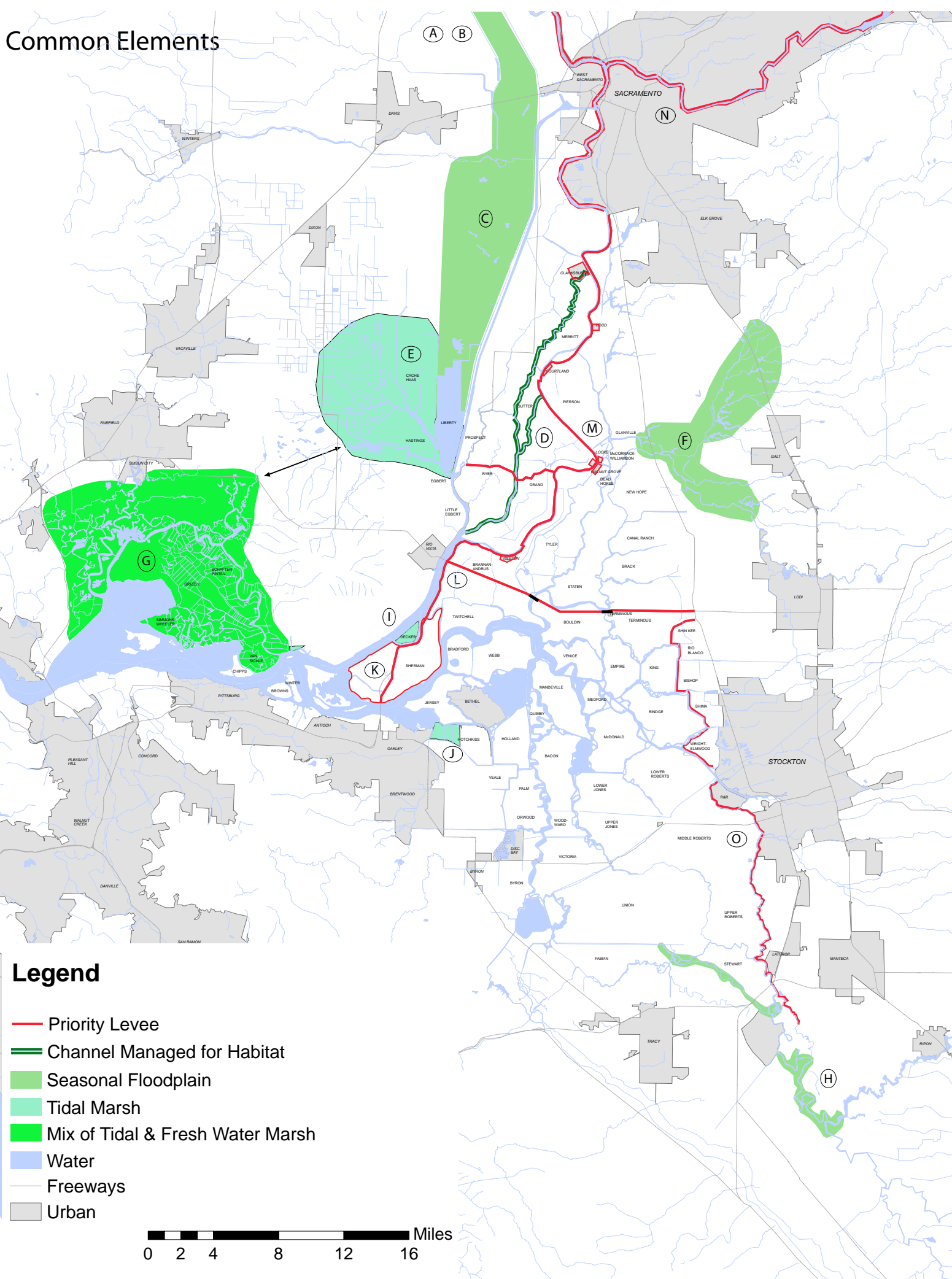
## Ecosystem

- A. Floodplain restoration along the main stem of the Sacramento River (upstream of city of Sacramento) for the benefit of splittail and migrating salmonids, and to increase nutrient and organic carbon flows to Delta. Improve salmon spawning gravels in upstream reaches and tributaries of Sacramento River.
- B. Infiltration of floodwaters upstream to reduce Delta flood risk and replenish Central Valley groundwater aquifers
- C. Manage Yolo Bypass for benefit of splittail and salmonids, and to increase nutrient and organic carbon flows to Delta.
- D. Enhance channel configuration and hydraulics of Elk Slough, Sutter Slough, and Steamboat Slough to provide alternative route for migratory fish that avoids Georgiana Slough and the Delta cross-channel.
- E. Improve hydraulic residence time and tidal exchange between Cache Slough and the Delta to contribute organic carbon, nutrients, phytoplankton and zooplankton to the Delta, for the benefit of Delta smelt among others. Create a hydrologic and terrestrial connection between Cache Slough and Suisun Marsh.
- F. Restore Mokelumne and Cosumnes River corridors
- G. Increase availability of brackish and freshwater tidal habitat in Suisun Marsh, including dendritic channels with both intertidal and subtidal areas, to increase habitat diversity and quality, and availability of habitat for Delta smelt and other species. Increases in organic carbon, phytoplankton, and zooplankton production benefit numerous aquatic species in the area. Continue to maintain significant expanses of freshwater marsh in Suisun Marsh.
- H. Seasonal floodplain restoration on lower San Joaquin River, including flood bypass on Paradise Cut
- I. Tidal marsh restoration at Decker Island
- J. Tidal marsh restoration at Dutch Slough

