State of California
Department of Water Resources
Sustainable Groundwater Management Program
Alternative Assessment Staff Report

Groundwater Basin Name:	Eel River Valley (Basin No. 1-010)
Submitting Agency:	County of Humboldt
Recommendation:	Do Not Approve
Date Issued:	July 17, 2019

I. Summary

The County of Humboldt (County) submitted an alternative (Eel River Valley Basin Alternative *or* Alternative) for the Eel River Valley Groundwater Basin (Eel River Valley Basin *or* Basin) to the Department of Water Resources (Department) for evaluation and assessment as provided by the Sustainable Groundwater Management Act (SGMA).[1] The Eel River Valley Basin Alternative is based on an analysis of basin conditions that demonstrates the basin has operated within its sustainable yield over a period of at least 10 years.[2] Based on evaluation of the Eel River Valley Basin Alternative and consideration of public comments, Department staff find the Alternative has not satisfied the objectives of SGMA and recommend that the Alternative not be approved.

An alternative based on an analysis of basin conditions requires that the basin has operated within its sustainable yield, which SGMA defines with reference to the absence of undesirable results.[3] The County provides evidence that groundwater use and levels, where they have been monitored, have been stable through time, and provides evidence regarding seawater intrusion that the County claims shows no significant change over time. The County has not developed a quantitative estimate of sustainable yield or established minimum thresholds to establish undesirable results, and claims there is insufficient information to do so. The County has not managed the Basin to any objective standard, but the County claims that stable groundwater conditions prove that the Basin has not experienced undesirable results and that the Basin has, by definition, operated within its sustainable yield. The County also claims that stable groundwater conditions provide evidence that undesirable results associated with land subsidence, degradation

[1] Water Code § 10720 *et seq.*
[2] Water Code § 10733.6(b)(3)
[3] Water Code § 10721(w)

of groundwater quality, and depletion of interconnected surface water are also not present and are not likely to occur.

In the absence of established criteria for undesirable results, the County relies on the exemption from the requirement to establish such criteria if undesirable results related to those sustainability indicators are not present and are not likely to occur in the Basin. The County has provided evidence that certain groundwater conditions, such as groundwater elevation and seawater intrusion in the shallow aquifer, have likely been stable. Based on evidence of historical stability, the County may argue that undesirable results related to these conditions are not likely to occur in the Basin. However, the County has little or no information with regard to other conditions, such as seawater intrusion in the lower aquifer or depletion of interconnected surface water, that would justify exempting the County from making determinations about undesirable results that are essential to SGMA's definition of sustainable management. In fact, evidence provided by the County suggests that the effects on interconnected surface water could, at times, be significant. Although the County, by submitting the Alternative, has asserted that those effects are not significant and unreasonable for the Eel River Valley Basin, the Department cannot assume undesirable results have not occurred in the absence of a compelling argument and adequate supporting data. The Eel River Valley Basin Alternative does not sufficiently demonstrate the absence of all undesirable results and, therefore, Department staff recommend that it not be approved.

The remainder of this assessment is organized as follows:

- **Section II. Review Principles** describes the applicable law and other considerations regarding the Department's assessment and evaluation of alternatives.
- **Section III. Submitted Material** describes materials (i.e., reports, data, and other information) submitted by the County as part of its Alternative.
- **Section IV. Required Conditions** describes whether the Alternative satisfies each of the four conditions required for the Department to review an alternative.
- **Section V. Alternative Contents** briefly describes the contents of the Alternative submittal.
- **Section VI. Assessment** describes the findings of the Department's review of the Alternative, whether it satisfies the objectives of SGMA, and, if applicable, describes recommended actions to address in future updates to the Alternative.

II. Review Principles

The County submitted an alternative based on an analysis of basin conditions to the Department for evaluation and assessment to determine whether it satisfies the

objectives of SGMA for the Eel River Valley Basin. To satisfy the objectives of SGMA, an alternative based on an analysis of basin conditions must demonstrate that the basin has been operated within its sustainable yield for a period of at least 10 years.[4] The SGMA definition of sustainable yield requires the avoidance of undesirable results.[5] As a result, an alternative based on an analysis of basin conditions must demonstrate that the submitting agency has an understanding of groundwater conditions that would cause undesirable results, as well as analysis in the alternative demonstrating the absence of undesirable results over a 10-year period.

