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Selection of Projects and Management Actions for Salinas Valley Water Supplies

DRAFT Report

Purpose of the Report

Numerous groundwater management projects have been proposed by the Monterey County Water Resources Agency (MCWRA) and by the Salinas Valley Groundwater Basin Groundwater Sustainability Agency (SVGBGSA) and the other groundwater sustainability agencies (GSAs) in the six separate Groundwater Sustainability Plans (GSPs) adopted or drafted for the Salinas Valley. Although the SVGBGSA proposes that it should ultimately identify and adopt an integrated suite of multi-subbasin projects,[1] the GSPs do not provide a methodology or criteria for selecting that suite of projects, for allocating their costs, or for evaluating the choice between projects and management actions, including pumping controls.

This report is intended to identify economic and technical issues that should be addressed in the selection of water supply projects and management actions for the Salinas Valley. Water management agencies must resolve these issues to choose projects using an open and reasoned process. Ultimately, selection of projects and management actions is their responsibility.

Summary of Issues in Selection of Projects and Management Actions

1. Willingness to pay. First, the agencies must determine the willingness of urban water suppliers and agricultural users to pay for projects and management actions. It appears possible that the unit cost per acre-foot (AF) for many of the proposed projects may exceed willingness to pay. These projects are therefore infeasible.

2. Water needs and water rights. Second, the agencies should identify the water needs and water rights of the urban suppliers and agricultural water users because those needs and rights critically affect willingness to pay and the scope of needed projects and management actions. Users should not be willing to pay for water projects to provide new or relocated water to replace water they already have a right to obtain at their cost of pumping. Rough calculations based on data from

[1] See, e.g., 180/400 GSP, p. 9-25; Eastside GSP, p. 9-4.

the six GSPs suggests that at least 13,962 AFY of new or relocated water is needed to support urban suppliers and at least 28,630 AFY is needed to support agricultural users. If so, this suggests that projects or management actions providing at least 42,592 AFY are needed and that it may be equitable to allocate about one third of the cost of new water projects to urban suppliers and two thirds to agricultural users.

3. Equity issues between subbasins. Third, the agencies must address equity issues between subbasins. The ad hoc development of six GSPs by six different subbasin committees has resulted in inconsistent assumptions about water budgets and about responsibility for undertaking projects and management actions. Two of the six GSPs do not acknowledge overdraft conditions in their subbasins and it is not clear what responsibility, if any, these GSPs would assume for projects and management actions that benefit other subbasins. Another GSP assumes that the primary responsibility for managing overdraft and seawater intrusion lies with adjacent subbasins, and, again, it is not clear what responsibility this GSP assumes. The inconsistent approaches to water budgets and mitigation responsibility must be resolved in order to secure water users' willingness to pay for water projects or to incur the cost of pumping allocations and controls.

4. Costs and benefits of pumping reductions compared with infrastructure projects. Fourth, the agencies must weigh the costs and benefits of pumping reductions against the costs and benefits of infrastructure projects. Pumping reductions can be achieved by fallowing or by pumping allocations and controls. To the extent that the direct unit cost per AF for fallowing, or, alternatively, the opportunity cost per AF for pumping allocations and controls, are lower than the cost per AF for infrastructure projects, then pumping reductions may be preferable. Information from water markets, studies of other groundwater basins, and information in the GSPs regarding fallowing costs suggests that pumping reductions may in fact be less expensive than many of the infrastructure project proposals in the six GSPs.

5. Least cost alternatives. Finally, the agencies should work through the range of potentially feasible projects and management actions to identify the least cost combination. This requires more information about proposed projects, especially unit costs and benefit volumes and locations, than is currently available, at least in the GSP documents.

The water agencies should address and resolve these issues openly in selection of groundwater projects and/or management actions. Without resolution of these issues, it is premature to proceed with the assumption that any particular project or projects should be pursued.

1. Determine the willingness to pay for water projects by agricultural water users and urban water suppliers because that determines project feasibility.

There is no point in pursuing projects that cannot be funded. Determining what projects may feasibly be funded requires estimating of the quantities of water (new or relocated supply) that would be purchased or financed at various price points, in effect developing a demand curve. It is not sufficient just to determine one value, e.g., the maximum amount that might be paid for an acre-foot by a farmer seeking to preserve permanent crops in an extended drought: a project is only economically feasible if there are buyers willing to pay the long term average cost for all of the water it supplies. Stakeholder rejection of the 2021 draft Proposition 218 Engineer's Report for the Nacimiento and San Antonio dams maintenance projects demonstrates that determining the willingness to pay is complex and that failure to determine willingness to pay accurately may result in significant delay in project selection and funding.

If projects are sponsored through the Sustainable Groundwater Management Act (SGMA) GSP process, then the GSPs must include both the estimated cost for each project and "a description of how the Agency plans to meet those costs."[2] DWR must have substantial evidence to support a finding that the projects are "feasible" and that the GSA "has the financial resources necessary to implement the Plan."[3] The current draft GSP's do not provide evidence that funding is actually feasible. Their discussions of project funding merely list the kinds of funding arrangements that are commonly used for large capital projects with no discussion of actual willingness to pay in the Salinas Valley.[4]

For agricultural uses, irrigation water is an input to production, so the maximum value of water is constrained by expected returns. There must be some price beyond which agricultural users will not pay for water projects. Is it $500 per AF? $750? $1,000? $1,500? And how much water would be demanded at each of these prices? The GSP's simply fail to address these critical questions. Furthermore, we are advised that MCWRA has not systematically studied willingness to pay for water projects. The GSAs or MCWRA should commission an econometric study to develop a rough demand curve to inform the feasibility of water supply projects for the Salinas Valley.

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[2] 23 CCR § 354.44(b)(8).

[3] 23 CCR § 355.4(b)(5),(9).

[4] Eastside GSP at 10-15; Monterey GSP at 10-23; Langley GSP at 10-15; UVA GSP at 10-15; Forebay GSP at 10-15.