## Levees and landform

- K. Protection of Sherman Island against levee failure to avoid destabilizing rest of Delta
- L. Highways 12, 160 and 220 rebuilt on top of seismically safe, 100-year flood levees
- M. Seismically-safe, 100-year flood ring levees surrounding legacy towns
- N. Seismically-safe flood protection for Sacramento and West Sacramento
- O. Seismically-safe flood protection for Stockton/Lathrop area

## Common Elements



# Straw Proposal 1 – “Enhanced existing Delta”

**Land form and levees:** Protects the existing Delta island configuration and salinity pattern.

- \* Levees in the subsided areas are gradually upgraded to meet the future 100-year flood standard and to withstand the combined effects of sea level rise and subsidence.
- \* Western Delta islands and islands containing critical infrastructure are further protected with seismically resistant levees (1.1), beginning immediately.
- \* The islands of the central Delta are protected with special double-sided levees allowing them to store floodwaters, with compensation to local farmers (1.2).

**Conveyance and water quality:** Water conveyance takes the same physical route as now.

- \* Overall export pumping levels would be reduced in the dry season (1.3).
- \* Due to the diminishment of the snowpack from regional climate change, the total quantity of dry-season dam releases will be reduced, and a larger proportion of what remains will be needed to meet in-Delta and Contra Costa needs and to maintain water quality.
- \* Infiltration of wet season floodwaters into Central Valley groundwater aquifers (see “Common Elements”) makes up for reduced Delta pumping for Central Valley farmers.

**Ecosystem:** Enhancement of seasonal floodplain and tidal marsh habitats around periphery of Delta encourages recovery of native aquatic species and desirable non-natives.

- \* Terrestrial habitats and perennial wetlands expanded through purchase of conservation easements from willing landowners, perhaps in most deeply subsided areas (1.4).
- \* Reduced pumping levels may contribute to pelagic organism recovery.

**Land use:** Delta remains an agricultural region, with some urban expansion in secondary zone.

- \* State assists the development of markets in carbon sequestration, biofuels, and other innovative crops suited to the Delta (1.5).
- \* Tourism and recreation investments concentrated along Highways 160 and 12, in north Delta waterways, and in legacy towns (1.6).
- \* Legacy towns permitted moderate growth to expand local economies.