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.[6] The submitted alternative must also be complete and must cover the entire basin.[7] The GSP Regulations[8] require the Department to evaluate an Alternative "in accordance with Sections 355.2, 355.4(b), and Section 355.6, as applicable, to determine whether the Alternative complies with the objectives of the Act".[9] The elements of the cited sections are not all applicable to alternatives. Some provisions apply to GSPs and alternatives alike, to alternatives only prospectively, or do not apply to alternatives at all.[10] Ultimately, the purpose of the evaluation is to determine whether an alternative satisfies the objectives of SGMA.[11] The agency must explain how the elements of an alternative are "functionally equivalent" to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate the ability of an alternative to achieve the objectives of SGMA.[12] The explanation by the agency that elements of an alternative are functionally equivalent to elements of a GSP furthers the objective of demonstrating that an alternative satisfies the objectives of SGMA. Alternatives based on groundwater

[4] Water Code § 10733.6(b)(3)
[5] Water Code § 10721(w)
[6] Water Code § 10733.6(c)-(d)
[7] 23 CCR § 358.4(a)
[8] 23 CCR § 350 *et seq.*
[9] 23 CCR § 358.4(b) (emphasis added)
[10] Procedural requirements, including submissions by the agency, posting by the Department, and the public comment period, apply equally to plans and alternatives (23 CCR § 355.2(a)-(c)). The periodic review of Plans (23 CCR § 355.6(a)) applies to alternatives prospectively but does not apply to initial submissions. Other regulatory provisions are inapplicable to alternatives, including the two-year review period (23 CCR § 355.2(e)), which is based on the statutory time-frame that applies to Plans but not alternatives (Water Code § 10733.4(d)); the "incomplete" status that allows the agency to address "one or more deficiencies that preclude approval, but which may be capable of being corrected by the Agency in a timely manner" (23 CCR § 355.2(e)(2)), which applies to plans undergoing development, but not alternatives that purportedly satisfy the objectives of SGMA at the time of their submission (Water Code § 10733.6(a)); and, for the same reason, corrective actions to address deficiencies in plans (23 CCR § 355.4(a)(4)), which applies to plans developed after the adoption of SGMA, but is inapplicable to alternatives that predate SGMA.
[11] Water Code § 10733.6(a)). The Department considers the regulatory language in 23 CCR § 358.2(d) ("complies with the objectives of [SGMA]") to be equivalent to the statutory threshold upon which it is based.
[12] 23 CCR § 358.2(d)

management plans or historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise format and content of a GSP. The Department's assessment is thus focused on the ability of an alternative to satisfy the objectives of SGMA as demonstrated by information provided by the agency; it is not a determination of the degree to which an alternative matched the specific requirements of the GSP Regulations.

When evaluating whether an alternative satisfies the objectives of SGMA and thus is likely to achieve the sustainability goal for the basin, staff reviews the information provided by and relied upon by the agency for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.[13] The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the agency, whether sustainable management criteria and projects and management actions described in an alternative are commensurate with the level of understanding of the basin setting, and whether those projects and management actions are feasible and likely to prevent undesirable results.[14] Staff will recommend that an alternative be approved if staff believe, in light of these factors, that alternative has achieved or is likely to achieve the sustainability goal for the basin.[15]

An alternative based on a demonstration that the basin has operated within its sustainable yield over a period of at least 10 years may be approved based on information that demonstrates that objective criteria defining operating standards that governed groundwater management for the basin were established and consistently achieved. Even when staff review indicates that an alternative will satisfy the objective of SGMA, the Department may recommend actions to facilitate future evaluation of that alternative and to allow the Department to better evaluate whether an alternative adversely affects adjacent basins. DWR proposes that recommended actions be addressed by the submission date for the first periodic evaluation.

Staff assessment of an alternative involves the review of information presented by the agency, including models and assumptions, and an evaluation of that information based on scientific reasonableness. The assessment does not require Department staff to recalculate or reevaluate technical information provided in an alternative or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve an alternative does not signify that Department staff, were they to exercise the professional judgment required to develop a plan for the basin, would make the same

[13] 23 CCR § 351(h)
[14] 23 CCR § 355.4(b)(1), (3), and (5).
[15] 23 CCR § 355.4(b)

assumptions and interpretations as those contained in an alternative, but simply that Department staff have determined that the assumptions and interpretations relied upon by the submitting agency are supported by adequate, credible evidence, and are scientifically reasonable.

III. Alternative Materials

The County submitted an alternative based on an analysis demonstrating the basin has operated within its sustainable yield over a period of at least 10 years, pursuant to Water Code Section 10733.6(b)(3). The Eel River Valley Basin Alternative includes the following documents:

- Eel River Valley Groundwater Basin, Humboldt County, California: Groundwater Sustainability Plan Alternative – SHN Consulting Engineers and Geologists, in collaboration with Humboldt County, December 2016, 38 pages. (Alternative Report) [16]
- Complete Appendices of Eel River Valley Groundwater Basin, Humboldt County, California: Groundwater Sustainability Plan Alternative - SHN Consulting Engineers and Geologists, in collaboration with Humboldt County, December 2016, 190 pages.
    - Appendix A – Copy of Alternative Elements Guide
    - Appendix B – Workshop Summary (April 27, 2015)
    - Appendix C – Humboldt County Board of Supervisors Resolution No. 16-142
    - Appendix D – Irrigation Water Use Study (HCRCD, 2016)
    - Appendix E - Eel River Valley Groundwater Basin Surface Discharge Measurement Field Report (Surface Discharge Report; TGAEC, 2016)
    - Appendix F - Monitoring Well Installation, Aquifer Testing, and Water Level Data Collection (Well Installation Report; SHN, 2016)
    - Appendix G – GAMA Program Database Review (SHN, 2016)[17]
    - Appendix H - Eel River Valley Groundwater Basin GIS-Based Water Budget, Dec. 2016 (Water Budget Report)
    - Appendix I – Report Figures

