Ecosystem Amendment Performance Measures Independent Scientific Review

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Performance Measure (PM) 4.12: Subsidence reversal for tidal reconnection

Charge Question 1:

How clear and thorough are the performance measure's metric, baseline and target? What, if any, additional information is needed?

The metric is clear. Baseline (2), Short term elevation accretion in the Delta at 4 cm per year, sounds more like a target than a baseline. The baseline for this metric should be something like the average rate of current subsidence occurring on islands identified for this activity. The target is clear in the Target section, though there are inconsistencies between this stated target and the Target Methods section, particularly around start time of the subsidence reversal activity (2020 vs 2030) and end date for achieving targets (year 2050 vs 2100) (see below).

Charge Question 2:

How clear is the basis for selection of the performance measure? How complete are the scientific rationale, the justification, and the supporting references for the selection?

The basis for selection could be more clear about whether or not there are potential opportunities to link targets of this PM to others such as PM 4.15 Seasonal Inundation and PM 4.16 Acres of Natural Communities Restored. The third paragraph states, "Preventing the loss of land will also preserve the opportunity for the land to be restored for tidal reconnection." The paragraph ends by stating that projects must be initiated by 2030 and continue long term until land reaches desired intertidal elevation for tidal reconnection and restoration, but does not state when that desired elevation should be achieved. The fourth paragraph ends with "projects would need to accrete at least 4 cm per year" but does not provide a duration of time needed for accretion to occur. The Delta Reform Act section, "Viable populations of native resident and migratory species" references PM 4.16 and states that, "meeting the target of this measure (PM 4.12) will ensure that the Delta landscape maintains opportunities for natural wetland restoration…" The target date for achieving PM 4.15 and 4.16 is 2050. I do not have the information to know if some subsidence reversal projects could achieve the desired

intertidal elevation in 20-30 years, with an end date of 2050, or if a longer time period is needed. It is also unclear from the text what the preferred end date for achieving the target is. The Target Section reads, “An average elevation accretion of subsidence reversal is at least 4 cm per year up to 2050” but the Target Methods section calculates accretion to 2100. The text should be revised to clarify the preferred end date for achieving PM 4.12 and to clarify whether or not there is potential to support progress of other PMs by their target end date of 2050.

Targets of 3,000 acres in Suisun Marsh and 3,500 acres in the Delta are based on expected land loss in 10 years according to a sea level rise (SLR) projection of 2.6 feet by 2100. This is a small proportion of potential land area available for this activity, as identified in Figure 1 (PM 4.12 Datasheet). The Target Methods section states that a longer-term target date would require more foreknowledge of SLR and the future development of subsidence reversal technology. Given that an end of century projection is used to set the targets, it is not clear why this projection is not used to estimate land loss 20 or 30 years from now, and adjust targets accordingly.

Charge Question 3:

How clear and complete is the scientific basis for setting the targets? How complete is the consideration of key scientific references, available data, and existing monitoring capabilities?

The Baseline Methods section should mention the role of vegetation management in potentially influencing the 4 cm per year vertical accretion rate. Plant productivity, especially root growth drives the accretion rate, and the productivity can be affected by build up of thatch, or dead plant material in the wetland (Schile et al. 2013, Anderson et al. 2016). The 4 cm per year metric is based on a paper published in 2008, though the Twitchell Island subsidence reversal site has persisted beyond that date. Is it possible to get new elevation data at the site to get a longer term rate of accretion?

Staff used GIS to count for each island the number of acres that could reach intertidal elevations by 2100 or sooner. Why was 2100 the end date set for this analysis? The Target Section establishes the target to be 4 cm of accretion per year up to 2050. Can the GIS analysis be used to identify number of acres that could reach intertidal elevations by decade (e.g., 2050, 2060, 2070)?

Figure 1 (PM 4.12 Datasheet) should have a scale bar and north arrow. It would be helpful if current baseline elevation could also be shown in this figure.

Appendix 1.

Define “U” in the equations.

Why was the digital elevation model (DEM) resampled to 200m^2? I am not sure this was necessary.

Typo: “MHHW is the tidal datum for mean lower low water...” p. 15 and p. 16

Target Methods section – In the first paragraph, p. 16, why does the subsidence reversal zone formula assume a start date of 2020? This seems inconsistent with the main text of the PM, which implies that all subsidence reversal calculations would begin at 2030. Suggest changing to “assuming a beginning date of 2030 and end date of 2100.”

Target methods identify areas that can reach intertidal elevations by 2100. However, the Target Section indicates that subsidence reversal only needs to occur until 2050. What is the preferred target end date, 2100 or 2050?

Figure 2. Add scale bar and north arrow.

Charge Question 4:

How achievable are the targets relative to the stated time scales?

The target land area is relatively small in proportion to the total land area available for this activity based on initial elevation. If the goal is to achieve desired intertidal elevation by 2100 for the 6,500 acres, this seems to be fairly achievable.