**Infrastructure:** All critical infrastructure protected along with islands.

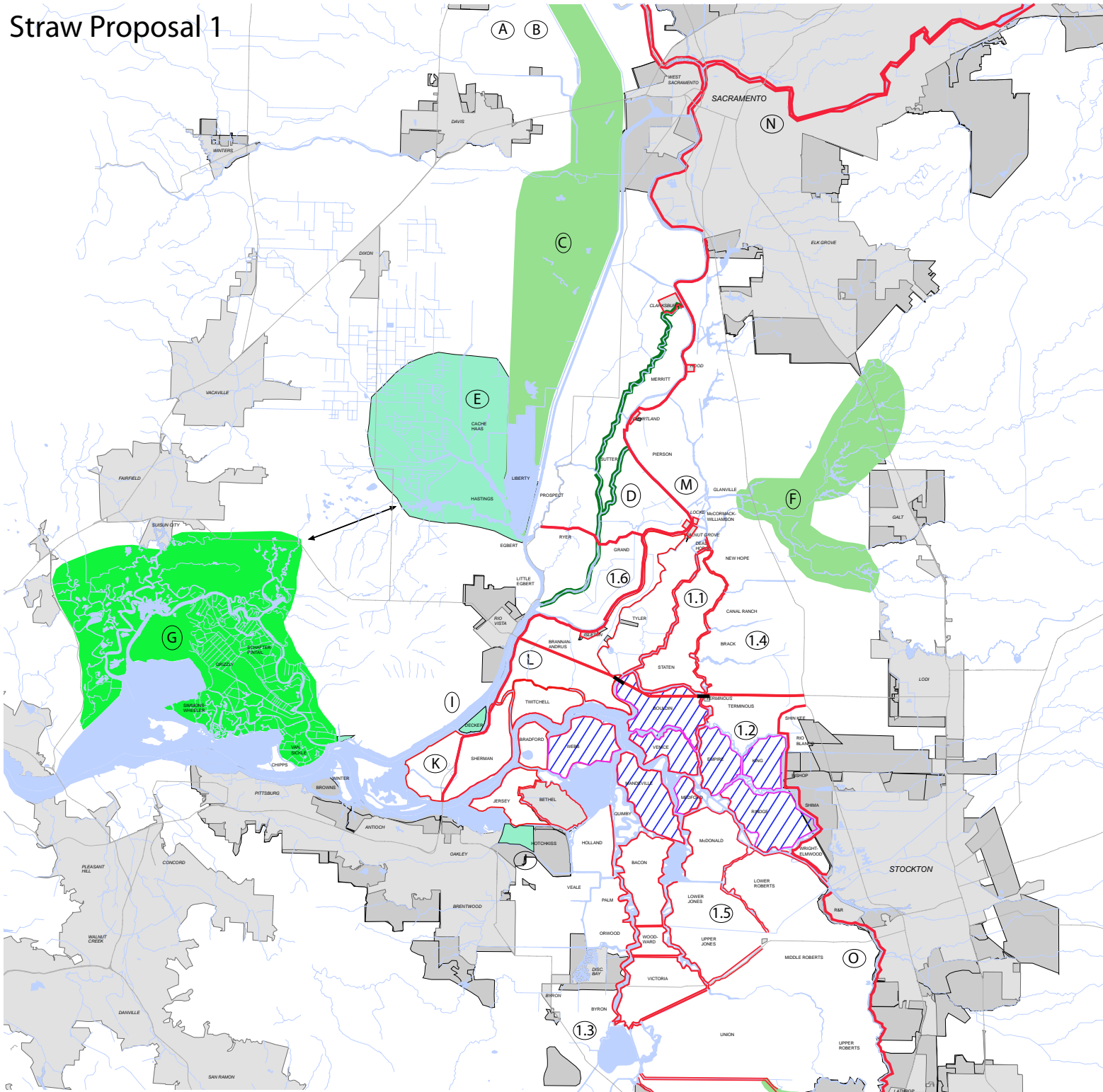
**Drivers of change:**

- \* *Sea level rise:* Minimal impact on salinity since west Delta islands protected and salinity repulsion continued. Gradual levee upgrades counter higher water elevation.
- \* *Seismicity:* Risk diminished in west Delta, and along infrastructure corridors. Risk remains elsewhere, but with diminished risk of “big gulp.”
- \* *Regional climate change:* Risk diminished by Central Valley flood control planning and in-Delta flood storage islands.
- \* *Subsidence:* Continues, but gradual levee upgrades counter its effects
- \* *Invasive species:* Ecosystem enhancements around the periphery of Delta improve native species
- \* *Population growth:* Cities expand out to sphere of influence lines, then infill.

**Policy Issues:**

- \* Can levee upgrades realistically provide the safeguards needed in light of drivers of change?
- \* How does this affect water supply reliability for those currently receiving water exported through the Delta?
- \* Will sufficient long-term funding be available to provide the levee upgrades anticipated for this vision?
- \* How would islands that would be flooded to attenuate floodwaters be identified and selected?
- \* How will out-of-Delta solutions, such as use of upstream flood plains for flood attenuation and groundwater storage, be implemented?

# Straw Proposal 1



## Legend

- Ⓐ Common Element
- ①.1 Element Specific to this Proposal
- Priority Levee
- /// Temporary Flood Storage Islands
- Channel Managed for Habitat
- Seasonal Floodplain
- Tidal Marsh
- Mix of Tidal & Fresh Water Marsh
- Water
- Freeways
- Urban

0 2 4 8 12 16 Miles

For discussion purposes only. Has not been approved by Delta Vision or the Stakeholder Coordination Group

## Straw Proposal 2 – “Eco-crescent”

**Land form and levees:** Protects the existing island configuration but confines water conveyance to an armored channel along South Fork of Mokelumne and Middle River.

- \* Critical infrastructure, including the Middle River water conveyance channel (2.1; see below), and a South Delta infrastructure corridor (including Highway 4, the Mokelumne Aqueduct, and the BNSF Railroad; 2.2) are protected with seismically safe levees.
- \* Levees on Sherman, Twitchell, and Brannan-Andrus Islands also made seismically safe
- \* Other levees are improved to future 100-year flood protection as needs appear.
- \* Setback and vegetated levees enhance habitat along Old River and in west Delta.

**Conveyance and water quality:** This scenario partially segregates the water conveyance system and aquatic habitat by gating connections between Old and Middle Rivers (2.3), and siphoning the Victoria Canal under Old River to deliver water to the Clifton Court Forebay (2.4).

- \* Water delivered through this channel to the pumps would be of higher quality than today.
- \* Overall export quantities may be reduced due to reduced conveyance capacity (2.5).
- \* Contra Costa intakes extended to Middle River to avoid Old River (2.6).

**Ecosystem:** In addition to enhancement actions around the periphery, this scenario calls for:

- \* Enhanced river channel habitat along the length of Old River (2.7).
- \* Setback levees in west Delta and the lower Sacramento River to allow tidal marsh restoration.
- \* Converting the west end of Sherman Island to managed tidal marsh (2.8).
- \* Salinity variation permitted inland to Webb Tract.
- \* Terrestrial habitat and wetlands easements purchased from willing landowners (2.9).
- \* New flood bypasses along lower San Joaquin River and in Stone Lakes region (2.10).

**Land use:** The Delta remains an agricultural region, with some urban expansion.

- \* West Delta islands transition away from agriculture to recreation, wildlife habitat or other land uses as salinity fluctuation impacts farming (2.11).
- \* Tourism and recreation investments concentrated along Highways 160 and 12, in north Delta waterways, and in legacy towns. Legacy towns permitted moderate growth to expand local economies.
- \* Boating throughout Delta. Fishing, hunting and birdwatching improved by ecosystem changes.

**Infrastructure:** All highways, the Mokelumne Aqueduct, and the BNSF Railroad protected in infrastructure corridors placed atop seismically safe levees.

- \* Stockton ship channel and water conveyance channel protected with seismically safe levees.
- \* Key electricity transmission lines and natural gas fields mostly protected on Sherman and Brannan-Island Islands; other reaches to be repaired/recovered on an as-needed basis.