The Agency also submitted an Alternative Elements Guide, a description of how the Alternative covers the entire Basin and has submitted Annual Reports.[18] Other material submitted by the County, public comments, other documents submitted by third parties,

[16] Identified as document "20161230 EelRiverGWAltPlan-rpt-Final" on the Department's Alternatives Portal.
[17] Groundwater Ambient Monitoring and Assessment Program (GAMA)
[18] The Annual Report is not part of the Alternative and was not reviewed by the Department for the purpose of approving the Alternative.

correspondence, and other information provided to or relied upon by the Department have been posted on the Department's web site.[19]

IV. Required Conditions

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.[20] The submitted alternative must also be complete and must cover the entire basin.[21]

A. Submission Deadline

SGMA requires that an alternative for a basin categorized as high- or medium-priority as of January 31, 2015, be submitted no later than January 1, 2017.[22]

The County submitted the Alternative on December 30, 2016, which complies with the submission deadline.

B. Part 2.11 (CASGEM) Compliance

SGMA requires that the Department assess whether an alternative is within a basin that is in compliance with Part 2.11 of Division 6 of the Water Code,[23] which requires that groundwater elevations in all groundwater basins be regularly and systematically monitored and that groundwater elevation reports be submitted to the Department.[24] To manage its obligations under this law, the Department established the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. The acronym CASGEM is used in this document to denote both the program and the groundwater monitoring law.[25]

SGMA specifies that an alternative does not satisfy the objectives of SGMA if the basin is not in compliance with the requirements of CASGEM.[26] Department staff confirmed that the Eel River Valley Basin was in compliance with the requirements of CASGEM prior to evaluating this Alternative and confirmed that the Basin remained in compliance with CASGEM prior to issuing this assessment.

[19] https://sgma.water.ca.gov/portal/#alt
[20] Water Code § 10733.6(c)-(d)
[21] 23 CCR § 358.4(a)
[22] Water Code § 10733.6(c). Pursuant to Water Code § 10722.4(d), a different deadline applies to a basin that has been elevated from low- or very low-priority to high- or medium-priority after January 31, 2015.
[23] Water Code § 10733.6(d)
[24] Water Code § 10920 *et seq*.
[25] Stats.2009-2010, 7th Ex.Sess., c. 1 (S.B.6), § 1
[26] Water Code § 10733.6(d)

C. Completeness

GSP Regulations specify that the Department shall evaluate an alternative if that alternative is complete and includes the information required by SGMA and the GSP Regulations.[27] An alternative submitted pursuant to Water Code Section 10733.6(b)(3) must include an analysis demonstrating the basin has operated within its sustainable yield over a period of at least 10 years. That analysis must include a report prepared by a registered professional engineer or geologist who is licensed by the state, and that report must be submitted under that engineer's or geologist's seal. The alternative must include an explanation of how the elements of the alternative are functionally equivalent to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate the ability of the alternative to achieve the objectives of SGMA.[28]

The County submitted an analysis under the seal of a licensed Professional Geologist along with an Alternative Elements Guide. The submission was deemed complete and was evaluated by the Department.

D. Basin Coverage

An alternative must cover the entire basin.[29] An alternative is presumed to cover the entire basin if the basin is contained within the jurisdictional boundaries of the submitting agency.

The Alternative confirms that the entire Eel River Valley Basin, as delineated by the Department in Bulletin 118, is within the County and so the basin is presumptively covered by the Alternative.

V. Alternative Contents

GSP Regulations require the submitting agency to explain how the elements of an alternative are functionally equivalent to the elements of a GSP as required by Article 5 of the GSP regulations[30] and are sufficient to demonstrate the ability of an alternative to achieve the objectives of SGMA.[31]

As stated previously, alternatives based on historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise

[27] 23 CCR § 358.4(a)(3)
[28] 23 CCR § 358.4(c)-(d)
[29] 23 CCR § 358.4(a)(4)
[30] 23 CCR § 354-354.44
[31] 23 CCR § 358.2(d). The requirements pertaining to Article 7 of the GSP Regulations (23 CCR § 356-356.4) relate to annual reports and periodic evaluation and are not applicable to review of the initial alternative.

format and content of a GSP, and the criteria for adequacy of an alternative is whether the Department is able to determine that an alternative satisfies the objectives of SGMA. Department staff rely on the submitting agency's determination of functional equivalence of alternative elements to facilitate its evaluation and assessment of an alternative (see Assessment, below). Although the exact components of a GSP are not required for an alternative, for organizational purposes the discussion of information contained in the Alternative Report and related documents provided by the County generally follows the elements of a GSP provided in Article 5 of the GSP Regulations. The reference to requirements of the GSP Regulations at the beginning of each section is to provide context regarding the nature of the element discussed but is not meant to define a strict standard applicable to alternatives.

