SLO COUNTY apcd
Air Pollution Control District
San Luis Obispo County

September 4, 2020

Sarah Miggins
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California Department of Parks and Recreation
P.O. Box 942896
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SUBJECT: California Department of Parks and Recreation's August 1, 2020 Oceano Dunes SVRA Draft 2020 Annual Report and Work Plan in Response to Stipulated Order of Abatement Number 17-01

Dear Ms. Miggins:

We are in receipt of your August 1, 2020 Draft 2020 Annual Report and Work Plan (ARWP) for the Oceano Dunes SVRA as well as the comments on the ARWP from the Scientific Advisory Group (SAG); thank you for meeting the deadline.

Based on the SAG and District review of this first draft, the ARWP is not acceptable in its current form; specific comments are enclosed. The District believes that the ARWP can be revised in time to approve it and implement the winter 2020/2021 mitigations, however, we must move quickly to revise the ARWP to meet the required timelines.

Based on the timelines required by the Stipulated Order of Abatement (SOA), State Parks has 21 days or until September 25, 2020 to make the correction and submit those changes for SAG and District review. However, the order does not allow for additional submittals past October 1st, so it is important for State Parks to have an approvable plan to the District by October 1st. To allow the SAG time to opine on the next draft, State Parks should plan to have a revised version completed by September 17, 2020.

After receipt of a provisionally approvable ARWP as required by the SOA, the APCD will schedule a public workshop using teleconference and/or ZOOM remote meeting interfaces to consider public comment. Within 7 days of the workshop, the District shall approve or conditionally approve the 2020 ARWP.

As requested by the Hearing Board, annual Hearing to discuss SOA compliance is scheduled for October 23, 2020 and will also be held remotely using ZOOM.

Feel free to contact me with any questions.

Respectfully,

GARY E. WILLEY
Air Pollution Control Officer

Enclosures

cc: Jon O'Brien, CA DPR, Hearing Board, District Board, District Counsel, Coastal Commission Staff & SAG

General Impression

Workplan for 2020-2021

The Annual Report and Work Plan (ARWP), received on August 3, 2020, documents the substantial efforts undertaken by State Parks to reduce emissions from the ODSVRA and improve air quality downwind of the Park. It also proposes an ambitious and well-designed monitoring plan; however, it fails to outline a path to achieving the goals of the Stipulated Order of Abatement (SOA),[1] and therefore it cannot be approved in its current form. Specifically, for the 2020-2021 cycle, the ARWP proposes to increase in the areal extent of wind-season dust controls from 230.9 to 270.9 acres. Without a detailed plan showing how State Parks will meet the SOA's initial target of a 50% reduction in PM_{10} mass emissions, the net increase of 40 acres of mitigation is not an adequate increment of progress toward the approximately 500 acres which State Parks' Particulate Matter Reduction Plan (PMRP)[2] estimated are needed to meet that target. Furthermore, the expected air quality impacts of the new 40-acre project have not been estimated, as required by Sections 4.d and 4.f of the SOA.[3]

The ARWP notes that the air quality model which generated the 500-acre estimate is being refined, and the District acknowledges that these refinements *could* show that compliance with the emissions reduction target is possible with fewer than 500 acres of controls. The ARWP also questions whether the SOA's default emissions reduction target (50%) is achievable or even appropriate. The SOA's overarching goal is to meet the state and federal PM_{10} standards,[4] and the District acknowledges that this *might* be achievable with a modified emissions reduction target. On the other hand, State Parks' has not yet proposed—nor has the District approved—any alternatives to the emissions reduction target or to the compliance scenario in the approved PMRP. Until either of those of things happen, the work plan must be designed to achieve the initial targets.

This is essentially the same position the District took a year ago on the 2019 ARWP:[5] "The District … recognizes that the PMRP compliance analysis estimate of 500 acres will likely change; however,

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[1] San Luis Obispo County Air Pollution Control District Hearing Board, "Stipulated Order of Abatement, Case No. 17-01," May 4, 2018. Available online: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/Filed%20%26%20Approved%20SOA%20Case%2017-01%20Apr-30-18.pdf

[2] California Department of Parks and Recreation, Off-Highway Motor Vehicle Recreation Division, "Oceano Dunes SVRA Draft Particulate Matter Reduction Plan," June 2019. Available online: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/Draft_PMRP_20190606.pdf.

[3] SOA 4.d states that ARWPs "shall propose dust control activities to be undertaken or completed in the next year **together with analyses of expected outcomes, mitigation effectiveness, and potential emissions reductions**;" and SOA 4.g states "Each [ARWP] will estimate, using air quality modeling, the benefits downwind of the ODSVRA and, specifically, the anticipated reduction in PM_{10} concentrations in populated areas due east of the ODSVRA on the Nipomo Mesa. These estimates will include a sensitivity analysis on emissions rates of increasing the level of effort for each mitigation technique in subsequent years;"

[4] SOA 2.b states "The [PMRP] shall be designed to achieve state and federal ambient PM10 air quality standards;"

[5] Gary E. Willey to Dan Canfield, August 26, 2019, "California Department of Parks and Recreation's August 1, 2019 Oceano Dunes SVRA Draft 2019 Annual Report and Work Plan in Response to Stipulated Order of Abatement." Available online: https://storage.googleapis.com/slocleanair-

until this estimate is revised, the design goal must remain 500 acres ... Unless and until changes to the target are proposed by OHMVR and then approved by the SAG, the design goal must remain a 50% reduction in emissions, and the ARWP must outline a viable path to achieving that goal."

