

4.2 GROUND WATER RESOURCES

4.2.1 Summary of Environmental Consequences

The main effect of the alternatives is to change the base level of the regional aquifer, which is controlled by the elevation of the Salton Sea. The Salton Sea has a minor effect on perched aquifers in Imperial County, so changes in the Sea level would not be expected to have any impact on perched ground water there. In the Coachella Valley, where the regional aquifer is near the ground surface and can already contribute to drainage problems, a decrease in the elevation of the Sea could lower the regional water table and reduce the drainage problems. The elevation of the Sea is expected to decline under the No Action Alternative with reduced inflow conditions. None of the alternatives would affect artesian groundwater systems in the basin.

For Alternative 1, Sea elevation would rise with current inflow conditions. While the rise in Sea level could be prevented by breaching the dikes of the concentration ponds, an increase in the elevation of the Sea might contribute to drainage problems in low-lying areas of the Coachella Valley bordering the Sea. Similarly, increases in salinity of the Sea could increase the potential for saline water intrusion, if ground water is pumped upgradient of the Sea. The effects of saline water intrusion are increased in proportion to the difference in density between freshwater and salt water. These effects are likely to be most significant in Coachella Valley and not very significant in Imperial Valley, where there is little recharge to the regional aquifer, and most of the recharge is to the perched aquifer. The perched aquifer is not affected by conditions in the Sea.

Seepage from the brine collection ponds of the EES system sited at the former Salton Sea Test Base could result in a significant increase in the salinity of flows in San Felipe Creek.

Importation of flood flows from the Colorado River may have significant local effects on ground water conditions adjacent to streams used to convey the water to the Sea. For example, the upper reach of the Alamo River would receive significantly more flow than it normally does, and this is an area in which some of the stream flow recharges the regional aquifer. The recharge might result in a local beneficial impact because it would increase the quantity of ground water stored in the aquifer. Seepage from the stream channel would reduce the quantity of the flood flows that reach the Sea.

4.2.2 Significance Criteria

Impacts on ground water resources include changes in ground water quality, changes in the quantity of ground water available for existing or potential beneficial uses, and changes in the depth to ground water or in the magnitude or direction of the hydraulic gradient. Adverse impacts are judged to be significant if they do not comply with regulatory standards, plans, or policies; otherwise, the significance is based on the degree of harm the impacts may cause to humans or the environment. In general, any degradation of water quality that may reduce the existing or potential beneficial uses of the water is considered significant. The significance of a reduction in the quantity of ground water available for beneficial uses depends on the size, timing, duration, and

permanence of the effect. The significance of changes in hydraulic conditions, such as direction of flow, depends on the context in which the change occurs.

4.2.3 Assessment Methods

Potential impacts of project alternatives on ground water were assessed through review of available literature and discussion with experts to build a conceptual model of the ground water conditions in the study area (as described in Chapter 3) and the use of professional judgment to identify the ways in which project components would interact with the ground water system. Although the creation of a ground water flow model was not deemed appropriate for this assessment, others have performed modeling of portions of the study area, and their results were considered in this assessment. The ground water contribution to the inflow to the Salton Sea is believed to be relatively minor compared to the contribution of surface water. Also, because the Sea is a terminal lake, most of the ground water system lies upgradient of the proposed project actions. Thus, the focus of the assessment was on those components of the project that would be located within the region upgradient of the Sea, that are outside the hydrologic basin of the Sea, or that could indirectly affect ground water flow patterns. For example, increased surface water flows in ground water recharge areas can result in increased ground water recharge. Also, lowering the elevation of the Sea could lower the base level of the regional ground water system, resulting in a readjustment of the regional gradient and increased depth to ground water upgradient of the Sea. In general, the assessment of impacts on ground water resources is a qualitative assessment because most of the impacts are expected to be minor and do not warrant more detailed analysis.

4.2.4 No Action Alternative

Effect of No Action Alternative with Continuation of Current Inflow Conditions

No ground water impacts are expected with continuation of current inflows. Actually, a large portion of the current inflows are derived from ground water that has been collected in subsurface drains from the perched aquifer in the Imperial Valley, and from shallow ground water intercepted by subsurface drains in the Coachella Valley. Therefore, a continuation of existing inflows implies that there would be no change in the perched ground water system.

Effects of No Action Alternative with Reduced Inflows

Reduction in inflows are expected to occur as a result of reductions in the quantity of agricultural tailwater, improved irrigation efficiency, changes in cropping patterns, and other conservation measures. Most of the reductions would occur at points that do not affect the amount of ground water recharge or ground water use. For example, because very little of the applied irrigation water percolates below the perched water table in the Imperial Valley, a reduction in the amount of water applied would not necessarily change the amount of recharge to the regional aquifer.