A. Administrative Information

GSP Regulations require information identifying the submitting agency, describing the Plan area, and demonstrating the legal authority and ability of the submitting agency to develop and implement a Plan for that area.[32]

The Eel River Valley Groundwater Basin lies entirely within the County, which is the submitting agency for the Alternative. The Alternative Report describes the general setting of the Eel River Valley Basin as having an area of 72,957 acres, with a population of approximately 21,558.[33] The Alternative Report describes beneficial uses as including agricultural, municipal, domestic, and industrial water supply, as well as freshwater replenishment to surface waters. Nine public water suppliers are noted to utilize groundwater in the Basin, but no district or other public agency is responsible for groundwater management, and neither a groundwater management plan nor groundwater use ordinance are in effect.[34] It is estimated that 350 production wells exist within the Basin. The Basin includes the flood plain of the Eel River and its tributary, the Van Duzen River, which drain the watershed downstream to the Pacific Ocean.

The Alternative Report provides a description of the County and its legal authority.[35] The County of Humboldt has three departments with roles related to groundwater: the Department of Public Works, the Department of Planning and Building, and the Department of Health and Human Services.[36] The Department of Public Works serves the role of Monitoring Entity for participation in the CASGEM program and has taken the lead role in coordinating the region's response to SGMA. The Public Works Department created the Eel River Valley Groundwater Working Group, consisting of representatives

[32] 23 CCR § 354.2-354.10
[33] Alternative Report, Section 2.1, p. 3
[34] Alternative Report, Section 2.5, p. 5
[35] Alternative Report, Section 2.5, p. 5
[36] Alternative Report, Section 2.5, p. 5

from municipal agricultural, and environmental interests, to guide the local response to SGMA (*see* Groundwater Conditions, below). The Department of Planning and Building is the County's land use authority, and implements the County's General Plan, which includes a Water Resources Element and county-wide policies regarding groundwater. The Department of Health and Human Services administers the County's well permit program and provides oversight for certain subsurface contamination sites.

B. Basin Setting

GSP Regulations require information about the physical setting and characteristics of the basin and current conditions of the basin, including a hydrogeologic conceptual model, a description of historical and current groundwater conditions, and an assessment of the water budget.[37]

1. Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps.

The Alternative Report describes a hydrogeologic conceptual model based on published studies, data collected by the Department and U.S. Geological Survey (USGS), and work done in preparation of the Alternative.[38] The Alternative Report describes that local geology is highly controlled by tectonics associated with the Mendocino Triple Junction, located about 20 miles south of the Basin.[39] The Alternative Report characterizes the basin as being composed of unconsolidated sediments deposited by the Eel and Van Duzen Rivers overlying thick layers of sedimentary rocks. Significant sediment volumes are transported by the rivers from the uplands east of the valley, and flooding of the valley occurs periodically, depositing sediment within the floodplain.

The Alternative Report describes the two principal aquifers developed for groundwater resources in the Basin: the upper Alluvium and the underlying Carlotta Formation.[40] The Alluvial aquifer is described as being up to 200-feet thick, unconfined, and widely utilized for agricultural irrigation. The Carlotta Formation is described as being composed of coarse-grained clastic sediments and up to a few thousand feet thick. The Alternative Report notes that most municipal wells in the Basin are completed in the upper portion of the Carlotta Formation (100 to 300 feet below ground surface) and that the full depth of fresh water resources in that aquifer is not well understood.[41]

[37] 23 CCR § 354.12 *et seq.*
[38] Alternative Report, Section 3.1, p. 11
[39] Alternative Report, Section 3.1.1, p. 11
[40] Alternative Report, Section 3.1.3, p. 13
[41] Alternative Report, Section 3.1.10, p. 16

2. Groundwater Conditions

The GSP Regulations require a description of historical and current groundwater conditions in the basin that includes information related to groundwater elevations, groundwater storage, seawater intrusion, groundwater quality, subsidence, and interconnected surface water, as applicable. The GSP Regulations also require an identification of groundwater dependent ecosystems.[42]

The Alternative Report cites a study conducted by the USGS in 1975 as the source of information regarding historical groundwater conditions in the basin, and notes that no subsequent (historical) studies have been performed.[43] The Alternative Report does not describe the purpose or scope of the 1975 study, but a review of the USGS report indicates that the focus of the 1975 study was to update and evaluate changes to groundwater levels and the freshwater-seawater transition zone (i.e., seawater intrusion) of the alluvial (upper) aquifer relative to information collected by another USGS study in 1952.[44] The 1975 study determined that the position of the freshwater-seawater transition zone in the alluvial aquifer[45] and groundwater elevations had not changed between the 1952 and 1975 studies, and concluded that pumping did not exceed annual recharge in the basin.[46] The Alternative Report compares seawater intrusion in the shallow aquifer from 1975 with data collected in 2016. The Alternative Report compares the 100 mg/L chloride isoconcentration line identified in 1975 with sampling results from 2016 and states that no appreciable shift in the freshwater-seawater transition zone has occurred over that period. The Alternative Report indicates that chloride concentrations increase with depth, which is consistent with findings from the earlier study.