The November 2019 modification to the SOA ("MOA")[6] required State Parks to implement a total of 92.2 acres of additional dust controls in the 2019-2020 cycle. This acreage requirement was designed to make steady progress toward implementing the PMRP compliance scenario by the deadline in the SOA. Specifically, the PRMP estimated that 501.1 acres of dust controls were needed, 132.2 acres were already in place, and 4-years remained to complete the balance of 368.9 acres. Thus, 92.2 acres per year were needed to make steady progress. Table 3-11 of the present ARWP indicates that, as of spring 2020, a total of 230.9 acres of mitigations have been deployed; thus, applying similar logic, 90.1 acres of new dust controls per year for the next 3 years would constitute steady progress. This is consistent with the SAG's review letter, dated August 31, 2020, which recommended that the "ARWP plan for an increase in the amount of new dust mitigation treatment areas beyond the 40 acres stated in the draft ARWP to at least double this amount."

For these reasons, the District could find the mitigation efforts in the ARWP provisionally approvable if it satisfies one of the following:

- Propose increasing the areal extent of dust controls by about 90 acres, bringing the total extent of wind-season dust controls to about 320 acres. The plan suggested by the SAG in Figure 1 of their review letter would suffice. Alternatively,
- Model a compliance scenario which demonstrates meeting the initial emissions reduction target (a 50% reduction in mass emissions) with fewer than 500 acres, and then propose new dust controls consistent with making steady incremental progress toward implementing that scenario, or
- Propose a modification of the initial emissions reduction target, model a compliance scenario which demonstrates meeting the modified target, and then propose dust controls consistent with making steady incremental progress toward implementing that scenario. Any proposal to modify the SOA 2.c emissions reduction target would require the endorsement of the SAG and approval of the APCD and/or the Hearing Board.

The District recognizes that critical data collection and analysis activities are ongoing. These activities, which include updating the emissions and dispersion model, are supported by the District as they are likely to yield a more refined estimate of what is needed to comply with the SOA 2.b goal of achieving the state and federal PM_{10} standards; however, it will likely take several months at a minimum for these activities to be completed. The District could therefore accept an ARWP which

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org/images/cms/upload/files/Aug%2026%202019%20APCD%20Response%20to%20SP-Aug%201%202019%20ARWPCOMBINED.pdf

[6] San Luis Obispo County Air Pollution Control District Hearing Board, "Order to Modify Existing Stipulated Order of Abatement, Case No. 17-01," December 9, 2019. Available online: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/AMENDED%20Order%20of%20Abatement%2011-18-19_FILED_12.pdf

proposes a default plan consisting of about 90 acres of new dust controls along with an option to propose alternative mitigations at a later date. The alternative would be based on updated modeling or other analysis not currently available. Switching from the default 90-acre plan and implementing the alternative would require the recommendation of the SAG and approval of the APCD. A public workshop, noticed according to the procedures outlined in the MOA, would also be required, to meet the spirit of that document since it requires that the ARWP go through a workshop.

If State Parks pursues this option, the ARWP should propose a clearly defined process—including deadlines—for making the choice between the default and alternative mitigation plans. Among other deadlines, it should define the date which by State Parks will commit to the default plan if the alternative has not yet been approved. Lead times for permit applications and approval of other agencies (e.g., the Coastal Commission) should be considered. Consistent with the process in MOA section 7, the SAG should be given at least 10 business days to review the plan and submit a recommendation to the APCD, and the APCD should be given at least 7 days after the receiving the SAG's review, to deny or provisionally approve the plan. If provisionally approved, the APCD should schedule a public workshop for no sooner than 15 days after issuing the provisional approval. Based on feedback received at the public workshop, the APCD would issue a final approval or denial within 7 days of the workshop.

Mass Emissions versus Receptor Concentration

According to Sections 2.2 and 3.3 of the ARWP, the Desert Research Institute (DRI) model estimates that the current wind-season dust controls (230.9 acres) have resulted in a 54% to 58% reduction in PM_{10} concentration at CDF and a 14.7% reduction in mass emissions, relative to the 2013 baseline defined in the ARWP. Section 2.2 of the report states that "These model results suggest that the dust controls are effective at reducing the downwind PM_{10} concentrations at receptor sites to a greater degree than is indicated by the reduction in total mass emissions." This is expected. When an emission rate changes at a source, the effect on a receptor will depend on where the receptor is located relative to the source. Receptors that are upwind or far from the source will experience little to no change in concentration, while nearby downwind receptors may see very large changes. To date, ODSVRA mitigation efforts have been focused upwind of CDF, so it is not surprising that large concentration reductions have been modeled (and observed) at CDF. While this PM_{10} *concentration* reduction is greater than the Park-wide *emissions* reduction, it is likely that other downwind locations have not experienced that magnitude of PM_{10} reduction. In fact, Sections 2.2 and 3.3 of the ARWP both state that "The DRI model is also used to evaluate potential changes in downwind PM_{10} concentrations at selected receptor sites such as CDF and MESA2;" however, the Mesa2 results are not reported. The District anticipates that the modeled reduction in Mesa2 concentration is much less than that at CDF and quite possibly even less than the 14.7% reduction in Park-wide mass emissions.