**Drivers of change:** *Sea level rise:* Increased salinity intrusion; increased pressure on levees.

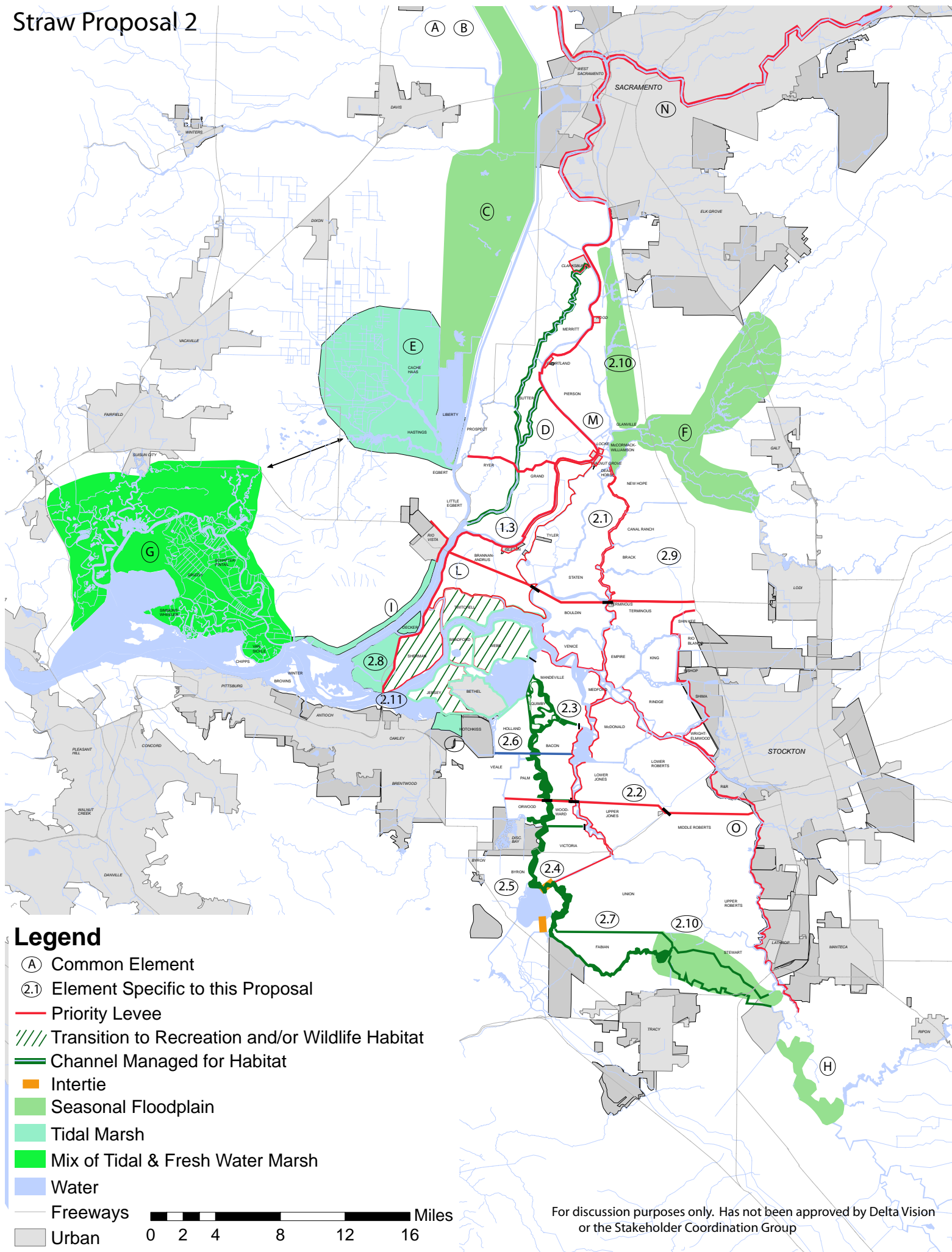
- \* *Seismicity:* Risk diminished along conveyance route, ship channel, in west Delta.
- \* *Regional climate change:* Risk diminished by Central Valley flood control planning
- \* *Subsidence:* Continues, but assumption is that gradual adaptation is possible
- \* *Invasive species:* Salinity variability in far western Delta may reduce invasive species there
- \* *Population growth:* Cities expand out to sphere of influence lines, then infill. Potential conflicts between flood bypass and urbanization in South Delta must be addressed.

### Policy questions

- \* What are the impacts of the eco-crescent on recreation and island access?
- \* How does this proposal address water reliability for those receiving water exported through the Delta?
- \* How will adaptive management be utilized to determine if the desired ecosystem benefits and improved water quality are being realized?
- \* Is the idea of transitioning West Delta agriculture to cropping types or patterns more acceptable to salinity fluctuation acceptable to Delta farmers, and how would it be accomplished?
- \* How are land use issues to be resolved, such as expanding to lines of influence and creating flood bypasses in urbanizing areas?



# Straw Proposal 2



## Straw Proposal 3 – “Adaptable Delta”

**Land form and levees:** This proposal protects the existing land form of the Delta.

- \* All western and central Delta islands between the two east-west infrastructure corridors are protected with seismically-safe ring levees (3.1).
- \* All minor channels and sloughs cut off by ring levees are gated to allow flexible management of water flows and ecosystem (3.2). Levees along those channels remain in status quo.
- \* Infrastructure corridors atop seismically safe levees protect Highways 12 and 4, the Mokelumne Aqueduct, and the BNSF Railroad (3.3).
- \* Water storage islands (3.4; see below) need new levees to withstand inundation on both sides.
- \* Levees along conveyance channel made seismically safe.
- \* Other levees gradually brought up to future 100-year flood standards.