It is possible that reductions in the amount of surface water imported to the region could lead to a shift to greater ground water use for irrigation. Ground water currently is used very little, and the ground water quality is relatively poor compared to imported surface water. An increase in ground water use could have significant impacts on ground water quality if it were to reduce the elevation of the regional water table. A reduction in the regional water table could lead to saline water intrusion from the Salton Sea. Under the No Action Alternative, the salinity of the Sea would continue to increase. The effects of saline water intrusion would be enhanced by increased salinity in the Sea.

4.2.5 Alternative 1

Effect of Alternative 1 with Continuation of Current Inflow Conditions

The construction of concentration ponds in the Sea would maintain the Sea at a higher elevation than under the No Action Alternative for a given inflow. At current inflows, the elevation of the Sea would rise to an elevation of -224 ft msl by about 2015, when accelerated Phase 2 exports are initiated. The increased elevation would increase the base level of the regional aquifer. If the base level rises, the elevation of the regional water table will rise also. The amount of the rise would be relatively minor, but there could be significant local effects, such as in the southern part of Coachella Valley. If the regional water table rises, it could increase drainage problems in low-lying lands.

Pumping ground water to offset the rise would increase the potential for saline water intrusion, which is caused by the difference in density between saline water and freshwater. Freshwater is less dense and floats on saline water. The freshwater layer “piles up” over the salt water. Pumping the fresh water reduces the weight of the freshwater above the salt water and allows the salt water to flow toward the region of lower pressure. A small reduction in the elevation of the freshwater surface can allow a large rise in the salt water surface. For saline water at about 35 mg/L, a reduction in freshwater head can cause the salt water interface to rise about 40 ft, under hydrostatic conditions. While the relationship between salt water intrusion and changes in freshwater head are far more complex in most situations, the general effect is that lowering the freshwater head, by pumping wells near the Sea, for example, could induce salt water to enter the aquifer. The impacts of saline water intrusion would be most significant near the Sea and would diminish away from the Sea.

Effect of Alternative 1 with Reduced Inflows

With reduced flows, the elevation of the Sea may decline by as much as 10 ft by 2030. A decline in Sea level would lower the base level of the regional aquifer and would temporarily increase the rate of ground water flow toward the Sea. Over time, the regional ground water table would decline. These effects would occur gradually, just as the rise in the elevation of the Sea in the past has probably caused the regional water table to rise. One of the effects of lowering the elevation of the Sea would be to induce more ground water to flow toward the Sea from storage in the aquifer. The increased ground water flow would probably be small relative to surface flows, but would temporarily offset some of the decrease in surface inflows, and thereby damping the rate of decline in the elevation of the Sea. Similarly, as the elevation of the sea rises, some of

the Sea water would go into storage in the aquifer, reducing to a small extent, the rate of elevation increase. The magnitude of these effects cannot be accurately predicted with the information available.

The Salton Sea is not hydraulically connected to the perched water table created by irrigation water percolating to shallow depths. This shallow ground water, which is often drained with tile drains, is one of the principal sources of inflow to the Sea. Therefore, changes in irrigation and the volume of return flows are not expected to have much effect on ground water conditions throughout the Imperial Valley and other areas with perched ground water.

The impacts of reductions in Sea level and the potential impacts of increased ground water use would be the same under Alternative 1 as for the No Action Alternative, except that the declines in Sea level might not be as large for Alternative 1. The difference in the effects would be minor.

Importation of flood flows could affect the local ground water hydrology in the vicinity of the streams used as conveyances. For example, the upper reach of the Alamo River is a recharge area. Some of the flow in the stream seeps to the underlying aquifer. The amount of seepage could be greatly increased compared to current conditions when flood flows are imported. The recharge would be stored in the aquifer and would benefit future ground water users. However, the losses from the stream would reduce the quantity of the flood flows that reach the Sea.

No significant ground water impacts are expected to result from operation of the North Wetland Habitat or the Pupfish Pond. However, since the elevation of the water in the ponds would be maintained at -227 ft, while the elevation of the Sea would eventually decline to a minimum of -237 ft by 2030, it is possible that some seepage from the ponds to the water table would occur locally. The shallow sediments in the shoreline areas tend to be composed of very fine-grained materials, containing a high proportion of silts and clays, however. The permeability of this material is expected to be very low. Therefore, the rate of seepage from the ponds is likely to be low.