ARWP Section 3.3 states that "Discussions between the SAG, DRI staff and CDPR staff on this topic included discussions around possible alternatives to the existing SOA goals that appear unachievable. All parties will continue coordination on possible SOA Goal Alternatives, noting that the foremost goal is to achieve reductions in PM10 concentrations toward attaining state and federal air quality standards while minimizing impacts to public recreation opportunities." It is unclear what is meant by "the foremost goal." It is not a goal of the SOA. Section 2.b clearly states that the goal is to "to achieve state and federal ambient PM10 air quality standards" not to merely "achieve reductions in PM10 concentrations *toward* attaining" the standards. Furthermore, "minimizing impacts to public recreation opportunities" is not a goal or consideration of the SOA. Modifications of the SOA goals would need to be approved by the Hearing Board.

Based on these passages as well as statements made by State Parks, the District is concerned that State Parks may propose abandoning the SOA 2.c emissions reduction target in favor of a concentration reduction target. It is not an accident that SOA includes a mass emissions-based target rather than a concentration-based target; rather, it was crafted that way to ensure that PM_{10} levels would be reduced across the Nipomo Mesa rather than at a specific site. (See the Appendix for further discussion.) Put another way: Inevitably, dust mitigation projects will be designed to meet (and evaluated against) the explicit goal(s) of the SOA. If the goal is a reduction in PM_{10} concentration at a certain receptor, then projects will be developed to reduce PM_{10} there, but other receptors will not likely enjoy the same benefits. By including a goal based on *mass emissions from across the most emissive zone of the ODSVRA* (i.e., the open riding and camping area), SOA seeks to ensure that the benefits of dust control are distributed across the downwind area.

The District is open to entertaining changes to the SOA 2.c target as required by SOA 2.d[7] and supports the recommendation in the SAG's review letter that "that OHMVR engage with a subset of SAG members to seriously consider scientifically-justified alternatives to the current 50% emissions reduction target that may more directly reflect the impact of dust mitigation treatments on downwind airborne dust concentrations." However, the District cannot approve shifting from a Park-wide mass emissions basis to a receptor concentration basis unless safeguards are included to ensure that air quality improves across the Mesa. It is a priority of the District to improve air quality for *everyone* downwind of the ODSVRA; PM_{10} should not only be reduced at CDF.

As discussed in Appendix, the emissions reduction target of 50% was developed from a simple comparison of PM_{10} concentrations between CDF and the Oso Flaco monitoring site. The District could approve an alternative emissions reduction target if supported by modeling or other analyses demonstrating attainment of the PM_{10} standards with the alternative target.

[7] In fact the District has already approved changes to the 2.c target: the DRI model is being used in lieu of the CARB model and the definition of the baseline has changed from "the maximum 24-hour PM10 baseline emissions … based on air quality modeling based on a modeling scenario for the period May 1 through August 31, 2013" to the 10 days in this period with the highest modeled emissions. See ARWP Section 2.4.1.

Additional Comments

The following comments on specific sections of the ARWP must also be addressed in a revised ARWP.

2.3.1 Meteorological, PM, and Saltation Monitoring

ARWP Figure 2-4 shows an "In situ calibration" plot of Hourly BAM_{10} concentration versus Hourly MetOne PM_{Bin6} concentration. No other details of the calibration procedure are provided, so the following observation may be misplaced, but it would appear from the figure that the BAM data are being treated as the dependent (y-axis) variable and the Met One particle profiler data as the independent (x-axis) variable; this may introduce bias into PM_{10} values estimated from the profiler data. This bias is likely to be small, but nonetheless it is more appropriate to swap the axes and treat the BAM data as the independent variable and the profiler data as the dependent data. Treating the data this way, ordinary least squares (OLS) would yield a slope, *m,* and intercept, *b*, for the linear profiler versus BAM relationship; the correction equation for the profiler data would then be:

$$Corrected\ Profiler\ PM_{10} = \frac{1}{m} \times PM_{bin6} - \frac{b}{m}$$

Note that the correction equation derived from this procedure will be different from one derived by treating the profiler data as the dependent variable and the BAM as the independent (the situation depicted in ARWP Figure 2-4), even though the R^2 values for the two regressions will be identical. This is because by construction, the independent variable in OLS is assumed to be measured without error, and all noise or error in the fit is assigned the dependent variable; the best fit line is thus one which minimizes the vertical differences between the observed dependent values and the line. Treating the data as in Figure 2-4 implicitly assumes that it is the profiler data that is measured without error and the differences between the measured data and the best line are due to noise or error in the BAM data. Instead, treating the profiler data as the dependent variable and the BAM as the independent variable, as we suggest, assumes the opposite: that the BAM data is measured without error and the noise "lives with" the profiler measurements. While neither the BAM nor profiler measurements are noise-free, the profiler measurements are likely noisier,[8] and thus should be treated as the dependent variable in order to minimize attenuation bias.[9]

Additionally, Table 2-2 in this section shows the position of BSNE sand traps within two dust control areas in 2019. For the 37.7-acre fence array, "Normalized Distance" is defined in terms of "Distance/Fence Height," while for the 7-acre revegetation site it is defined in terms of "Distance/Total Length of Transect." This difference should be explained. This section would also

[8] If the BAM and profiler were equally noisy (or if the noisiness of each were well-characterized), then Deming regression would be the preferred approach, as it can account for measurement error in both variables.
[9] For a basic introduction to attenuation bias, see the video "Measurement Error," Nathan Wozny, April 4, 2016. https://www.youtube.com/watch?v=Pz4ephK-f94.