**Conveyance and water quality:** Water storage within the Delta creates new flexibility in management of water conveyance and export.

- \* Existing In-Delta Storage Project proposals are implemented, with additional storage potentially created somewhere close to the project pumps (3.5).
- \* Conveyance continues in existing channels, and overall export quantities would remain the same (3.6), but with greater flexibility in the timing and direction of water movement.
- \* Contra Costa intakes moved south to avoid organic carbon.

**Ecosystem:** In addition to enhancements around Delta periphery, Bouldin Island and Holland Tract become perennial wetland habitat islands (3.7).

- \* Extensive installation of channel gates (as well as storage capacity) allows flexible experimentation and adaptive management of Delta ecosystem, especially with respect to in-channel flow and salinity conditions.
- \* Tidal marsh creation on Sherman Island and on west shore of Sacramento River (3.8).
- \* Flood bypasses are created along the San Joaquin and in the Stone Lakes region (3.9).

**Land use:** Delta remains predominantly agricultural, but at least four islands removed from agriculture for water storage and habitat.

- \* Seepage mitigation required on islands adjacent to water storage islands.
- \* Economic development centered around legacy towns.
- \* Tourism and recreation concentrated in North Delta, along Highways 160 and 12, and perhaps near habitat islands. Some minor sloughs and channels lost to boating at specific times.

**Infrastructure:** All infrastructure systems protected by infrastructure corridors or ring levees.

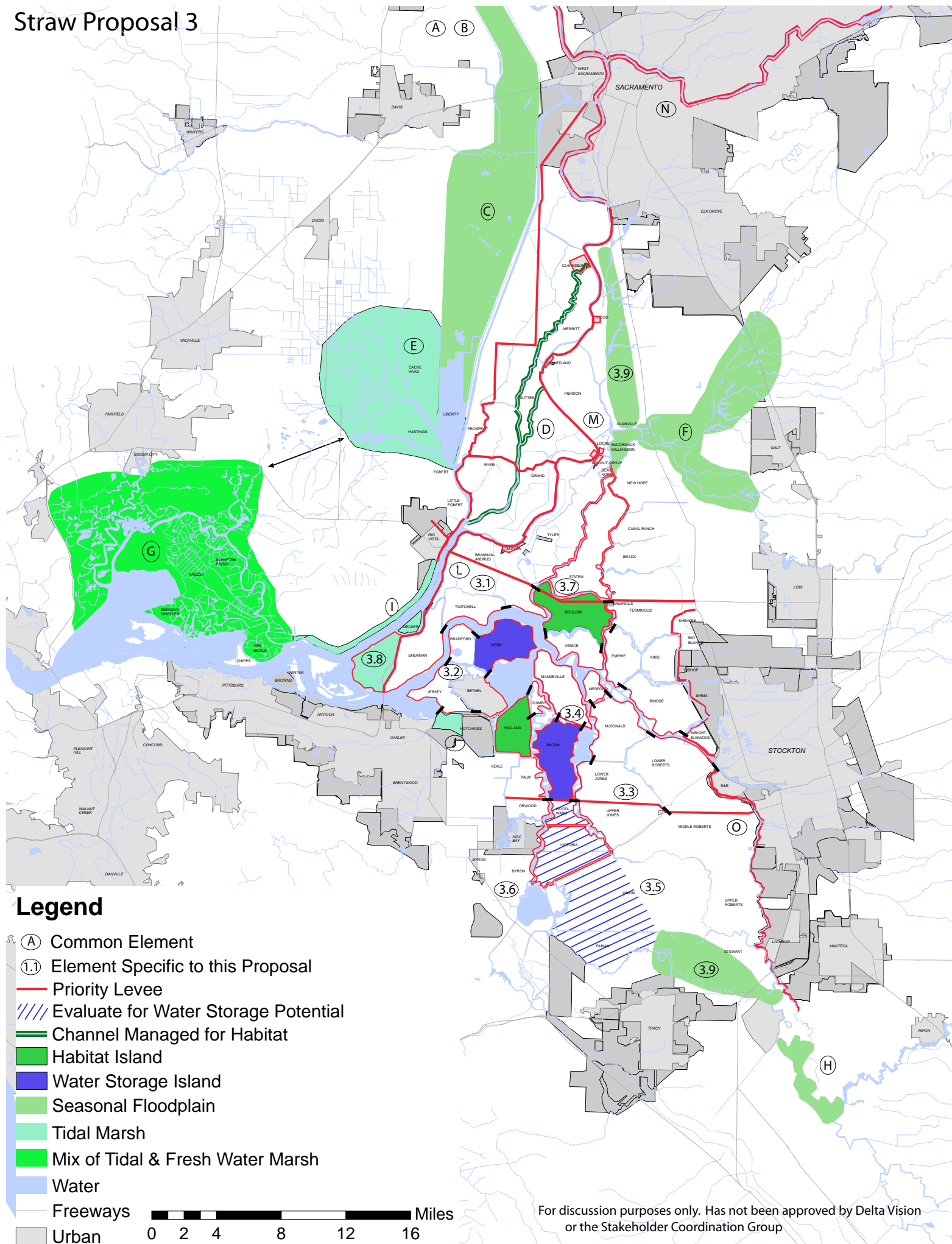
**Drivers of change:**

- \* *Sea level rise:* Salinity intrusion can be managed on experimental basis.
- \* *Seismicity:* Risk diminished by seismically safe ring levees.
- \* *Regional climate change:* Risk diminished by Central Valley flood control planning, ring levees
- \* *Subsidence:* Continues, but island failure risks diminished by ring levees
- \* *Invasive species:* Adaptive management of ecosystem may reduce prevalence of invasives
- \* *Population growth:* South Delta and east Delta become substantially urbanized.