Charge Question 5:

How well were scientific uncertainties (both outside and within management control) incorporated in the development of the targets and in the assessment of progress toward the targets?

Another uncertainty will be the ability to measure and monitor elevation changes spatially across the subsidence reversal wetland. Sustainability of accretion rates may also be dependent on vegetation management (see above).

Under “Sea Level Rise”, describe what the “landscape model” is.

Charge Question 6:

Are the identified data sources complete and appropriate to support robust assessment of the performance measure?

Data sources are not complete and not all are appropriate.

4. CDFW Wetlands Restoration for Greenhouse Gas Reduction Program – p. 10. There seems to be a typo here, “…fund greenhouse gas emissions.”

5. The Ameriflux Network provides useful publications and data; however, it does not provide the elevation change data needed to track this PM.

6. DEMs of densely vegetated marshes will have high error (~20 cm). Statistical correction of the DEM is possible, but requires collection of RTK-GPS data points across the marsh to build a statistical model (McClure et al. 2016). It would not be appropriate to use a DEM to track elevation change. Instead, it would be better to use field survey methods like RTK-GPS or surface elevation tables.

Generally, greenhouse gas flux measurements will not be useful in tracking the success of the subsidence reversal project – elevation change data is what is most needed.

Charge Question 7:

How well are adaptive management and alternative actions considered in performance assessments and reporting?

Adaptive management and alternative actions are not considered in performance assessments and reporting, except to mention that reporting every five years will inform the Council's adaptive management and other relevant decision-making. Given that SLR projections are being updated frequently, one adaptive management strategy would be to assess new SLR projections 5-10 years from now and identify alternative actions, or updated targets if needed.

Performance Measure 4.15: Seasonal Inundation

Charge Question 1:

How clear and thorough are the performance measure's metric, baseline and target? What, if any, additional information is needed?

The metric, baseline and target for acres that are hydrologically connected and acres that inundate at least once every two years are fairly clear. I am assuming that "hydrologically connected" means through surface water connectivity, not groundwater. Is this the case? If so then language should be changed to specify this. It may be helpful to amend language for Target (2) to read "non-tidal floodplain area".

Charge Question 2:

How clear is the basis for selection of the performance measure? How complete are the scientific rationale, the justification, and the supporting references for the selection?

Some clarifications could be added to the Basis for Selection section. For example, under the heading, Hydrologic Connectivity, describe in what way "limiting connectivity of waterways from such structures could improve ecosystem function." Also, identify which conveyance structures are excluded from this performance measure. There is also some repetitive text. Remove the sentence in this section starting "This interaction requires two components…" In the section on Seasonal Floodplain Inundation, references (e.g. CDWR 2016) are needed to explain the ecological rationale for setting the frequency of inundation target at a two-year interval.

Charge Question 3:

How clear and complete is the scientific basis for setting the targets? How complete is the consideration of key scientific references, available data, and existing monitoring capabilities?

There is some conflicting text around the baseline for area of land inundated. The Baseline section states that the baseline is approximately 15,000 acres of the connected land inundated at a two-year interval. However the Methods – Inundation section states that "the baseline was set at zero acres as of the year 2013". Under Target Methods – Connectivity, it is assumed that only 17% of the acres with increased connectivity will be suitable for salmonid species. With planned selection of land area to restore connectivity, it seems that it would be feasible to generate more suitable habitat for salmonids than just 17% of the targeted 51,000 acres.

With respect to monitoring capabilities, for inundated areas, one may want to consider the new Landsat Dynamic Surface Water Extent (DSWE) map, which can be updated every two weeks and performs decently in vegetated areas. As stated, the Sentinel-1 radar data can also be used to map inundation approximately every 5 days, providing information on inundation duration. Moving forward, the NISAR satellite will be launched

in 2022 and will have an L-band radar instrument that will be able to map surface water extent as well as inundated vegetated areas.

In contrast, the NASA Surface Water and Ocean Topography Mission (SWOT) satellite, with a Nadir altimeter and a KA-band radar interferometer, is designed to map surface water height, not area extent. This satellite is also planned for launch in 2022. Under section Alternative Data Sources – Inundation, this description of SWOT should be corrected.

It is understandable that inundation depth was not accounted for in the inundation analysis due to lack of data. However, with SWOT data, calculation of inundation depth in open water areas may be possible if bare earth elevation is known. Because habitat quality is related to inundation depth, this metric could be considered in future monitoring efforts.

Charge Question 4:

How achievable are the targets relative to the stated time scales?

Since much of the land available for restoring connectivity is privately owned, the availability of willing sellers will partially determine how achievable the targets are. Progress in this performance measure is closely related to progress in other Performance Measures such as 4.16, Acres of Natural Communities Restored, since restoration of some ecosystems like tidal wetlands, willow riparian or valley foothill riparian may co-occur with restoring connectivity and inundated areas.

Charge Question 5:

How well were scientific uncertainties (both outside and within management control) incorporated in the development of the targets and in the assessment of progress toward the targets?