Many of the projects proposed in the draft GSP's produce water that would cost over $1,000 per AF. There is at least some evidence that such projects may not be feasible. First, water markets provide some evidence of willingness to pay. Although some farmers have reportedly paid as much as $2,200 per AF for some amounts of water for high value crops (e.g., on a short term basis to protect investments in permanent crops), the average NASDAQ Veles California Water Index water futures price is now only $686 AF, an historically extraordinarily high price attained only as a result of a long drought period.[5] Agricultural water has reached market prices in the $500 to $1000 range only in times of water stress.[6]

Research in the San Joaquin Valley establishes that most farmers would not be willing to pay more than $300 to $500 per AF for new long-term supplies:

> Our economic model of valley agriculture (described below) provides some guidance on how much farmers would be willing to pay for additional long-term water supplies. This price is the profit farmers can earn with an additional acre-foot of water; above this level, it is more economical for them to reduce water use and irrigated acreage. A small number of farmers might be willing to pay a very high price—as much as $900/acre-feet (af)— to avoid long-term fallowing of some very profitable lands. And to cope with temporary shortages—such as at the height of the 2012–16 drought—some farmers will pay top dollar for water to keep their orchards alive. [footnote omitted] But with available options, most valley farmers will not be willing to pay more than $300 to $500/af for new long term supplies.[7]

That research establishes that many San Joaquin Valley farmers would be willing to forego water supplies at much lower unit costs, leading to the conclusion that investments are unlikely in projects costing more than $500 per AF:

> For more than half of valley cropland, the cut-off price would be much lower, because an additional acre-foot of water would generate less than $200 in added profits. This difference in the profitability of water in different uses drives incentives to trade water. When valley-wide surface water markets are allowed,

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5 Aquaoso, California Agricultural Water Prices by Water District, June 17, 2021, available at https://aquaoso.com/blog/california-agricultural-water-prices/**.**

6 *Id.*

7 Hanak et al, Water and the Future of the San Joaquin Valley, p. 22, Feb. 2019, available at https://www.ppic.org/wp-content/uploads/water-and-the-future-of-the-san-joaquin-valley-february-2019.pdf.

> the price of water in the market falls to about $185/af. In our analysis of willingness to pay, we consider farmers' water demand with and without valley-wide trading under current conditions, and we also consider the possibility that profitability of farm water use may increase by up to 25 percent from shifts toward more profitable crops, higher prices for farm output, or cost-reducing technology. With this higher profitability and no valley-wide water trading, some farmers would be willing to pay more than $500/af to acquire up to 340 taf of new supplies. With more limited increases in profitability and some valley-wide trading, farmers would only be willing to pay this price for up to 100 taf. We assume farmers would seek to invest in less expensive projects where feasible, however. This reduces the likelihood of investments in projects costing more than $500/af. See Technical Appendix D for details.[8]

Based on this analysis, the research concludes that the San Joaquin Valley farmers would only be willing to invest in a subset of the potential new water supply projects – those with the lowest cost, such as reservoir reoperation and some groundwater recharge projects. Similar analysis should be undertaken for the Salinas Valley.

Conditions and farming profitability per acre in the Salinas Valley differ from the San Joaquin Valley. However, the Salinas Valley GSPs do provide evidence of willingness to pay based on Salinas Valley farming conditions reflected in local land values. The analysis of fallowing and agricultural land retirement in the Eastside, Langley, Upper Valley, and Forebay GSPs indicates the limits to willingness to pay for water supplies by identifying the opportunity cost (i.e., lost profits) for not farming. Based on local land values, water usage per acre, and cover crop costs, these analyses conclude that farmers would be willing to fallow land, thereby making its water available to others, at costs of between $195 to $1,730 per AF.[9] As in the analysis of San Joaquin Valley willingness to pay, the cut-off price would be lower for those farms with lower profitability per acre-foot, so a fallowing program designed to generate a particular volume of pumping reductions would not necessarily need to be based on the higher prices at which farmers would be willing to participate in a fallowing program.

If Salinas Valley agricultural users would find it more profitable not to use water at all when it is worth more than these fallowing cost estimates, it is not reasonable to suppose that they would vote to assess themselves for a capital project that produces water at higher costs per acre foot. Projects intended to produce agricultural water supplies at costs greatly in excess of the cost of water produced by a fallowing program may not be financially feasible.

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[8] Id., fn. 34.

[9] See Tables 9-1 in the various GSPs.

Economic feasibility for individual farmers is a first order consideration. A robust analysis may also consider the externalities from demand reduction to the extent that it results in lost economic value to the community from reductions in farming activity. However, to the extent that this second order cost is considered, the agencies responsible to choose and implement water projects should identify the parties that are expected to bear the cost to prevent this second order harm. It may not be realistic to expect individual farmers to pick up the social costs of their decision not to pay more for water.

Finally, as discussed in the next section, while municipal users may be willing to pay more per AF than agricultural users, it may be both legally difficult and inequitable to impose the entire burden of higher cost water on municipal suppliers who now pay the same cost as agricultural users, i.e., the cost to pump native groundwater.

In sum, the agencies responsible to implement water projects should determine the actual willingness to pay for infrastructure or fallowing projects in order to ensure that planning effort and capital are not diverted to economically unrealistic, infeasible projects.

2. Determine the urban and agricultural water rights and needs as a critical factor in willingness to pay.

Decisions about the amount and location of new or relocated water supply should be informed by a frank acknowledgment of water needs and water rights because needs and rights determine willingness to pay. Users who do not need new or relocated supplies because existing supplies to which they have superior rights are sufficient may not be willing to pay for projects. For example, urban suppliers may not be willing to pay for water for which they currently have superior rights to obtain at their cost of pumping. Or for example, the draft GSPs for the Upper Valley and Forebay Subbasins do not contemplate the need for any new water projects based on the conclusion that current and future supplies are likely sufficient. Although this conclusion has been challenged, for the purpose of planning new projects to produce or relocate water, some consensus regarding water needs and rights is essential.

a. <u>Urban supplier water needs and rights.</u>

Urban suppliers who have pumped in an overdrafted basin for five years have a prescriptive right that takes priority over pumping by agricultural overliers.[10] In an

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[10] Garner et al., The Sustainable Groundwater Management Act and the Common Law of Groundwater Rights—Finding a Consistent Path Forward for Groundwater Allocation, Journal of Environmental Law V38:2, 2020, pp. 187, 207, available at https://www.edf.org/sites/default/files/documents/01JELP38-2_Garner_etal.pdf.

adjudication, the amount of that right is reduced by so-called "self-help" pumping by overlying landowners, and it would also likely be ramped down to reflect the "safe yield" of the aquifer (similar to SGMA's "sustainable yield").[11] Typically, the urban supplier would have the prescriptive right to pump the same percentage of the safe yield as the percentage of total pumping it pumped during the prescription period.[12]

Urban supply may not be limited to prescriptive rights because the constitutional mandate for reasonable and beneficial use may make domestic water use a higher priority even without prescription.[13] Water Code sections 106 declares as state policy that domestic use is a higher priority than agricultural use, and one court interpreted this to require urban use even without prescription.[14]

However, on balance, urban suppliers may not be willing to count on water rights greater than their prescriptive rights.[15] The prescriptive right may not be sufficient to cover existing urban demand because the right is determined by ramping-down historical pumping by the overdraft percentage, and it does not include water for growth. Thus, urban suppliers in overdraft areas or contemplating growth may be willing to pay for new or relocated supplies in an amount equal to their water needs for growth plus their percentage share of historic overdraft.