**Policy Issues:**

- \* Is it realistic to expect sufficient funding to create seismically safe corridors, a ring levee and in-Delta storage islands?
- \* Do in-Delta storage islands near the pumps meet concerns about water supply reliability given 1) ecosystem concerns and 2) the potential for catastrophic failures?
- \* How would it be determined which islands are best for in-Delta storage, including acceptability of landowners?
- \* What are the mechanisms for achieving economic development of Legacy Towns?

## Straw Proposal 3





## Straw Proposal 4 – “Peripheral conveyance”

**Land form and levees:** Sherman Island, Brannan-Andrus Island, east-west infrastructure corridors, highways, and Stockton ship channel protected by seismically safe levees (4.1).

- \* Setback and vegetated levees enhance habitat along Old River and along downstream end of the San Joaquin River (4.2).
- \* Other islands adapt to drivers of change as conditions evolve.

**Conveyance and water quality:** A peripheral canal provides high quality, reliable, year-round water supply to state and federal water projects (4.3).

- \* Canal intakes at Hood or Clarksburg. Canal routed to pumps, to San Joaquin River, or both.
- \* Total quantity of export as large or larger than today.
- \* Water quality in west and central Delta declines due to diversion from Sacramento River. San Joaquin routing of canal could improve water quality in south Delta.
- \* Contra Costa intakes moved south to avoid salinity and organic carbon.

**Ecosystem:** In addition to enhancement actions around the periphery, Old River is enhanced and west Delta tidal wetlands are created in the same manner as in Straw Proposal 2.

- \* Separation of water conveyance and pumping impacts from Delta channels allows habitat enhancement in numerous other channels, including Georgiana Slough, both forks of the Mokelumne River, and eastside tributaries (4.4).
- \* Installation of gates in key locations allows flexible adaptive management (4.5).
- \* Some ecosystem improvements could be compromised or lost by mass island failure.
- \* Purchase of conservation easements from willing sellers expands terrestrial habitat and perennial wetlands in eastern Delta (4.8).

**Land use:** Delta agriculture made more vulnerable by reduction in water quality.

- \* Greater urbanization in south and east Delta as agriculture declines (4.6).
- \* West Delta islands transition away from agriculture to recreation, wildlife habitat or other land uses as salinity fluctuation impacts farming (4.7).
- \* Additional tourism and recreation development occurs in North Delta, primarily along Highways 160 and 12. Boating remains, fishing and recreation enhanced by ecosystem changes.
- \* All land uses at higher risk than in other scenarios due to island failure potential.

**Infrastructure:** Highways, Mokelumne Aqueduct, BNSF Railroad, and Stockton ship channel protected by levee investments.

- \* Key electricity transmission lines and natural gas fields mostly protected on Sherman and Brannan-Andrus Islands; other reaches to be repaired/recovered on an as-needed basis.

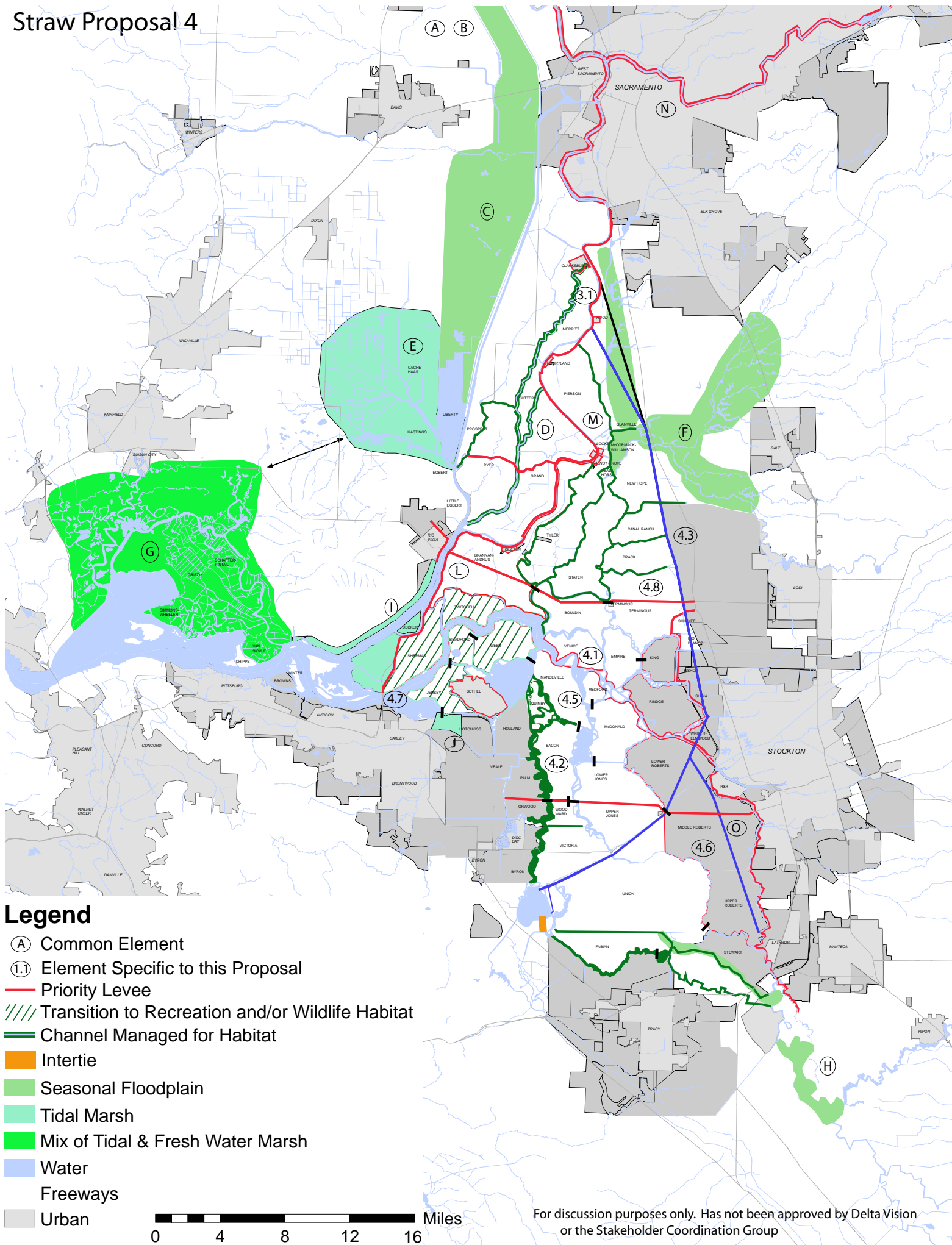
**Drivers:** *Sea level rise:* Salinity intrusion into west Delta and beyond; additional pressure on levees.