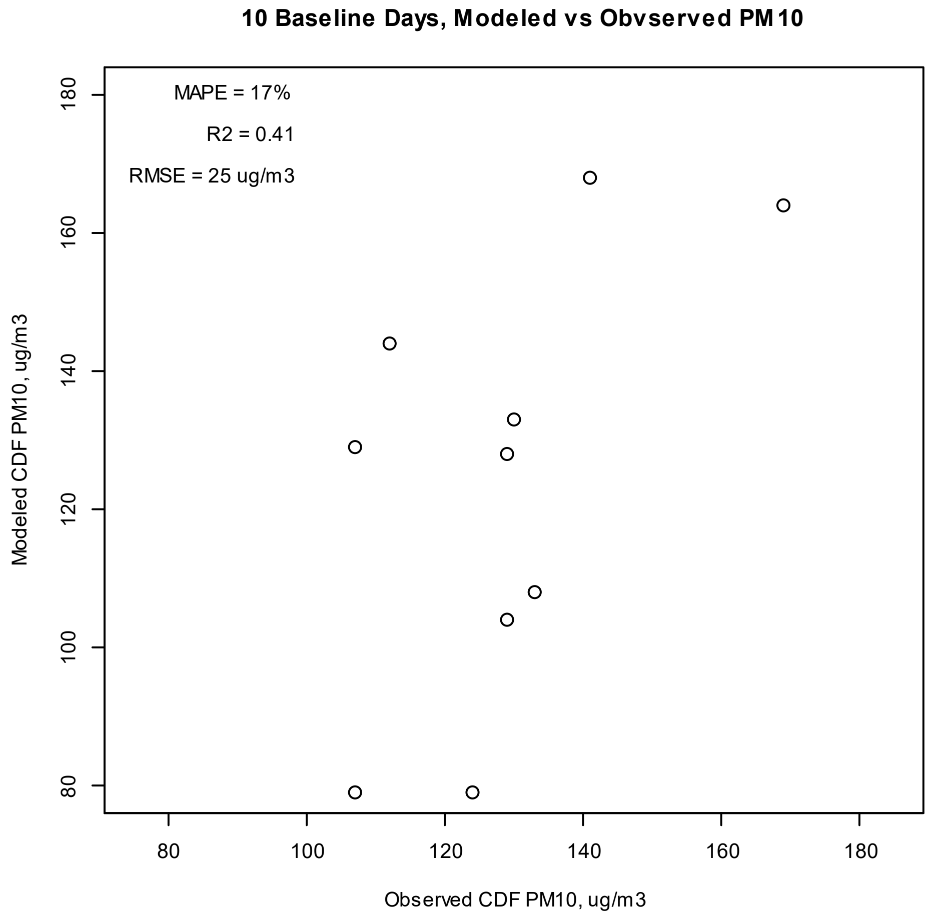
benefit from a graphical or tabular presentation of the normalized sand flux (NSF) results that are mentioned in the text.

2.3.3 DRI Model Verification

The District supports the using the 10 "baseline days" for evaluating progress toward mitigating ODSVRA dust impacts; however, we do not think it is sound to evaluate the model itself using just these 10 days. As explained below, it would be better to evaluate the model's performance against the entire dataset or at least a subset of days spanning the full range of observed daily averages.