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[11] Id. at 189-190, 207. "Safe yield" is functionally equivalent to SGMA's "sustainable yield." (Id. at 206 n 189.)

[12] Id. at 187, 207.

[13] Id. at 177-178, 196-198.

[14] Id. at 197. No court has yet interpreted Water Code section 106.3, declaring the human right to water for domestic purposes.

[15] Urban suppliers are likely to want more certainty for planning than agricultural users:

> Thus the interests of urban utilities may diverge from agricultural interests in some basins: while many growers may prefer to forgo firm pumping allocations in favor of a slow glide path to sustainability, groundwater-reliant urban utilities will be interested in greater certainty. Setting pumping allocations—and devising a clear timeline for transitioning to sustainability—can put utilities on a firmer footing as they plan for the future.

(Ayres et al., Groundwater and Urban Growth in the San Joaquin Valley, Sept. 2021, available at https://www.ppic.org/publication/groundwater-and-urban-growth-in-the-san-joaquin-valley/.)

The amount for which urban suppliers may be willing to pay can be roughly estimated from data in the GSPs and AMBAG urban growth forecasts.

- The 180/400 GSP identifies an historic 10% overdraft totaling 10,900 AFY and current urban use of 17,400 AFY.[16] AMBAG projects that the primary urban areas in the 180/400, Salinas and Gonzales, will grow 15.8% from 2015-2045.[17] Thus, urban suppliers in the 180/400 Subbasin may be willing to pay for 10% of the existing use 17,400 AFY use, representing their share of historic overdraft mitigation, plus the water to support 15.8% growth, a total of 4,489 AFY.

- The Eastside GSP concludes a 27% to 30% reduction in pumping would be required to avoid overdraft and attain sustainable yield, and it identifies current urban pumping as 7,500 AFY.[18] Again, the primary urban users are parts of Salinas and Gonzales, for which AMBAG projects 15.8% growth from 2015-2045.[19] Thus, urban suppliers in the Eastside Subbasin may be willing to pay for 30% of their existing 7,500 AFY pumping plus 15.8% growth, or 3,435 AFY.

- The Monterey GSP reports current Monterey Subbasin pumping as 5,274 AFY.[20] It projects future pumping at 10,788 AFY.[21] It finds no overdraft in the Marina/Seaside/Fort Ord area, "if adjacent subbasins are managed sustainably and the 180/400 Foot Aquifer Subbasin reaches its SMCs."[22] It implicitly finds an overdraft of 374 AFY for the Corral de Tierra area based on a sustainable yield of

16 180/400 GSP, pp. 3-11, 6-40, 6-42.

17 AMBAG, Final 2022 Regional Growth Forecast, Nov. 8, 2020, available at https://www.ambag.org/sites/default/files/2020-12/Final%20Draft%202022%20Regional%20Growth%20Forecast_PDF_A.pdf.

18 Eastside GSP, pp. 6-30, 6-28. Note that the Eastside GSP states that pumping may be understated. Id. at 6-29.

19 AMBAG, Final 2022 Regional Growth Forecast, Nov. 8, 2020.

20 Marina GSP, pp. 6-26, 6-31 [3,503 AFY for Marina-Ord and 1,771 AFY for Corrral de Tierra].

21 Monterey GSP, p. 6-36 [2,474 AFY for Corral de Tierra and 8,314 for Marina-Ord area].

22 Monterey GSP, 6-59 to 6-60.

2,100 AFY and pumping demand of 2,474 AFY.[23] Thus, urban suppliers in the Monterey Subbasin may be willing to pay for 5,888 AFY, representing 5,514 AFY for growth and 384 AFY of overdraft.[24]

- The Langley GSP reports current pumping of 1,400 AFY, consisting of 100 AFY of municipal supply, 700 AFY of agricultural supply, and 600 AFY of rural domestic supply.[25] It estimates that the sustainable yield is 1,100 AFY, resulting in a 300 AFY overdraft.[26] It projects no change in future urban or rural domestic demand and only a 100 AFY increase in agricultural demand.[27] Based on these data, urban and rural domestic users may be willing to pay for half of the overdraft mitigation, i.e., half of 300 AFY or 150 AFY, because they pump half of the current demand, but may not be willing to pay for any water for growth.

In sum, based on the GSP's for the northern subbasins that contain large urban populations where there is substantial overdraft and/or expected urban growth, there appears to be a potential willingness to pay for at least 13,962 AFY of new or relocated water to support northern Monterey County urban uses as follows:

- 180/400 4,489
- Eastside 3,435
- Monterey 5,888
- Langley 150

Total 13,962 AFY

b. <u>Agricultural water needs and rights.</u>

Even if there is no growth in irrigated land and water used per acre, agricultural users may be willing to pay more than their current cost to pump. In particular, agricultural users may be willing to pay for new or relocated water to eliminate overdraft or meet the Sustainable Management Criteria (SMCs) based on the mandate under SGMA to attain

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[23] Monterey GSP, pp. 6-61, 6-36.

[24] This assumes that essentially all water use in the Monterey Subbasin is domestic and that the entire burden to mitigate the estimated 374 AFY overdaft should fall on urban suppliers.

[25] Langley GSP, p. 6-17.

[26] Langley GSP, p. 6-23.

[27] Langley GSP, p. 6-29.

sustainability within 20 years. As a first approximation, where pumping exceeds long-term sustainable yield, pumping must be reduced or, alternatively, new or relocated water must be supplied by water projects. Only two of the GSPs for subbasins with significant agricultural water use acknowledge overdraft conditions that must be ameliorated. In the 180/400 Subbasin, addressing a 10% overdraft in the existing 91,900 AFY agricultural pumping would require 9,190 AFY in new or relocated water.[28] In the Eastside Subbasin, addressing the 30% overdraft of the reported current agricultural pumping of 64,800 would require 19,440 AFY of new or relocated water.[29] Thus, agricultural users in northern Monterey County may be willing to pay for 28,630 AFY of new or relocated water.