The performance measure text does not provide details on scientific uncertainties both outside or within management control. The target acres for inundated floodplain area was increased to account for uncertainty in creating suitable habitat for salmonids, but careful site selection and planning should address this uncertainty. Mapping error in remote sensing products such as surface water extent should be considered when assessing progress toward targets.

Charge Question 6:

Are the identified data sources complete and appropriate to support robust assessment of the performance measure?

See response to question 3. For the inundation target, continue to use Sentinel data. Consider the use of the Landsat DSWE product in the short term, and NISAR radar data when it is available after 2022. SWOT is not used to map surface water extent, but

could be used to track water depth. For the connectivity target, data sources seem complete.

Charge Question 7:

How well are adaptive management and alternative actions considered in performance assessments and reporting?

Adaptive management and alternative actions are not considered in performance assessments and reporting, except to mention that reporting every five years will inform the Council's adaptive management and other relevant decision-making.

Performance Measure 4.16: Acres of Natural Communities Restored

Charge Question 1:

How clear and thorough are the performance measure's metric, baseline and target? What, if any, additional information is needed?

The metric, baseline and target for acres of natural communities restored is clear.

Charge Question 2:

How clear is the basis for selection of the performance measure? How complete are the scientific rationale, the justification, and the supporting references for the selection?

The basis for selecting the performance measure is clear, given that more than 90% of natural communities in the Delta have been lost through reclamation and land conversion. A critical part of the basis for selection is that restoration of these natural communities is a crucial step in native species recovery. The basis for selection states that at least 11 recovery and conservation plans exist for the Delta and Suisun Marsh that identify restoration and management actions needed to achieve recovery of 35 species of special-status plants and 86 fish and wildlife species of conservation concern. More references are needed to support the statement that restoration of natural communities should include restoration of underlying processes that support their recruitment, disturbance regimes, and community succession.

Charge Question 3:

How clear and complete is the scientific basis for setting the targets? How complete is the consideration of key scientific references, available data, and existing monitoring capabilities?

The scientific basis for setting the targets is not entirely clear. According to the Basis for Selection, one of the purposes of restoring natural communities is recovery of the multiple special status species in the Delta and Suisun Marsh. According to Table 1, all wetland target acres are based on the Central Valley Flood Protection Plan, which only considers Chinook salmon. Other sources of information, such as shortfalls in habitat required for non-breeding shorebirds (Dybala et al. 2017) is not considered in setting targets for wetland restoration. Also, the total area of land lost for each natural community, as documented in SFEI's Sacramento-San Joaquin Delta Historical Ecology Investigation (Robinson et al. 2014, Whipple et al. 2012) was not considered in setting targets. It is unclear why the Grassland ecosystem type has a Target Acres set to 0. Decline in grassland at the Delta perimeter has been significant. While there is currently more grassland mapped now than historically, much of this is fallow land within the interior Delta that used to be freshwater emergent wetland (Whipple et al. 2012, p. 66) and likely does not provide the same function as historical grasslands on the perimeter.

Grasslands support high biodiversity; in particular, California annual grasslands support 75 species including 10 vertebrates, 14 invertebrates, and 51 plants that are listed as threatened or endangered under the Endangered Species Act (Jantz et al. 2007).

High-resolution vegetation mapping by VegCAMP seems to be an appropriate way to monitor change in restored area. However the accuracy of each mapped category should be considered when determining progress toward meeting targets. VegCAMP should also be used to track loss in natural communities from land conversion to quantify net increase from baseline acres. While the basis for selection of this performance measure includes restoring ecosystem functioning, there is no monitoring metric identified that would evaluate the quality of the restored natural community.

Charge Question 4:

How achievable are the targets relative to the stated time scales?

Since much of the land available for restoration is privately owned, the availability of willing sellers will partially determine how achievable the targets are. Restoration of physical processes that enable the formation of these natural communities will also determine the rate of restoration; progress in this performance measure is closely related to progress in other Performance Measures such as 4.15, Seasonal Inundation (restoring land-water connections), which will likely be needed for riparian restoration.

Charge Question 5:

How well were scientific uncertainties (both outside and within management control) incorporated in the development of the targets and in the assessment of progress toward the targets?

The performance measure text does not include any discussion on scientific uncertainties. These include land area available for restoration, error in mapping natural communities, uncertainties in restoration trajectory and quality, and capacity of restored areas to support special status species and help meet targets for species recovery plans.

Charge Question 6:

Are the identified data sources complete and appropriate to support robust assessment of the performance measure?

The data sources are appropriate. New data sources will become available soon, such as the Central Valley Joint Venture 2019 Implementation Plan, which could be used to support assessment of the performance measure. However because not all data sources were used to create each target, it is not clear how they will be used to assess the performance measure.

Charge Question 7:

How well are adaptive management and alternative actions considered in performance assessments and reporting?

Adaptive management and alternative actions are not considered in performance assessments and reporting, except to mention that reporting every five years will inform the Council's adaptive management and other relevant decision-making.

References

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