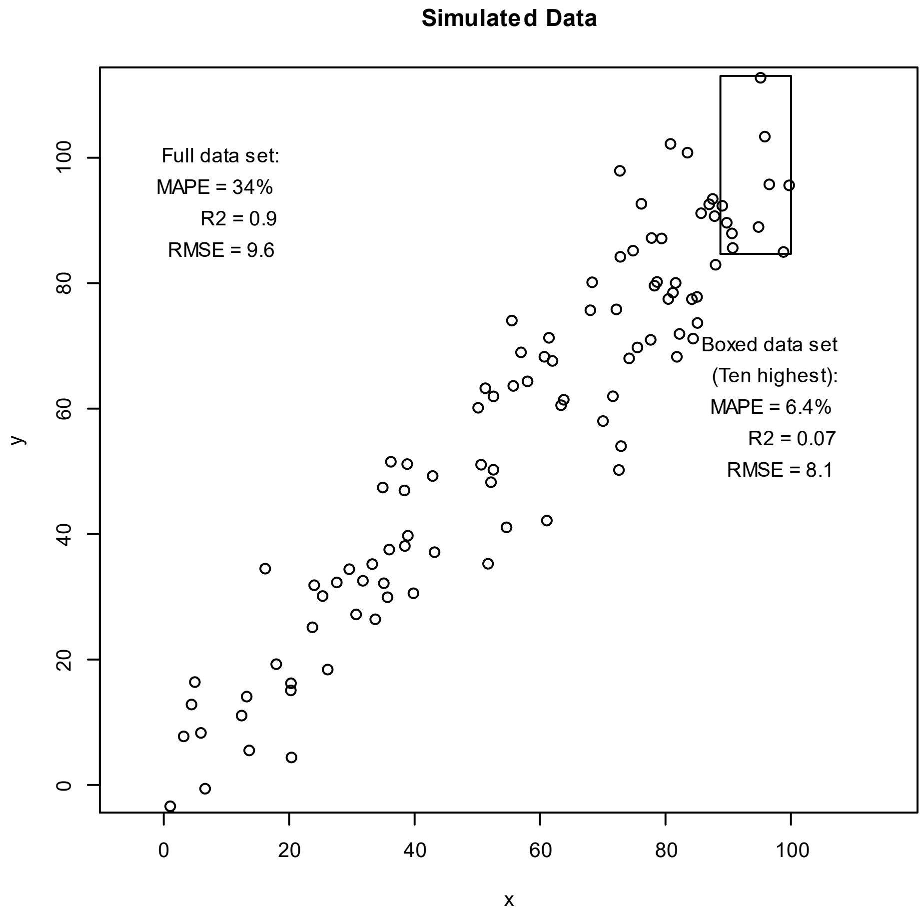
In the figure below, the CDF data from Table 2-4 in ARWP is presented as a scatter plot rather than a bar graph as in Figure 2-9. Viewed this way, the correlation between modeled and observed PM_{10} for these 10 days at CDF is not very impressive, and the R^2 for these data is only 0.41. For these 10 points, the mean absolute percent error (MAPE) is 17% and the root mean square error (RMSE) is 26 μg/m^3;[10] however, a "naïve" or "intercept-only" model which does not have any meteorological or emissions inputs and always predicts the observed mean (128 μg/m^3), performs even better, with a MAPE of 9.7% and RMSE of 17 μg/m^3. The results for Mesa2 are even worse: using the DRI predicted concentrations, R^2 = 0.07, MAPE = 24%, and RMSE = 25 μg/m^3, while for a naïve model which always predicts the observed mean (96.4 μg/m^3) MAPE = 17% and RMSE = 20 μg/m^3.

[10] The ARWP states that MAPE "considering both sites" is "17% (±11%)," but this appear to be an error. The MAPE for CDF is 17% (± 12%), and combining the top 10 observations from each site, the pooled MAPE is 20% (±16%).



Thus, it would appear that the entire model could be dispensed with in favor of always predicting the mean. This, however, is an artifact of only considering a limited range of the dataset, in this case the 10 highest days. To be clear, the District does not believe that a model with no meteorological or emissions inputs performs better than the DRI model. As shown in the simulated data below,[11] even a strong correlation can appear poor when evaluated over a narrow slice of the data. These 100 points are strongly correlated, with $R^2 = 0.90$ ($r = 0.95$, p-value $< 2.2 \times 10^{-16}$); however, considering only the 10 points with the highest x values, the R^2 is only 0.07 ($r = 0.27$, p-value = 0.46). If the y values represent modeled values of x, then the MAPE and RMSE for the full dataset are 34% and 9.6, respectively. The "model" would clearly outperform a naïve model that always predicted the mean of x, the MAPE and RMSE of which being, 46% and 28, respectively. On the other hand, considering only the 10 highest points, the naïve model has the better RMSE (3.6 versus 8.1), while they are about the same in terms of MAPE (7.0% versus 6.4%).

[11] The x values were drawn from a uniform distribution from 0 to 100, and each y value was generated by adding a draw from normal distribution with mean = 0 and standard deviation = 10 to its corresponding x value.



For these reasons, the analysis presented in this section of the ARWP does not actually verify the model performance. The District also questions the need for any additional verification, as the model has already been endorsed by CARB and the SAG and published in a peer-reviewed academic journal;[12] however, if additional verification is desired, the District recommends using the entire dataset or at least a subset of days spanning the full range of observed daily PM_{10} averages. This applies to both sections 2.3.3.1 and 2.3.3.2, which evaluate model performance against the regulatory sites (CDF and Mesa2) and the temporary E-BAM sites, respectively.

2.4.3 COVID Closure study

The District supports studying the effect of the current OHV and camping ban on dust impacts. The grading undertaken by State Parks early on during the closure (noted in ARWP Attachment 4 and cited in the California Coastal Commission's Executive Director Cease and Desist Order No. ED-20-

[12] J.F. Mejia, J.A. Gillies, V. Etyemezian, R. Glick (2019). "A very-high resolution (20m) measurement-based dust emissions and dispersion modeling approach for the Oceano Dunes, California," *Atmospheric Environment*, 218:116977. https://doi.org/10.1016/j.atmosenv.2019.116977.

CD-01)[13] should be acknowledged in any analyses. While camping and public vehicular access ceased in March, the frequency and extent of grading/bulldozing activities in the ODSVRA reportedly increased significantly in April, May, and June. Therefore, at times some areas of the Park may have been just as disturbed as they were when OHV activity was allowed.