In sum, northern Monterey County urban and agricultural water users may collectively be willing to pay for 42,592 AFY of new or relocated water or, alternatively, to accept the economic burden of pumping reductions. About a third of the new or relocated water would be needed by urban users and two thirds by agricultural users.

These rough estimates are primarily illustrative and are subject to revision as the GSPs are refined for new water budgets based on better modeling, a process that is now under way.

Similar calculations could be made for other subbasins in the southern portions of the County. However, since those subbasin GSPs do not report overdraft, there may be no willingness to pay for additional or relocated water.

In addition, the GSPs acknowledge that seawater intrusion, which affects the 180/400 and Monterey Subbasins, must be mitigated. The GSPs acknowledge that various projects that provide new or relocated water to improve recharge or reduce pumping in coastal areas may reduce seawater intrusion by raising groundwater levels, but the 180/400 GSP also proposes a "Seawater Intrusion Pumping Barrier" that it claims could remedy seawater intrusion without raising groundwater levels and thus without replacing the cumulative storage deficits in the coastal subbasins.[30] It is unclear whether and to what extent the proposed pumping barrier would obviate the need to address overdraft conditions in the near term, although logic suggests that a continuing level of overdraft is not sustainable in the long term. At this point, there is no consensus on a project or management action to address seawater intrusion. However, if new or relocated water

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[28] 180/400 GSP, pp. 6-25, 6-42.

[29] Eastside GSP, pp. 6-28, 6-30.

[30] 180/400 GSP, p. 9-26 and Appendix 11G, response to comment 8-139, pdf page 991.

supplies in excess of the amounts needed to address overdraft are needed to mitigate seawater intrusion, this may substantially increase the estimated needs for new or relocated water, at least until the cumulative storage deficits in the coastal subbasins are made up.

c. Project and management action cost sharing between urban and agricultural users.

Both urban suppliers and agricultural users have incentives to pursue water projects or pumping reductions. However, based on their differing needs and water rights, they do not value water supplies equally. Urban use for domestic purposes is not valued primarily as part of a production function, and urban users are generally willing to pay more than agricultural users for whom willingness to pay is constrained by the need that their farming remain profitable. This complicates allocating the cost of water projects that may benefit both classes of users. For example, agricultural users may not be willing to pay the projected average cost of water for the 15,000 AFY Regional Municipal Supply project proposed in the Eastside and Monterey GSPs, which comes to $4,100 per AF ($2,900 for desalination plus $1,200 per AF for securing source water from the assumed seawater intrusion pumping barrier project), because that cost may exceed the cost at which farming would remain profitable. On the other hand, urban suppliers would not likely be willing to pay for more capacity than the shortfall between their future needs and current prescriptive rights, estimated above at 13,962 AFY for the Monterey, Eastside, Langley, and 180/400 Subbasins.

Urban suppliers and agricultural users may also not be willing to pay for higher cost desalination water if lower cost water supply or demand reduction projects are possible. For example, there may be much more willingness to pay the $1,100 to $1,450 per AF for the 12,900 AFY "Winter Release with ASR for CSIP and/or Direct Delivery to Marina Ord" project proposed in the Eastside and Monterey GSPs. These users may also be more willing to pay $195 to $1,730 per AF for a fallowing program or to incur the opportunity costs of pumping allocation and controls if these costs are less than the desalination project cost. Regardless which projects are selected, equitable allocation of the cost of water supply projects and demand reduction programs between urban and agricultural users should reflect their relative rights to the existing lowest cost water, i.e., pumped native groundwater, and, after that, to the lowest cost additional water suplies. As noted above, based on the GSP documents, it appears that urban suppliers are responsible for about a third of the needed supply increase or demand reduction and agricultural users are responsible for about two thirds. This may suggest a ratio for allocating the cost burdens between these classes of users.

Some may argue that urban users should pay a larger share of new water supplies simply because they are less able to do without it and therefore less price sensitive. In this realpolitik approach to cost allocation, a rule of thumb in deciding whether to proceed with a project or pumping reduction with benefits to both classes of users might be to determine first the cost per acre-foot to urban suppliers if the project were scaled only to meet urban supplier needs and then to determine what the marginal cost per acre-foot would be if the project were scaled up to provide benefits to agriculture. Only if both classes of users were willing to pay their marginal costs would it make sense to pursue the larger project; otherwise the project should only be scaled to supply urban users. In this approach, however, urban users should be able to look toward the public agencies to ensure that the least cost projects are made available to urban and agricultural users on an equal footing. It may not be equitable, for example, to permit all of the available low cost projects to be used to benefit agriculture, e.g., surface water supplies, leaving urban suppliers with only the high cost project opportunities, e.g., desalination.

3. Address the equity issues between subbasins clearly and promptly.

Groundwater users may not be willing to pay for projects that require complex cost and benefit allocations without knowing that there is some fair way to allocate these costs and benefits. Equity among subbasins is a major area of contention among agricultural users that may affect willingness to pay for projects to provide new or relocated water or to accept the burdens of reduced pumping. This issue would arise regardless whether sustainability is to be achieved through SGMA or through application of water rights law through adjudication. And indeed, groundwater rights experts recommend that SGMA plans that employ pumping allocation and controls model it on common law groundwater rights adjudication methods.[31]

SGMA mandates that DWR "shall evaluate whether a groundwater sustainability plan adversely affects the ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[32] However, beyond mandating the provision of certain information, e.g., that descriptions of basin settings include inter-basin groundwater flows, SGMA does not provide clear guidance to determine the need for, and the allocation of costs and benefits for, multi-basin projects or management actions. For example, SGMA provides no definitive rule for sharing the sustainable yield of interconnected basins or subbasins: the "no-adverse-effect" rule by itself does not obviously lead to a specific set of sustainable management criteria for a subbasin or to the determination of minimum inter-subbasin flows.

Inter-subbasin flow objectives are an equitable consideration because they affect water balances, which in turn affect the obligation under SGMA to address overdraft

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[31] Garner et al, 2020.