The Alternative Report describes recent groundwater elevation data, including data collected from six wells as part of the CASGEM program, data collected at 16 wells between November 2015 and November 2016 by a member of the Eel River Valley Groundwater Working Group (Working Group), and a groundwater level measurement event in fall 2016 at 54 wells coordinated by various members of the Working Group.[47] The Alternative Report discusses groundwater level conditions in the area it refers to as the Eel River Valley Alluvial Aquifer using hydrographs from wells located generally west of the confluence of the Eel and Van Duzen rivers.[48] Those hydrographs show that groundwater levels in the alluvial aquifer fluctuate in elevation seasonally within a range

[42] 23 CCR § 354.16
[43] Alternative Report, Section 3.2, p. 16
[44] Groundwater conditions in the Eureka Area, Humboldt County, California, 1975, U.S. Geological Survey Water-Resources Investigations Report 78-127 (1978); results of the earlier study were published in Geology and ground-water features of the Eureka area, Humboldt County, California, USGS Water Supply Paper 1470 (1959).
[45] USGS Water-Resources Investigations Report 78-127 (1978), p. 19
[46] USGS Water-Resources Investigations Report 78-127 (1978), p. 16
[47] Alternative Report, Section 3.2.1, p.17
[48] Alternative Report, Section 3.2.1.1, p. 18

of approximately 10 feet and are relatively stable through time.[49] The Alternative Report also notes that three monitoring wells installed in October 2016 along the Eel River in this area show a close hydrologic connection between groundwater and the River.[50] The Alternative Report describes that this close connection was similarly noted in the 1975 USGS study, and that the Eel River is an important contributing factor to the historically stable groundwater elevations and seaward groundwater gradient.

The Alternative Report separately discusses groundwater conditions in the Van Duzen Watershed, referring to the portion of the Basin upstream of the confluence of the Eel and Van Duzen rivers.[51] The Alternative Report states there are no monitoring wells in that upstream area with sufficiently long periods of record to evaluate seasonal and long-term trends, and that the upper alluvial aquifer and underlying Carlotta Formation are "known to be in good hydrologic connection" although evidence supporting the latter statement is not cited.

The County relied on data collected by the Working Group to create groundwater elevation contour maps for spring and fall 2016. Those maps depict relatively steep hydraulic gradients in the upper portion of the basin and relatively flatter gradients in the downstream portion of the Eel River Valley approaching the coast for both periods.[52] The fall 2016 map, which was generated with data from the additional 54 wells noted above, shows additional detail such as deflection in the water table in the vicinity of the Eel River, although those details are not discussed in the Alternative Report.

The Alternative Report estimates that total groundwater storage in the basin, including both the upper Alluvial and lower Carlotta aquifers, is approximately 2 million acre-feet.[53] The County notes that only a fraction of that is usable due to the possibility of excess production inducing further landward migration of seawater or causing undesirable results related to surface waters and cites a previous estimate of the usable basin storage developed by the Department in 1965 of 100,000 acre-feet.[54] The Alternative Report evaluates changes in groundwater storage for the western, alluvial portion of the basin using data collected from 1989 to 2016 from four CASGEM wells.[55] The Alternative Report notes a strong correlation between precipitation and storage, but indicates that, due to the limited amount of data and the use of sea level as an "arbitrary lower boundary" for the base of usable storage, the calculated change in storage is intended to

[49] Alternative Report, Figure 3-14
[50] Alternative Report, Section 3.2.1.1, p. 19, and Appendix F
[51] Alternative Report, Section 3.2.1.2, p. 19
[52] Alternative Report, Figures 3-12 and 3-13
[53] Alternative Report, Section 3.1.9, p. 15
[54] Alternative Report, Section 3.1.9, p.15; and Section 3.2.2, p.19
[55] Alternative Report, Section 3.2.2, p. 20

demonstrate trends in storage changes and not the absolute changes in storage volume for the basin.

The Alternative Report describes groundwater conditions related to water quality as generally good and notes the absence of larger-scale contaminant plumes affecting water supplies.[56] The Alternative Report notes the presence of several open Leaking Underground Storage Tank sites and Cleanup Program Sites that operate under regulation from the State, but describes impacts to groundwater quality associated with open regulatory sites as limited in extent laterally and vertically, and concludes that they are unlikely to pose regional scale threats to groundwater quality.[57] The Alternative Report and the GAMA Program Database Review describe an analysis of water quality data obtained from the State Water Resources Control Board's Geotracker-Groundwater Ambient Monitoring and Assessment (GAMA) database.[58] The analysis was conducted for six constituents, including arsenic, chloride, nitrate, sodium, specific conductance, and total dissolved solids. Other constituents were excluded because their historical results were either below detection limits or were low relative to the cited water quality objectives.[59] The analysis included determining the average concentration for each constituent by decade and comparing the decadal average with water quality objectives, including the maximum contaminant level (MCL), secondary MCLs, and agricultural limits. Constituents that historically had decadal averages above the various water quality objectives, including chloride, specific conductance, and total dissolved solids, all saw those decadal averages drop below the water quality objectives by approximately the 1980s.