3.1.2 Remaining Initial SOA wind fence - conversion to native dune vegetation

The District supports converting the remaining initial SOA wind fence arrays to vegetation islands; however, State Parks must minimize the delay between removing the existing wind fences and initiating planting activities. During the transition from fence array to vegetation, restoration areas must remain fenced, with OHV activity and camping prohibited.

As noted in 2.1.3 of the ARWP, a total of 35 acres of wind fencing were removed in September 2019, but it was not until March of 2020 that these areas were fully treated with native vegetation and/or straw. This is too long, especially as no justification for this delay has been provided. The District has not completed a full analysis of the monitoring data from 2019, but it appears that PM_{10} levels at CDF and Mesa2 increased in the fall relative to the historically low levels observed in the spring. This coincided with when the existing wind fencing had been removed in preparation for planting.

The implementation schedule in Table 5-3 shows the fences being removed in September and mulch/straw application beginning in October but not being completed until November. Thus, these dune sheets will be at least partially uncontrolled during October, which is often just as windy as the spring months; in fact, in 2019 there were more exceedances of the state PM_{10} standard at CDF in October than in any other month that year. As noted above, the window of uncontrolled emissions must be minimized; State Parks should also consider shifting this window further into the winter, and/or applying the mulch/straw treatment concurrently as the wind fences are removed.

3.1.4 Removal of 2019-2020 seasonal wind fencing (two 20-acre arrays)

The MOA 3.x requires that these seasonal dust controls remain in place through October 31: "x. This project shall be maintained until at least October 31, 2020." The implementation schedule in Table 5-2 shows the removal of these fences starting September and being completed in October. This is inconsistent with the MOA. The implementation schedule must be revised to show this item beginning in November.

3.1.6 Dust Control Treatment for southern 20-acre wind fence array from 2019 – tbd

The District supports converting this area to permanent dust controls; however, this section is incomplete as no dates have been provided for when the treatment will be completed (see Table

[13] California Coastal Commission, "Consent Executive Director Cease and Desist Order No. ED-20-CD-01," July 7, 2020. Available online: https://documents.coastal.ca.gov/reports/2020/7/W6a/EDCDO Findings and NOI 070720.pdf.

5-6). The District acknowledges that the details of the dust control treatment are still being developed; however, State Parks should still include a completion date for the project, as they have for the project in the next section, which is also not fully designed.

3.1.7 New Temporary vehicle exclosure/seasonal dust control treatment – wind fence or straw mulch (40 acres)

Without the location(s) of the proposed dust controls, this section is incomplete. Relatedly, the SOA 4.d requirement that ARWPs "propose dust control activities to be undertaken or completed in the next year **together with analyses of expected outcomes, mitigation effectiveness, and potential emissions reductions**," (emphasis added) is also not met. Per the SOA process, mitigation measures are to be fully proposed and modeled in the ARWP. These details are to be included in the next draft.

3.2 Expected Outcomes, Effectiveness, and Potential Emissions Reductions and 3.3 Sensitivity Analysis / Projection of Additional Controls Necessary to Achieve a 50% Reduction in Maximum Baseline Emissions

These sections rely heavily on ARWP Attachment 3, which is a PowerPoint presentation titled "Oceano Dunes, Emission, Dispersion, an Attribution Model Results and Treatment Assessment," by DRI researchers Jack Gillies, John Meija, Eden Furtak-Cole, and Vic Etyemezian. Without a transcript or recording of the presentation, it is very difficult to understand the meaning of many of these slides. As such, the District does not consider Attachment 3 to be an appropriate supporting document for the ARWP. If State Parks wishes to use the information in the presentation to support the ARWP, then they must submit additional information. Ideally, State Parks or DRI could develop a written report explaining in detail the same results discussed in the presentations. At minimum, a transcript or audio recording of the presentation should be provided.

The results discussed in these sections were obtained using the updated model described in Attachment 3, which uses a different method for generating the emissions grid than was used in the modeling presented in the PMRP. The District is concerned that the new methodology may be over-smoothing the underlying emissions, which could bias the estimate for how many acres of controls are needed to meet the SOA requirements. At any rate, no justification has been provided for the new methodology, so the District cannot endorse it at this time. Karl Tupper, the District's Senior Air Quality Scientist, detailed these concerns in an email to Jack Gillies (DRI and SAG member) and Bill Nickling (SAG Chair) in June, the relevant portion of which is reproduced here:

> *After thinking about it for a while, I am concerned about the new emissions grid that Jack presented at the last SAG meeting and the conclusions being drawn from it. These results were also mentioned during the SAG presentation to our Board. I think we need to discuss the issue further before too much more is said about and done with the new grid. The PMRP modeling suggested a scenario in which 500 acres of controls would be*

needed to meet the SOA goals. If I understand correctly, the new modeling suggests that more that this may be needed. At a minimum, I think we need to understand why the two models give different results before we decided which results to use.

In a nutshell, I am concerned that the new emissions grid may be over-smoothed, causing hot spots to appear less hot, while less emissive areas appear more emissive; the net result of which is to make it appear that emissivity doesn't vary as much across the ODSVRA. With fewer hot spots (or less-hot hot spots) the strategy of "targeting hot spots to get the most bang for your buck" looks less appealing. So before we start jumping to conclusions based on the new grid, at a minimum we need to understand why the new grid is different.