[32] Water Code § 10733(c).

conditions. Inter-subbasin flows are directly affected by groundwater levels, for which SGMA requires each subbasin to set a minimum threshold and a measurable objective. Further complicating the issue, SGMA expressly leaves it to the discretion of the GSA whether, and to what extent, to address pre-2015 undesirable results such as low groundwater levels, storage depletion, and seawater intrusion, each of which has a causal relationship with groundwater levels that historically determined inter-subbasin flows:

> The plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015. Notwithstanding paragraphs (1) to (3), inclusive, a groundwater sustainability agency has discretion as to whether to set measurable objectives and the timeframes for achieving any objectives for undesirable results that occurred before, and have not been corrected by, January 1, 2015.[33]

This invites the question whether the GSA goal will be to preserve only post-2015 levels of inter-subbasin flows or will attempt to restore some earlier historical condition, and if so, what condition. For most Salinas Valley subbasins, the groundwater level measurable objectives that will determine inter-subbasin flows are based on pre-2015 conditions.[34] Arguably, there is no obvious baseline or natural level of groundwater levels or inter-subbasin flows because the reservoir operation and pumping volumes in each subbasin determine groundwater levels and inter-subbasin flows. It is not clear that the GSA's process for setting groundwater level objectives through the ad hoc deliberations of each subbasin committees has identified or applied a consistent or principled method for determining inter-subbasin flows.

It is no secret that in the Salinas Basin there are wide differences of opinion as to the likely obligations of various subbasins to shoulder the costs of water projects or pumping reductions. The GSPs manifest this in inconsistent estimates of inter-subbasin flows in their water balances, different conclusions as to the necessity of multi-subbasin projects and management actions, and in water budgets that are expressly contingent on adjacent basins attaining sustainable management criteria (SMCs), including calls for SMCs that represent pre-2015 conditions. Comments on GSPs and requests for additional inter-subbasin flow modeling reflect a concern for equitable allocation of project costs and the burdens of pumping reductions.

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[33] Water Code § 10727.2(b)(4).

[34] Eastside GSP, pp. 8-6, 8-11, 8-18 [ambiguously sets both the 1999 and 2011 level]; Monterey GSP [2004 and 2008 levels for its two subareas]; 180/400 GSP, p. 8-6 [2003 level]; Upper Valley GSP, p. 8-6 [2011 level]; Langley GSP, p. 8-6 [2010 level]; but see Forebay GSP, p. 8-6 [higher than 2015 level].

Water rights adjudication provides some guidance for the necessity to address connectivity of groundwater basins. Even where all water rights in connected basins are not adjudicated together, an adjudication may require maintenance of certain underflows between the basins.[35] Again, however, there may be no simple or obvious method to determine what those minimum underflows should be in determining future obligations to ameliorate overdraft.

Nonetheless, by adopting water balances for each subbasin, by defining sustainable yields, and by setting measurable objectives, the GSA will effectively commit itself to a de facto pumping allocation for each subbasin as a whole (because long-term pumping may not exceed sustainable yield) and to minimum inter-subbasin flow amounts, which in turn will determine responsibility to ameliorate overdraft under SGMA. Because willingness to pay for projects or to bear the burden of pumping reductions ultimately depends on agreements as to water balances and inter-subbasin flows, the GSA should frankly and transparently address the disagreements over these issues. Project selection cannot realistically proceed until the benefitted and burdened participants are identified.

One possible method for determining the groundwater level SMCs and the inter-subbasin flows to use in the subbasin water budgets, and by extension to use in allocating responsibility for ameliorating overdraft, would be to base them on the groundwater levels and flows assumed in allocating the cost of past water projects on the theory that these groundwater levels and flows represent benefits for which landowners have already made substantial investments.[36] Stakeholders probably need to address these issues directly before any progress can be made on selecting projects that have benefits to, or impose costs on, multiple subbasins.

4. **Evaluate the costs and benefits of pumping reductions against the costs and benefits of capital projects.**

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[35] Garner et al., 2020, at 178-181.

[36] The prior modeling need not, and likely will not, match the current modeling. The effect of past modeling errors, e.g., a systematic over-estimate of project benefits, could be prorated among subbasins. The point is not to match current conditions, which may be substantially different than previously modeled conditions due to other factors, e.g., increased pumping, but to establish a principled foundation for determining future cost allocations.

Statewide, SGMA planning has focused on expanding water supplies rather than demand management.[37] However, sustainability for overdrafted aquifers can be attained either by pumping reductions or by projects that supply new or relocated water.

Although the Salinas Valley GSPs have identified pumping allocation and controls as an available method to attain sustainability, the GSPs have not discussed how the decision would be made to choose this approach over construction of physical infrastructure.[38]

Before making any commitment to infrastructure projects, the project sponsor should investigate the cost to attain sustainability by means of pumping reductions instead. Pumping reductions may be less costly, and they may obviate infrastructure projects.

Pumping reductions may also be more timely. For example, the seawater intrusion minimum threshold in the 180/400 GSP calls for an immediate halt to intrusion at the 2017 line of advance. The 180/400 GSP provides that the proposed seawater intrusion pumping barrier would take five years to implement, presumably after it is selected for implementation, during which time seawater intrusion would advance.[39] Pumping controls would not require time for physical construction.

a. Example one: cost of pumping reductions vs. seawater intrusion barrier.

It is possible that a temporary reduction in pumping to levels below the sustainable yield in the Pressure Subarea, which includes the Monterey and 180/400 Subbasins, could restore protective groundwater elevations and halt seawater intrusion.[40] Once protective

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[37] Ayres et al., Groundwater and Urban Growth in the San Joaquin Valley, Sept. 2021, available at https://www.ppic.org/publication/groundwater-and-urban-growth-in-the-san-joaquin-valley/.

[38] The Langley, Monterey, and Eastside GSPs expressly identify pumping allocation and controls as a potential management action to attain sustainability. Arguably the Upper Valley and Forebay GSPs do not identify this potential management action only because these GSPs conclude that their subbasins are not in overdraft. The 180/400 GSP calls for determination of individual landowner pumping "allowances" for the 180/400 Subbasin as part of the "Water Charges Framework," in which tiered rates for pumping in excess of a prorata share of the subbasin's sustainable yield is supposed to deter that pumping and/or pay for projects to supply additional water.

[39] 180/400 GSP, p. 9-54.