- \* *Seismicity:* Risk diminished on Sherman and Brannan-Andrus Islands. Risk remains elsewhere.
- \* *Regional climate change:* Risk diminished by Central Valley flood control planning
- \* *Subsidence:* Continues on agricultural islands, additional pressure on levees
- \* *Invasive species:* Habitat restoration and salinity changes might diminish invasives
- \* *Population growth:* South Delta and east Delta become substantially urbanized.

### Policy Issues:

- \* How could this vision address issues of ongoing levee upgrades and maintenance to sustain current Delta land use?
- \* How can concerns about water quality in the West Delta be addressed by this vision?
- \* Can flood risks in the Delta be reduced in concert with this vision?
- \* How realistic are the pathways being considered for peripheral conveyance in this vision?
- \* Consistent with the concept of “staging” visions for the Delta, how can peripheral conveyance be staged to evaluate the potential benefits and costs?

# Straw Proposal 4



## Straw Proposal 5 – “Dual conveyance”

**Land form and levees:** Protects the existing island configuration but reserves priority levee investment for critical infrastructure lines and legacy towns.

- \* Middle River water conveyance channel (**5.1** see below), a South Delta infrastructure corridor (including Highway 4, the Mokelumne Aqueduct, and the BNSF Railroad; **5.2**) and other critical infrastructure protected with seismically safe levees.
- \* Sherman, Twitchell, and Brannan-Andrus Islands made seismically safe.
- \* Other levees improved to future 100-year flood protection as needs appear.
- \* Setback and vegetated levees enhance habitat along Old River and in west Delta.

**Conveyance and water quality:** This scenario creates a dual conveyance that includes both a small peripheral canal and an armored through-Delta channel.

- \* Gated connections between Old and Middle Rivers (**5.3**), and siphoning of the Victoria Canal under Old River to deliver water to Clifton Court (**5.4**).
- \* Water delivered to the pumps by both means would be of higher quality than today. In-Delta water quality would likely be worse in west Delta.
- \* Overall export quantities would be as great or greater than today (**5.5**).
- \* Contra Costa intakes moved to Middle River to avoid Old River (**5.6**).

**Ecosystem:** In addition to enhancement actions around the periphery, this scenario enhances river channel habitat along the length of Old River (**5.7**).

- \* Setback levees in west Delta and the lower Sacramento River allow tidal marsh restoration.
- \* Converting the west end of Sherman Island to managed tidal marsh (**5.8**).
- \* Salinity variation permitted inland to Webb Tract.
- \* Terrestrial habitat and wetlands easements purchased from willing landowners (**5.9**).
- \* New flood bypasses along lower San Joaquin River and in Stone Lakes region (**5.10**).

**Land use:** The Delta remains an agricultural region, with some urban expansion.

- \* West Delta islands transition away from agriculture to recreation, wildlife habitat or other land uses as salinity fluctuation impacts farming.
- \* Tourism and recreation investments also concentrated along Highways 160 and 12, in north Delta waterways, and in legacy towns.
- \* Legacy towns permitted moderate growth to expand local economies.
- \* Boating remains throughout Delta. Fishing, hunting and birdwatching improved.

**Infrastructure:** All highways, the Mokelumne Aqueduct, and the BNSF Railroad protected in infrastructure corridors placed atop seismically safe levees.

- \* Stockton ship channel and water conveyance channel protected with seismically safe levees.
- \* Key electricity transmission lines and natural gas fields mostly protected on Sherman and Brannan-Island Islands; other reaches to be repaired/recovered on an as-needed basis.