4.2.6 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

The impacts on ground water under Alternative 2 would be derived from changes in the elevation and salinity of the Sea, as described for the No Action Alternative. The effects generally would be similar for similar changes in elevation. The elevation of the Sea is expected to increase by about three feet by 2030 under the No Action Alternative, while it is projected to decline by about six feet under Alternative 2. Thus, the effect would be to cause a lowering, rather than a rise, in the regional water table. Lowering of the regional water table would occur due to draining of ground water stored in the aquifer into the Sea. As described for Alternative 1, this increased inflow of ground water to the Sea would offset some of the elevation decline projected by modeling.

The impacts from importation of flood flows would be the same as those described above for Alternative 1.

Operation of the salt collection and concentration ponds of the EES system could cause large quantities of salt to percolate to the underlying water table. The brine would flow with the ground water toward the Salton Sea. To reduce leakage, the ponds would be lined with fine-grained soils. A small volume of brine may reach the aquifer, but it would increase the salinity of the ground water only downgradient of the EES between the EES and the Salton Sea. Provided that there are no ground water wells in the vicinity, the effects would not be significant. Ground water close to the margins of the Sea is expected to be of low quality, and pumping it would induce saline water intrusion from the Sea. It is unlikely that much brine would leak from the concentration ponds. The concentrated salts on the bottom of the ponds would precipitate and clog the soil pores, reducing or preventing further infiltration of water. In effect, the crystallization of salt would act as a liner in the bottom of the ponds.

Effect of Alternative 2 with Reduced Inflows

With reduced inflows the impacts on ground water would be similar to those described above and for the No Action Alternative. The decrease in elevation projected to result from Alternative 2 would be only one to three feet greater throughout Phase 1 than the projected decline in elevation under the No Action Alternative.

The impacts from importation of flood flows would be the same as those described above for Alternative 1.

4.2.7 Alternative 3

Effect of Alternative 3 with Continuation of Current Inflow Conditions

The impacts on ground water resources in general would be the same as those described for Alternative 2, with the exception of one local impact. Seepage from the brine collection ponds of the EES system sited at the former Salton Sea Test Base could result in a significant increase in the salinity of flows in San Felipe Creek. Brine seepage from the collection ponds may create a mound of saline recharge on the shallow aquifer from which flow will radiate outward. Most of the flow will be in the direction of the established gradient, toward the Salton Sea. However, due to the proximity of a portion of the EES installation to the incised channel of San Felipe Creek, some of the flow may discharge in the channel or banks of the creek. This would dramatically increase the salinity of the waters of the creek, especially during low flow periods.

Effect of Alternative 3 with Reduced Inflows

The impacts on ground water resources would be the same as those described for alternative 3 with current inflows, above.

4.2.8 Alternative 4

Effect of Alternative 4 with Continuation of Current Inflow Conditions

The impacts on ground water resources due to changes in elevation of the Sea would be intermediate between the impacts of the No Action Alternative and of Alternative 2. An initial rise in elevation of the Sea would be followed by a moderate decline in the elevation of the Sea.

Effect of Alternative 4 with Reduced Inflows

The effects of elevation change in the Sea on ground water levels in the regional aquifer would be similar to those described for Alternative 2 with reduced inflows.

4.2.9 Alternative 5

Effect of Alternative 5 with Continuation of Current Inflow Conditions

The impacts on the regional ground water table from changes in the elevation of the Salton Sea would be nearly identical to those described for alternative 2. Since the EES would be placed within the north pond in the Sea, there would be no impacts on ground water from seepage of saline water.

Effect of Alternative 5 with Reduced Inflows

The impacts on ground water resources would be nearly identical to those described for alternative 4.

4.2.10 Cumulative Effects

The discussion of impacts in the preceding section acknowledges the range of potential cumulative effects of other existing or foreseen projects on the water balance of the study area. Implementation of the project alternative is not expected to contribute further to cumulative ground water impacts from other projects in the study area.

4.2.11 Mitigation Measures

The extraction of ground water should be carefully monitored to identify the occurrence of saline water intrusion. It may be possible to reduce the potential impacts of saline water intrusion by accompanying any ground water extraction necessary to lower the water table near the Sea by injecting freshwater upgradient to create a hydraulic barrier to further inland saline water intrusion. The extracted ground water could be discharged back to the Sea.

Impacts of brine seepage from the EES at the former Salton Sea Test Base on surface water in San Felipe Creek could be reduced by lining the ponds. The significance of the impacts on San Felipe Creek would be judged relative to its effects on pupfish or other aquatic species. A monitoring program should be implemented to identify whether these impacts occur. The monitoring program should include ground water flow monitoring and ground water quality sampling. If impacts appear likely, then mitigation might include diluting the salinity in the creek by diverting fresher flows to the creek from drains or other sources.

4.2.12 Potentially Significant Unavoidable Impacts

No significant unavoidable impacts to ground water resources are expected to result from implementing the project alternatives.