That was the nutshell, the more detailed version is this: As you know, the model needs an emissivity estimate for each grid cell. With the CARB-generated emissions grid (which was used in the PMRP modeling and the associated publication), for grid cells without a PI-SWERL measurement, it takes the 5 nearest PI-SWERL measurements and averages them using applying a $1/r^2$ *weighting, where r is the Euclidean distance between the measurements and the cell being estimated. The new emissions grid disclosed by Jack uses the most recent PI-SWERL measurements and a somewhat different interpolation scheme. Frankly, I don't remember the details except that is it different, and after the 1/r or* $1/r^2$ *weighted averaging is done there's an additional smoother that is applied.* [According to ARWP Attachment 3, it is a $1/r^2$ weighting of the nearest 20 measurements, followed by a "9 x 9 smoothing filter."] *I am worried that the smoother may be smoothing over real features—hot spots and "troughs" of low emissions.*

So I think we need to get to the bottom of this. Why are the grids different and leading to different conclusions? Is it the new data or the new interpolation algorithm? The obvious thing to do (in my mind) would be to apply the CARB algorithm to the new data and see how the grids compare. (Or apply to the new algorithm to the old data...) Is the CARB method less smooth? If there are significant differences attributable to the interpolation algorithm, which algorithm is correct? I suspect the answer to this question can be determined from the data through cross-validation. We don't need to make educated guesses about how much smoothing is appropriate, we can let the data guide us. (I did something like this back in 2016 with the 2013 PI-SWERL data, see the attached document—especially the "Determining the Optimal Level of Averaging" section.) If the different grids are not an artifact of the algorithm, then the difference must be due to the data—August 2013 vs spring 2018. And if that's the case, then which measurements should we use? That's a tough question--I have less intuition about that one, and I'm certainly open to ideas.

As noted in the email, State Parks should evaluate the emission grid methodology and determine whether the difference between the grids is an artifact of changing the interpolation algorithm or is due to actual changes in emissivity (or both). If the difference is due to changing the interpolation algorithm, then the model should use whichever methodology that is most accurate, and the ARWP must fully explain and justify how this judgement was made. To the extent that differences are due to changes in the measured emissivity, it should be determined whether those changes represent real, long-term changes in emissivity, or if they are short-term variations due to weather, recent wind-event history, or changing seasons.

The District appreciates the document "Investigating the Discrepancy Between the DRI and CARB Model Results for 2013 Emissivity Conditions," which was provided by DRI on August 31, 2020, and describes differences in the emissions grids calculated by CARB and DRI. These groups used the same methodology and same dataset, yet somehow the resulting emissivity maps are notably different; this document provides some possible explanations for this discrepancy. It also notes that in terms of emissions on the 10 baseline days, the two maps are very similar: "when the two methods are compared using the meteorology of the 10 baseline days, the patterns of emissions are much closer in agreement, even though the magnitude is different … in hindsight and in both modeling approaches (Fig. 2), suggests that placement of controls further east may have provided some additional benefit to improving air quality."

While informative, the DRI document does not adequately address the questions raised in the District's June email quoted above. The document states that

> *"To allow the direct comparison between the two years DRI first carried out two interpolation/extrapolation procedures for the PI-SWERL data. The first was the same procedure as previously done by DRI and CARB, i.e., data were extrapolated using a $1/r^2$ weighted distance of the 5 nearest measurements to develop an emissivity relationship for a grid cell that did not have a measurement within it … DRI also carried out a second interpolation/extrapolation procedure, with again a $1/r^2$ weighted distance but using 20 nearest neighbor measurements, and with an additional 9 × 9 grid cell smoothing to remove some of the blotchiness to the emissivity pattern. It turned out that the choice of interpolation/extrapolation had little effect on the total emissions for both years of PI-SWERL data, differing by <1% between the two approaches."*

It is unclear which PI-SWERL dataset was used in the analysis (2013 or 2018) and how the percent difference between results was calculated. The conclusion should be supported by a figure showing the emissivity maps derived from the same data using the two different methodologies.

Section 3.3 ARWP states that "DRI's emission modeling suggests that reduction in emissions is a linear relation between area under control and emission reductions, i.e., a 1% reduction in emissive area under control lowers mass emission by 1%." This statement is not supported by information in the ARWP or Attachment 3. Assuming dust controls reduce emissions to zero, then if the emission rate (which is a function of both emissivity and wind shear) was constant across the ODSVRA, then a 1 to 1 relationship would be expected between the percent of ODSVRA acreage with dust controls and percent emissions reductions. This, however, is not the case: both the original and new emissions grids have a heterogenous distribution of emissivity, and wind shear also changes across the domain, so the modeled emissions reduction must depend to some extent on *where* dust controls are placed, not just on their total areal extent.

The relationship between increasing dust controls and emissions reductions could be tested, for example, by modeling 230.9 acres of randomly distributed dust controls. If the model predicted about the same 14.7% emissions reduction reported in ARWP Table 3-11 for the dust controls currently on the ground, then the purported 1 to 1 relationship would be demonstrated.