[40] See Geoscience, Protective Elevations To Control Sea Water Intrusion in the Salinas Valley, CA, 2013, available at https://www.co.monterey.ca.us/home/showdocument?id=19642.

groundwater elevations were re-established by an interim period of pumping below sustainable yield, pumping the entire long-term sustainable yield for the Pressure Subarea should be possible without causing seawater intrusion, because that yield is defined as the level that would not cause undesirable results, including seawater intrusion.

If restoration of protective elevations via temporary reduction in pumping were possible, it could obviate the Seawater Intrusion Pumping Barrier proposed in the 180/400 GSP.[41] Rough calculations suggest that temporary reductions in pumping to levels below sustainable yield in order to restore protective groundwater elevations may in fact be less expensive than the proposed pumping barrier.

Pumping reductions might be obtained via fallowing at a direct cost or, alternatively, by pumping allocation and controls, at an opportunity cost, that would not exceed $1,000 per acre-foot. Based on a range of local land rentals, the Eastside GSP identifies the temporary fallowing management action cost to reduce water use as from $590 to $1730 per acre-foot; the other GSP's identify the same or lower costs. (Eastside GSP, p. 9-67; Langley GSP Table 9-2 [same]; Upper Valley GSP Table 9-2 [$195 to $395 per AF]; Forebay GSP Table 9-2 [$430 to $1270 per AF].) The fallowing cost per acre-foot may be a rough proxy for the farmers' opportunity cost not to farm, so if the pumping reductions were mandated through a program of pumping allocations and controls instead of being attained by voluntary fallowing, $1,000 per acre-foot may still be a reasonable estimate for the economic burden of pumping reductions. As noted above, water market data suggest that agriculture would rarely if ever pay more than $1,000 per acre-foot to buy water.

The reported cumulative storage deficit from 1944 to 2013 for the Pressure Subarea, which includes the Monterey and 180/400 Subbasins, is 110,000 AF.[42] The reported projected sustainable yield for the Pressure Subarea is 117,070 AFY with projected pumping demand of 126,255.[43] A 7.3% reduction in pumping would be required to attain

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41 180/400 GSP, pp. 9-52 to 9-55.

42 Brown and Caldwell, State of the Salinas River Groundwater Basin, p. ES-11, Table ES-3, available at https://digitalcommons.csumb.edu/cgi/viewcontent.cgi?article=1020&context=hornbeck_cgb_6_a.

43 The projected 2030 sustainable yield of the 180/400 GSP is reported to be 107,200 with projected pumping demand of 115,300 AFY. (180/400 GSP, p. 6-42.) The projected sustainable yield for the Monterey Subbasin is reported to be 9,870 AFY. (Monterey GSP at 6-59 to 6-60 [9,870 AFY can be pumped without overdraft if adjacent basins managed sustainably].) Future demand from the Monterey GSP is reported to be

the long-term sustainable yield. Further reductions of 8.7% would be required to eliminate the cumulative storage deficit of 110,000 AFY within 10 years. At $1,000 per AF, this water would cost $110,000 million. With a 3% discount rate, the present value of a program to reduce pumping by 110,000 AF over ten years would be $94 million. By contrast, the reported capital cost of the proposed pumping barrier would be $102 million with an annual O&M cost of $9.8 million, presumably payable in perpetuity. On a present value basis over just the next 30 years, the pumping barrier would cost $192 million. If the reported data in the GSPs for fallowing costs, sustainable yields, and water demand are accurate, the pumping barrier proposal to address seawater intrusion would be more than twice as expensive as pumping reductions. In addition, a program of pumping reductions could be implemented more quickly because it would not require a Proposition 218 process or physical construction.

This rough analysis does not address the possibility that the accumulated 330,000 AFY storage deficit in the Eastside Subbasin[44] would also have to be reduced or eliminated to halt seawater intrusion in the 180/400 Subbasin through a program relying on a one-time restoration of protective groundwater elevations rather than a pumping barrier. To the extent that the Eastside storage deficit induces flows from the 180/400, a protective elevation equilibrium condition in the 180/400 Subbasin may in fact require reduction or elimination of that deficit, significantly adding to the cost of this approach. A 2013 analysis concluded that provision of 60,000 AFY of in lieu recharge to coastal subbasins would be necessary and sufficient to halt seawater intrusion, and that this could be achieved by using the surface water supplies available through water right 11043.[45] The implication of that analysis was that the in lieu recharge program would be a perpetual infrastructure project, not a one-time replenishment of an historic storage deficit. Regardless, analysis to determine whether restoration of protective elevations would be less expensive than a pumping barrier should be undertaken before committing an agency to a perpetual pumping barrier.

b. <u>Example 2: cost of pumping reductions vs. proposed Eastside capital projects.</u>

10,955 AFY. (Monterey GSP, pp. 6-47 to 6-48 [projected pumping will total 10,955 AFY based on 8,767 from the Marina-Ord area and 2,188 AFY from the Corral de Tierra area].)

[44] Brown and Caldwell, State of the Salinas River Groundwater Basin, p. ES-11, Table ES-3 [accumulated storage deficits].

[45] Geoscience, Protective Elevations To Control Sea Water Intrusion in the Salinas Valley, CA, 2013, available at https://www.co.monterey.ca.us/home/showdocument?id=19642.

The Eastside Subbasin GSP's projected 2030 sustainable yield is 51,900 AFY and its projected demand is 72,300 AFY.[46] Thus, there is an ongoing need to mitigate a potential overdraft of 20,400 AFY. The Eastside GSP proposed a number of multi-subbasin infrastructure projects intended to do this. Considering just those projects that would provide more than a 1,000 AFY benefit, there is a wide range of benefit volumes and costs per acre-foot:

- The proposed Regional Municipal Supply project would supply 15,000 AFY of desalinated water to north County urban and agricultural users at a cost per AF of $4,033 to $4,146.47 Some portion of which would benefit the Eastside.[48]

- The Somavia Road project would move 3,000 AFY of groundwater from the 180/400 Subbasin to the Eastside Subbasin at $3,980 per AF.[49]

- The diversion of surface water using the 11043 Water Rights at Chualar or Soledad at $1,280 or $2,110 per AF respectively would provide 6,000 AFY to the Eastside.[50]

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46 Eastside GSP, p. 6-30.

47 As noted above, urban suppliers may be willing to pay for as much as 13,962 AFY of additional water for growth and their share of overdraft mitigation, but there may be no principled reason that urban suppliers should bear the burden of the highest cost water supply option.