The Alternative Report states that no evidence exists to indicate subsidence has occurred in the Basin. The Alternative Report claims that the relatively stable trends in groundwater elevation, narrow range in seasonal groundwater level variation, and the "granular nature of the sediments" are all indicative that conditions that could lead to subsidence are not present in the Basin.[60] However, the Alternative Report notes that no land subsidence monitoring has been conducted.

The Alternative Report describes the presence of several interconnected surface water bodies, including the Eel and Van Duzen Rivers, Yager Creek, and Salt River.[61] The Alternative Report and the Surface Discharge Report describe studies that measured gaining and losing conditions on the Eel and Van Duzen rivers and Yager Creek.[62] The studies, which involved performing streamflow measurements at discrete points and

[56] Alternative Report, Section 4.2.4, p. 31
[57] Alternative Report, Section 3.2.4.1, p. 22
[58] Alternative Report, Appendix G
[59] Alternative Report, Appendix G, p. G-2
[60] Alternative Report, Section 3.2.5, p. 24
[61] Alternative Report, Section 3.2.6, p. 24
[62] Alternative Report, Appendix E

calculating the difference in flow between adjacent gauging points, were conducted in August and October 2016 and showed both gaining and losing conditions on the Eel River, and losing conditions on the Van Duzen River and Yager Creek. While the 2016 studies provide an estimate of stream losses and gains between flow measurement points, they did not investigate the quantity and timing of depletions of the interconnected surface water due to groundwater use. The Alternative Report states that "[o]ther than periodic flow studies, little work has been done to quantify the connections the rivers have with their underlying groundwater system," but that wells installed in late 2016 can be used in the future to monitor for those conditions. [63] The Alternative Report further describes that recent studies have found the length and duration of low flow periods on the Eel River have increased more than can be explained by changes in rainfall, and that other changes such as sedimentation, forest composition, and streamflow diversions may be responsible for the increase. The Department reviewed the primary study focused on the Eel River watershed and noted that the most downstream gages considered (i.e., the USGS Scotia Gage on the Eel River and the USGS Van Duzen Gage) roughly correspond to the locations where those rivers flow into the Eel River Groundwater Basin.[64] It does not appear the referenced study evaluated streamflow conditions within the Basin or the depletion of streamflow due to groundwater use in the Basin.

The Alternative Report notes that groundwater dependent ecosystems in the Basin include "…freshwater emergent wetlands, forested/shrub wetlands, ponds and lakes, in addition to riverine and estuarine habitats", and includes a map of those features generated from the U.S. Fish and Wildlife Service's National Wetlands Inventory dataset.[65]

3. Water Budget

GSP Regulations require a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored, as applicable.[66]

The Alternative Report presents a summary of the Basin's water budget[67] and refers to the Water Budget Report for additional detail.[68] The Water Budget Report describes that annual water budgets for 1985 through 2015 were developed for the Basin including the surrounding watersheds. The annual water budgets represent watershed budgets for the

[63] Alternative Report, Section 3.2.6.4, p. 26
[64] Asarian, J.E. 2015. Long-Term Streamflow and Precipitation Trends in the Eel River Basin. Prepared by Riverbend Sciences for Friends of the Eel River, CA. 30p. + appendices.
[65] Alternative Report, Section 3.2.7, p. 27
[66] 23 CCR § 354.18
[67] Alternative Report, Section 3.3, p. 27
[68] Alternative Report, Appendix H

Upper Van Duzen River, Lower Van Duzen River, Yager Creek, Salt River, and Price Creek watersheds, but only portions of the Salt River, Price Creek, Yager Creek and Lower Van Duzen Rivers overlap with the Basin. The Alternative Report indicates that, to ensure all water contributing to the basin is captured in the budget, developing budgets for the watershed rather than the groundwater basin will reduce overall uncertainty.[69] The water budget provides estimates of inflows to the groundwater basin from precipitation, subsurface inflow, and recharge estimates over the watersheds and uses measured data for surface water inflow for the Eel River at Scotia Gage. The water budget estimates outflows from the groundwater basin including surface water outflow, subsurface outflow to the ocean, evapotranspiration, and groundwater withdrawals through pumping. The surface water outflow is estimated from a combination of surface water gages further upstream and estimated runoff and recharge. Several of the water budget components do not change with time, including the groundwater outflow and the recharge from the Eel and the Van Duzen Rivers. In addition, the stream aquifer interaction is estimated based solely on a 2016 study that looked at losing and gaining conditions for three days during August and October of that year.[70] The Water Budget Report concludes that the average annual change in groundwater storage is positive 85,564 acre-feet per year.