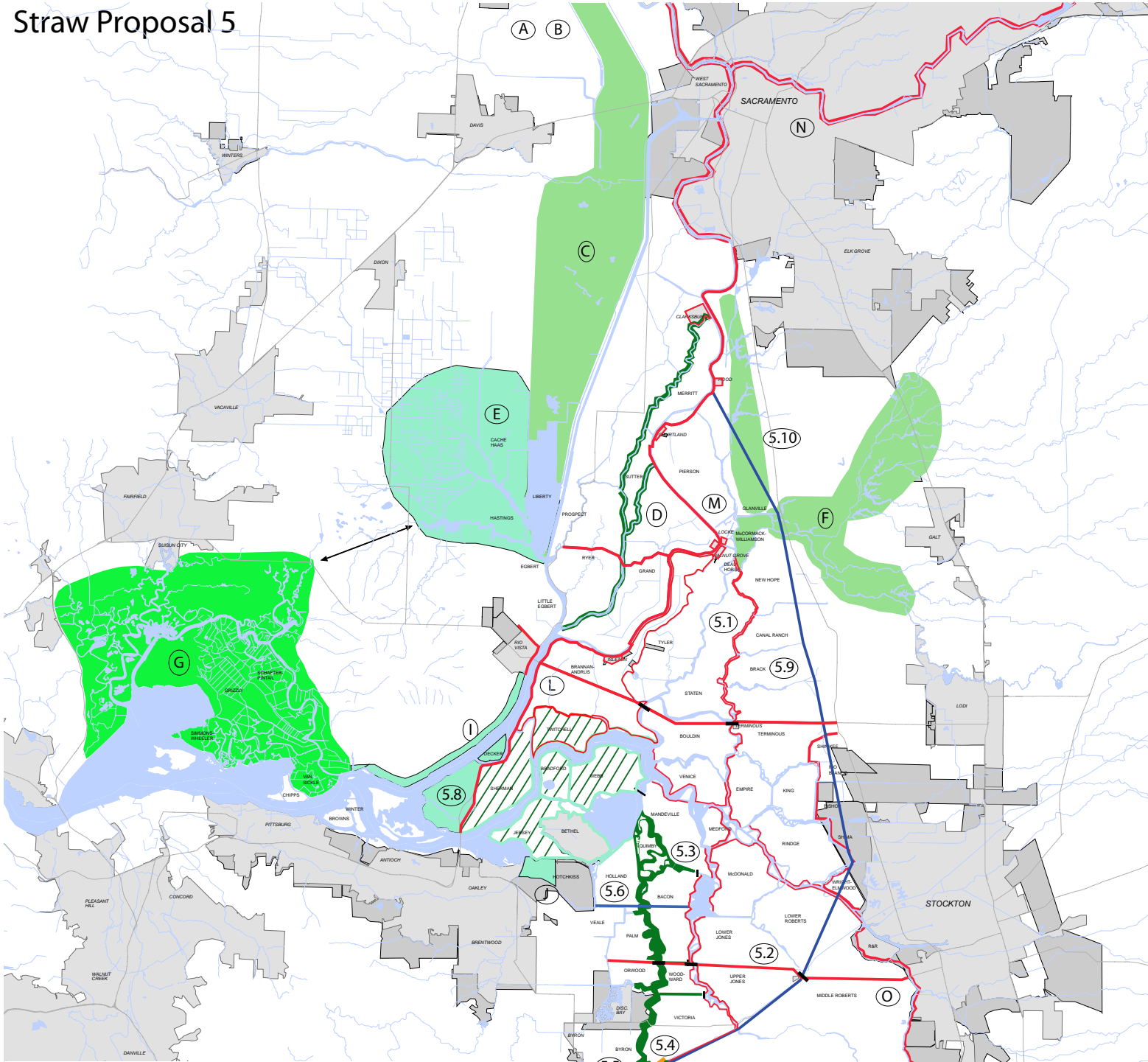
**Drivers of change:** *Sea level rise:* Increased salinity intrusion; increased pressure on levees.

- \* *Seismicity:* Risk diminished along conveyance route, ship channel, in west Delta.
- \* *Regional climate change:* Risk diminished by Central Valley flood control planning
- \* *Subsidence:* Continues, but assumption is that gradual adaptation is possible
- \* *Invasive species:* Salinity variability in far western Delta may reduce invasive species there
- \* *Population growth:* Cities expand out to sphere of influence lines, then infill. Potential conflicts between flood bypass and urbanization in South Delta must be addressed.

### Policy Issues:

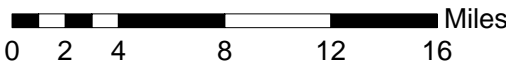
- \* Is it realistic to be able to fund both peripheral conveyance and an armored corridor through the Delta?
- \* For those concerned about existing (let alone increased) levels of exports, what assurances can be put in place to ensure any increase does not have deleterious impacts to the ecosystem or water quality?
- \* What assurances can be put in place to ensure levee upgrades and maintenance in the remainder of the Delta will not suffer as a result of this vision?

# Straw Proposal 5



## Legend

- Ⓐ Common Element
- Ⓘ.1 Element Specific to this Proposal
- Priority Levee
- //// Transition to Recreation and/or Wildlife Habitat
- Channel Managed for Habitat
- Intertie
- Seasonal Floodplain
- Tidal Marsh
- Mix of Tidal & Fresh Water Marsh
- Water
- Freeways
- Urban



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