48 The capital cost for the desalination plant and distribution pipelines would be $385-$393 million. (Eastside GSP, pp. 9-50 to 9-56; see also Monterey GSP, pp. 9-31 to 9-32.) This project would only be built as a supplement to the $102 million sea water intrusion barrier project, from which it would obtain brackish source water, so the total capital cost would be $487-$495 million. O&M for the desalination plant portion would be $13.2-$13.4 million, presumably in addition to the $9.8 million O&M for the seawater intrusion barrier, resulting in a total annual O&M cost of about $25 million. Over 30 years at a 3% discount rate, the present value of the cost of this 15,000 AFY project would come to $977-985 million. The reported cost per acre-foot for this water for just the desalination plant would be from $2,833 to $2,946. The cost of source water provision from the seawater intrusion barrier would add $1,200 per acre-foot, bring total cost to $4,033 to 4,146 per acre-foot. (Monterey GSP, p. 9-32.)

49 Eastside GSP, p. 9-5.

50 Eastside GSP, p. 9-5.

- Winter Releases with Aquifer Storage and Recovery would supply 12,900 AFY for ASR injection at $1,450 per AF or direct winter use by urban suppliers of a 3,600 AFY portion at $1,100 AFY, some portion of which would benefit the Eastside.[51]

- Expansion of CSIP would provide 9,900 AFY of recycled and river water for agriculture at $630 per AF, some portion of which would benefit the Eastside.[52]

- The multi-benefit Stream Channel improvements program might supply from 2,780 to 20,880 AFY at a cost of $60 to $600 per AF, but it is not yet clear what subbasins would benefit.[53] The primary benefits would be to those basins adjacent to the River, but the Eastside may get indirect benefits.

- The Interlake Tunnel would increase recharge to multiple subbasins by 32,000 AFY at a capital cost of $180.8 million and an unspecified operating cost.[54] No costs per AF are identified in the GSP and it is not clear to which subbasins the benefits would accrue.

There is insufficient information in the GSP to determine whether some combination of these projects could provide the Eastside Subbasin the needed 20,400 AFY, primarily because it is unclear what portion of the multi-subbasin projects would benefit the Eastside. However, if the direct or opportunity cost of pumping controls is in the vicinity of $1,000 per AF, most of these proposed project would be substantially more expensive than pumping controls. If the infrastructure projects costing less than pumping reductions cannot supply the entire 20,400 AFY, then the balance may better be supplied through pumping reductions. The analysis should be provided before commitments are made to infrastructure projects.

5. Discussion of projects proposed to meet identified northern Monterey County needs; information needed to identify least cost suite of projects.

As discussed above, although the GSPs for Upper Valley and Forebay do not evidence a willingness to pay for additional water supplies, the urban suppliers in the 180/400, Monterey, Eastside, and Langley subbasins may be willing to pay for 13,962 AFY for

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[51] Eastside GSP, p. 9-7; Monterey GSP, p. 9-9.

[52] Eastside GSP, p. 9-6.

[53] Eastside GSP, p. 9-7.

[54] Eastside GSP, p. 9-7, 9-95.

growth and to make up the shortfall in their prescriptive rights due to historic overdraft. Agricultural users in the 180/400 and Eastside may be willing to pay for 28,620 AFY to mitigate their share of the historic overdraft.

The 42,592 AFY needed for northern Monterey County could be provided through multiple approaches with widely varying unit costs, including fallowing, pumping allocation and controls, various uses of surface water under Water Right 11043, relocation of pumped groundwater, invasive species eradication, recharge improvements, recycling, and desalination. Several approaches are so much more costly than other alternatives, and appear to be so much more costly than the likely willingness to pay, that they may not warrant consideration unless all other options prove infeasible. In addition, there are many questions that must be addressed in order to proceed with a reasoned selection of projects or management actions.

a. Desalination.

At $4,100 per AF, the unit cost of the proposed 15,000 AFY Regional Municipal Supply project is at least twice the cost of most other alternatives.[55] Although the description of the Regional Municipal Supply project acknowledges that its excess water would be used by agriculture,[56] and its source water is assumed to be a pumping barrier project that would benefit both agricultural and urban users by mitigating seawater intrusion, the project has been understood to be a solution for urban supply shortages. However, unless less expensive alternative water supplies, e.g., surface water supplies from the Salinas River, are not available to urban uses for institutional or political reasons, it is hard to understand why urban users would be willing to pay so much more for water than agricultural users. The case has not been made publically that urban suppliers should shoulder more than their proportionate burden of the cost to mitigate overdraft. Thus, critical questions regarding the Regional Municipal Supply project include:

- Are there less expensive options to provide urban supplies?
- Is the Regional Municipal Supply feasible if it cannot obtain brackish source water from a seawater intrusion pumping barrier project?
- Which users benefit from the seawater intrusion pumping barrier project? How should its cost be allocated to those users?
- Which users benefit from a 15,000 AFY reduction in pumping for urban supplies? How should that cost be allocated?

[55] Similarly, relocation of 3,000 AFY groundwater from the 180/400 to the Eastside at $3,980 per AF proposed as the Somavia Road project may not be economically feasible.

[56] Eastside GSP, p. 9-50.

- Is there a less expensive way to address seawater intrusion than the pumping barrier, e.g., via relocating surface waters to the north, fallowing, and/or pumping allocations and controls? If so, is there a feasible alternative source water supply for the Regional Municipal Supply project?

b. Recycling.

Modest amounts of recycled water may be available for use by MCWD for landscape and for an Indirect Potable Use project (i.e., aquifer injection and retrieval of recycled water). The Monterey GSP estimates the cost for 826 AFY of landscape quality water at $1,600 per AF and at $3,300 per AF for 2,400 AFY of Indirect Potable Use water. These unit costs are higher than the costs for increased recharge and invasive species eradication and higher than the median cost for surface water use projects. Although these projects might be feasible because they can be undertaken by an urban supplier whose customers have a greater willingness to pay, it may not make economic sense or be equitable to pursue them if there are less expensive alternatives. The critical question for recycling projects is whether there are less expensive alternatives.

c. Use of surface water and the 11043 water right.