4. Management Areas

GSP Regulations authorize, but do not require, an agency to define one or more management areas within a basin if the agency has determined that creation of management areas will facilitate implementation of the GSP.[71]

The County has not identified management areas or defined management strategies that are functionally equivalent to management areas within the Eel River Valley Basin.

C. Sustainable Management Criteria

GSP Regulations require a sustainability goal that defines conditions that constitute sustainable groundwater management for the basin, the characterization of undesirable results, and establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator, as appropriate.[72]

1. Sustainability Goal

GSP Regulations require that sustainable management criteria include a sustainability goal that culminates in the absence of undesirable results within the appropriate timeframe, and includes a description of the sustainability goal, describes information used to establish the goal for the basin, describes measures that will be implemented to

[69] Alternative Report, Appendix H, Report p. 25
[70] Alternative Report, Appendix H, Report p. 22
[71] 23 CCR § 354.20
[72] 23 CCR § 354.22

ensure the basin operates within its sustainable yield, and contains an explanation of how the sustainability goal will be met. [73] The sustainability goal for an alternative based on an analysis of basin conditions represents the criteria that allowed the basin to be operated within its sustainable yield for a period of at least 10 years, which includes the avoidance of undesirable results.[74]

The County describes the sustainability goal for the basin as being "…to maintain high quality and abundant groundwater resources in support of existing and long-term community needs without causing undesirable results".[75] The Alternative Report concludes that the sustainability goal for the Basin is being met and will continue to be met for at least the near future.[76]

2. Sustainability Indicators

GSP Regulations specify that an agency define conditions that constitute sustainable groundwater management for a basin, including the characterization of undesirable results and the establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator.[77]

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, *when significant and unreasonable*, cause undesirable results.[78] Sustainability indicators thus correspond with the six undesirable results – chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon, reduction of groundwater storage, seawater intrusion, degraded water quality, including the migration of contaminant plumes that impair water supplies, land subsidence that substantially interferes with surface land uses, and depletions of interconnected surface water that have adverse impacts on beneficial uses of the surface water[79] – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

[73] 23 CCR § 354.24. For an alternative based on a demonstration of 10 years of sustainable management, the sustainability goal, or its functional equivalent, would have been developed at some previous time during basin management, and its goals met by the time the Alternative was submitted to the Department.
[74] Water Code § 10721(w)
[75] Alternative Report, Section 4.1, p. 30
[76] Alternative Report, Section 5.0, p. 35
[77] 23 CCR § 354.22
[78] 23 CCR § 351(ah)
[79] Water Code § 10721(x)

This section thus consolidates three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives. Information pertaining to the processes and criteria relied upon to define undesirable results applicable to the basin, as quantified through the establishment of minimum thresholds, are addressed for each sustainability indicator. However, a submitting agency is not required to establish criteria for undesirable results that the agency can demonstrate are not present and are not likely to occur in a basin.[80]

The County did not quantify or establish criteria for undesirable results. The County asserts, in its Alternative Elements Guide, that establishment of criteria for undesirable results is a level of analysis that "is unwarranted, because the Basin has been managed sustainably without undesirable effects".[81] Instead, the County claims that undesirable results are not present and not likely to occur for each sustainability indicator, as described below. The Alternative Report notes that the County determined measurable objectives were not required because of the demonstration that undesirable results were not present and not likely to occur. However, the Alternative Report discusses a goal-setting framework to be used for future management that it describes as functionally equivalent to setting measurable objectives. A table in the Alternative Report summarizing the goal-setting framework indicates that the County intends to use measured groundwater levels to evaluate the target condition of "continued stable trends" for groundwater levels and storage and the 100 milligram per liter chloride isoconcentration contour to evaluate the target condition of "no change in position of transition zone" for seawater intrusion.[82] Notes to the table indicate that no measurable parameters were set for water quality, land subsidence, or "beneficial uses of interconnected surface water"; for the latter, it was noted that no measurable parameter was set because of incomplete data and information.

a. Chronic Lowering of Groundwater Levels

GSP Regulations specify that the minimum threshold for chronic lowering of groundwater levels be based on groundwater elevations indicating a depletion of supply that may lead to undesirable results.[83]

The Alternative Report references long-term stability in groundwater levels, hydrogeologic conditions that it characterizes as highly favorable for recharge, relatively low volumes of pumping relative to Basin recharge, and that "…groundwater elevation monitoring performed in over 60 wells distributed across the Basin in fall 2016 did not identify any groundwater levels of concern".[84] The County concludes that this

[80] 23 CCR § 354.26(d)
[81] Alternative Elements Guide
[82] Alternative Report, Table 4-1, p. 33
[83] 23 CCR § 354.28(c)(1)
[84] Alternative Report, Section 4.2.1, p. 30

demonstrates that undesirable results associated with groundwater levels are not present and unlikely to occur in the basin. As a result, the County did not develop minimum thresholds for groundwater levels and claims that they are not required.

b. Reduction of Groundwater Storage

GSP Regulations specify that the minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results.[85]