Similarly, the statement that "The expected benefit of targeting 'hot spots' as identified initially in the CARB modeling has not resulted in 'extra' emission reduction, because that 'map' over-emphasized the presence of high emission areas," is not supported. As noted previously, it has yet to be determined whether the CARB map over-emphasizes hot spots, or the new DRI map under-emphasizes differences in emissivity (or whether emissivity was genuinely more heterogenous in 2013 compared to 2019). Furthermore, the new DRI emissivity map (page 25 of the ARWP Attachments PDF file)[14] still shows significant differences in emissivity across the riding and camping area, with some areas at least twice as emissive as others. As long as there is heterogeneity of emissivity, selectively targeting those higher emissivity areas should result in more emissions reduction per acre controlled.

The District agrees with the final two bullet points in the section—the scale of controls needed to meet the SOA 2.c emissions reduction target is indeed considerable, but capturing secondary effects of control measures in the model will likely reduce the estimated acreage needed to meet this target.

Additional SAG Comments

Please address the additional comments by Carla Scheidlinger and Raleigh Martin noted in the SAG's review letter, dated August 31, 2020.

Appendix: Background on SOA 2.c Emissions Reduction Target

In the years leading up to the SOA, State Parks had implemented annual dust control projects within the ODSVRA of up to 40 acres in size, but none of these had ever resulted in measurable air quality impacts downwind.[15] The District believed this failure to significantly affect air quality was due the

[14] Relatedly, the scale on the previous slide "Emissions for 3 PI-SWERL Test 'Wind Speeds (u*)' 2019" should be explained. The labels on the color scales are spaced uniformly, but the values do not increase uniformly (or logarithmically): 0, 0.02, 0.08, 0.32, 1.20, 1.60, 2.00, 2.60.

[15] San Luis Obispo County Air Pollution Control District, "2017 Annual Air Quality Report," November 2018. Available online: https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2017aqrt-FINAL2.pdf.

projects being too small and being located in the wrong area; this was confirmed by the CARB model, which was developed in 2017.

In crafting the SOA, the District sought to ensure that future mitigation projects would be large enough and in the right locations to not only measurably affect air quality, but to eliminate the excess emissions caused by decades of activity. This is the genesis of the language in Sections 2.b and 2.c of the SOA:

> *b. The [PMRP] shall be designed to achieve state and federal ambient PM10 air quality standards;*
>
> *c. To meet the objective of 2b, development of the [PMRP] shall begin by establishing an initial target of reducing the maximum 24-hour PM10 baseline emissions by fifty percent (50%), based on air quality modeling based on a modeling scenario for the period May 1 through August 31, 2013, and shall be carried out by the California Air Resources Board (CARB), or other modeling groups subject to the review of the Scientific Advisory Group (SAG), as defined in paragraph 3, below;*

This language was intended to ensure that the primary concern when designing dust controls is air quality, not impacts on recreation or other operational concerns. It also enshrines the use of modeling to guide the extent and placement of dust controls. Critically, it sets a quantifiable goal and a concrete "initial target" to be met by the deadline established in SOA section 2.a.

Section 2.c intentionally defined the "initial target" in terms PM_{10} emissions, i.e. kilograms of dust released into the atmosphere, rather than in terms of PM_{10} concentration at a specific receptor. This was chosen carefully, knowing that inevitably projects would be designed to meet the target, and if the target was a reduction in PM_{10} concentration at a certain receptor, then projects would be developed to reduce PM_{10} there—likely to exclusion of reducing concentrations elsewhere. By including a goal based on *mass emissions from across the most emissive zone of the ODSVRA* (i.e., the open riding and camping area), the SOA seeks to ensure that dust control benefits are distributed across the downwind area, rather than focused on a single location.

The specific emissions reduction target in Section 2.c—50%—was determined by comparing PM_{10} concentrations at CDF to Oso Flaco. While CDF is downwind of the open riding and camping area of the ODSVRA, Oso Flaco is within the Park but downwind of an area that has been closed to riding and camping for more than 30 years. Some amount of the PM_{10} measured at CDF under high wind conditions would occur even without OHV activity, but the difference in PM_{10} between these sites is assumed to be due to the long-term effects of OHV activity, namely destroying vegetation and increasing the emissivity of open sand areas. The comparison is not perfect—wind speeds tend be higher upwind of Oso Flaco and the site is closer to its source area than CDF—but it is nonetheless useful.

The Oso Flaco site was established in the summer of 2015. An analysis of the first full year of data (2016) data found that if concentrations at CDF had been reduced 53%, then the number of exceedances of the state PM_{10} standard at CDF would have equaled the number observed at Oso Flaco. Using 2017 data (which at the time was still preliminary), it was determined that a 49% reduction in CDF PM_{10} was needed to achieve the same result. Similarly, the annual average PM_{10} level at CDF was almost twice that of Oso Flaco: 35 $\mu g/m^3$ (CDF) versus 20 $\mu g/m^3$ (Oso Flaco) for 2016 and 43 $\mu g/m^3$ (CDF) versus 23 $\mu g/m^3$ (Oso Flaco) for 2017. It was thus determined that reducing PM_{10} at CDF by 50%, would achieve levels approximating those at an undisturbed “control” site, i.e. Oso Flaco. This concentration reduction target at CDF was then converted to a Park-wide emissions reduction target to prevent control measures from being narrowly focused on improving PM_{10} at a single receptor only, as discussed above.