Use of surface water from the reservoirs for which MCWRA has the 135,000 AFY water right 11043 is proposed in the Chualar Diversion project, the Soledad Diversion project, the Winter ASR and Direct Use project, the CSIP expansion project, and the Interlake Tunnel project, which are proposed by the 180/400, Eastside, Monterey, and Langley GSPs.[57] Use of this surface water supply is also assumed in proposals for reservoir reoperation, including increased winter releases in the Forebay and Upper Valley GSPs.[58] Use of the entire 135,000 AFY 11043 water right to guarantee at least a 60,000 AFY of in lieu recharge benefits to coastal subbasins was assumed to be necessary and sufficient to halt seawater intrusion by restoring protective elevations in a 2013 analysis.[59]

Unit cost estimates for delivering11043 water in the GSPs range from a low of $630 per AF (CSIP) to a high of $2,100 per AF (Soledad Diversion), with a median at $1,280 (Chualar Diversion). The GSPs do not identify a unit cost for the largest proposed 11043

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57 See Tables 9-1 in the respective GSPs.

58 Forebay GSP, pp. 9-6 to 9-7; Upper Valley GSP, p. 9-5.

59 Geoscience, Protective Elevations To Control Sea Water Intrusion in the Salinas Valley, CA, 2013, available at https://www.co.monterey.ca.us/home/showdocument?id=19642.

project, the Interlake Tunnel, but it may be in this range.[60] Furthermore, it remains unclear what subbasins the Interlake Tunnel would benefit. The Interlake Tunnel has been given independent momentum compared to the GSP-proposed projects because it is sponsored by MCWRA and has been funded with an initial $10 million grant for engineering, modeling, and environmental review. However, it may not make economic sense to invest in further engineering and environmental review for this project unless and until it appears to be viable and less expensive than other alternatives or a prerequisite to them.

Furthermore, it is difficult to compare the various surface water projects in the GSPs to each other and to the Interlake Tunnel because it is unclear whether the projects are mutually exclusive or could all be pursued in tandem. SGMA plans for the San Joaquin Valley have double counted available water sources for recharge and storage projects.[61] And for the Salinas Valley, for example, it is unclear if the Interlake Tunnel is a separate water source or simply a necessary precondition to accomplish some or all of the other GSP projects. It is also unclear what independent utility the Interlake Tunnel would have if the GSP surface water project were not undertaken. Coordinated analysis of these projects is essential to informed decision making.

Critical questions regarding proposals for increased use of surface waters include:

- What is the baseline assumption regarding reservoir operations and benefits to each subbasin, and how will those baseline conditions inform allocation of project costs to each subbasin?
- How will the costs and benefits be allocated between GSPs that identify no overdraft condition and those that acknowledge an overdraft conditions?
- Which surface water projects can be pursued in tandem and which, if any, are mutually exclusive?

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[60] When the Interlake Tunnel's estimated budget was only $82 million and its benefit was estimated at 20,000 AFY increase in reservoir storage, the unit cost was estimated at $309 per AF. (See https://www.co.monterey.ca.us/home/showpublisheddocument/67222/636668071806970000.) The Interlake Tunnel is now estimated to cost more than twice as much at $180.8 million and to provide less than twice as much water at 32,000 AFY. (Eastside GSP, p. 9-7, 9-95.) However, without modeling, it is unclear how the increase in reservoir storage would translate into overdraft mitigation in the two subbasins that do acknowledge overdraft conditions.

[61] Hanak, E., J. Jezdimirovic, A. Escriva-Bou, and A. Ayres. 2020. *A Review of Groundwater Sustainability Plans in the San Joaquin Valley*. Public Policy Institute of California.

- Is the Interlake Tunnel project a precondition for any of the GSP surface water projects?
- What are the Interlake Tunnel benefits to each subbasin and the unit costs for Interlake Tunnel water with and without the GSP surface water projects?
- What is the demand curve for agricultural water? For urban water?
- Are there less expensive alternatives than use of surface water supplies, e.g., fallowing, pumping allocations and controls, invasive species eradication? If so, what is the optimal combination of surface water supply projects and other projects?
- If 11043 water could be used to halt seawater intrusion, as suggested by the 2013 Geoscience analysis, would foreseeable urban and agricultural water needs in the four northern subbasins be met? If not, what would be the shortfall?

d. Recharge improvements.

Modest amounts of water could be provided by projects to increase recharge. A portion of the Multi-Benefit Stream Channel Improvements project identified by several GSPs would provide 1,000 AFY at a unit cost of $930 per AF. However, it appears that the primary subbasins benefitting from this project would be the Upper Valley and Forebay, which would each receive 400 AFY of recharge from four recharge basins, but which do not identify a need for additional water supply projects.

The Monterey GSP identifies a 160 AFY surface water diversion recharge project at a unit cost of $3,050 per AF. The Langley and Eastside GSPs identify similar 350 AFY surface water diversion recharge projects at $1,800 (Langley) or $2,350 (Eastside) per AF.

The Eastside, Langley, Upper Valley, and Forebay GSPs each identify a 400 AFY Managed Aquifer Recharge project at $870 per AF. The Eastside and Langley GSPs identify a 1,000 AFY Floodplain Enhancement and Recharge project with a unit cost of $1,050 per AF.

Critical questions regarding these projects include:

- Do recharge projects in the Upper Valley and Forebay provide any benefits to subbasins that acknowledge overdraft? If not, would they be pursued? How would the cost of such projects be allocated?

- Have these projects been studied in sufficient detail to support these estimates? The coincidence of costs and benefits for similarly described projects, e.g., the 400 AFY benefit and the $870 per AF cost for four GSPs' "Managed Aquifer Recharge" projects, suggests the analysis is fairly generic.

- Which projects are mutually exclusive, if any?

e. Invasive species eradication.

Although MCWRA has undertaken some invasive species eradication in the past,[62] there is still not a firm estimate of the costs and benefits of a larger program. The GSPs all estimate the benefit as from 2,790 to 20,880 AFY of increased recharge at a unit cost of from $60 to $600 per AF. The GSPs do not allocate these benefits to subbasins other than to state that subbasins adjacent to the Salinas River would benefit more than other subbasins.[63] Although the unit costs may be much lower than the costs of other projects and the benefits may be substantial, the estimates of costs and benefits vary by an order of magnitude. The project cannot be compared to other project without further refinements to these estimates. However, if the costs are actually as low as $60 per AF, this project would cost less than any other proposed project.

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62 Eastside GSP, p. 9-75.

63 Eastside GSP, pp. 9-76 to 9-77.