While the Alternative Report does not calculate a sustainable yield for the basin, it points to the stability of groundwater levels and other items noted in the *Chronic Lowering of Groundwater Levels* section, above. The County claims that evidence demonstrates that undesirable results associated with groundwater storage are not present and unlikely to occur in the basin.[86] As a result, the County did not develop minimum thresholds for groundwater storage and claims that they are not required.

c. Seawater Intrusion

GSP Regulations specify that the minimum threshold for seawater intrusion be defined by a chloride isoconcentration contour for each principal aquifer where seawater intrusion may lead to undesirable results.[87]

The Alternative Report compared the 1975 and 2016 chloride isoconcentration contours and claimed that there has been no substantial shift in the freshwater-seawater transition zone. The Alternative Report cites the lack of additional seawater intrusion during that time as evidence that undesirable results associated with seawater intrusion are not present and unlikely to occur in the basin.[88] As a result, the County did not develop minimum thresholds for seawater intrusion and claims that they are not required.

d. Degraded Water Quality

GSP Regulations specify that the minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results.[89]

The Alternative Report references the County's evaluation of water quality data associated with the GAMA Program (see Groundwater Quality, above) and states that the analysis "…indicates high quality groundwater conditions with respect to nutrients".[90]

[85] 23 CCR § 354.28(c)(2)
[86] Alternative Report, Section 4.2.2, p. 30
[87] 23 CCR § 354.28(c)(3)
[88] Alternative Report, Section 4.2.3, p. 30
[89] 23 CCR § 354.28(c)(4)
[90] Alternative Report, Section 4.2.4, p. 31

The Alternative Report also states that "existing public agency records indicate there is an absence of a large-scale contaminant plume affecting water supplies". The Alternative Report concludes that the evidence noted above is sufficient to demonstrate that undesirable results associated with water quality are not present and not likely to occur in the basin. As a result, the County did not develop minimum thresholds for water quality and claims that they are not required.

e. Land Subsidence

GSP Regulations specify that the minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.[91]

The Alternative Report claims there is no evidence of significant land subsidence within the basin. The Alternative Report states that the majority of the sediments within the zone of groundwater fluctuation consist of "granular" deposits and references the historical stability in groundwater levels as evidence that undesirable results associated with land subsidence are not present and unlikely to occur.[92] As a result, the County did not develop minimum thresholds for subsidence and claims that they are not required.

f. Depletion of Interconnected Surface Water

GSP Regulations specify that the minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.[93]

The County points to several items as evidence that undesirable results associated with depletion of interconnected surface water are not present and not likely to occur in the basin, including: the general stability of groundwater levels even during times of drought, stable trends in groundwater pumping, groundwater pumping is dispersed throughout the basin, the significant volume of surface water that flows over the Basin, maintenance of deep pools during low-flow periods on the Lower Eel River, that other factors cause reduced streamflow on the Lower Eel River (e.g., upstream diversions and changes in forest composition), and that the Regional Water Board did not list the Eel River as impaired for flow.[94] As a result, the County did not develop minimum thresholds for depletion of interconnected surface water and claims that they are not required.

[91] 23 CCR § 354.28(c)(5)
[92] Alternative Report, Section 4.2.5, p. 31
[93] 23 CCR § 354.28(c)(6)
[94] Alternative Report, Section 4.2.6, p. 31

D. Monitoring Networks

GSP Regulations require that each basin be monitored, and that a monitoring network include monitoring objectives, monitoring protocols, and data reporting requirements be developed that shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions.[95]

The Alternative Report describes the County's monitoring network for future groundwater management as being a subset of the wells and surface water monitoring sites used for development of the Alternative Report, and includes a map of the proposed monitoring network.[96] The network includes nine new monitoring wells installed by the County in 2016. Six of the new monitoring wells are positioned near the rivers to help evaluate surface water and groundwater interactions. Six of the wells also have paired shallow and vertical screens for monitoring of the shallow and deep aquifers. The Alternative Report states that the new wells will be used along with existing wells monitored by the County for the CASGEM Program, although the CASGEM wells are not included in the monitoring network map. The Alternative Report also states that the County will continue to monitor surface water flows at the USGS Scotia and Bridgeville gauging stations.

The Alternative Report states that the network will be able to collect sufficient data to determine short-term, seasonal, and long-term trends in groundwater and related surface conditions.[97] Depth to groundwater measurements will be collected bi-annually to capture the seasonal highs and lows in the Basin. In addition, the County has installed pressure transducers to collect high-frequency groundwater levels in 16 wells, including the paired wells near the river channels. For seawater intrusion monitoring, the County will collect samples for chloride from two monitoring wells on a bi-annual basis, in addition to collecting samples from all wells every five years (note that it is not clear if the reference to all wells includes just the new wells shown on monitoring network map, or if it includes the CASGEM wells or other wells monitored in 2016 in support of the Alternative Report development).

The Alternative Report states the County's intention to review groundwater data from its improved monitoring network following the 2017 water year to determine if additional monitoring network components are needed. The evaluation will be included in the County's annual reporting and will include identification of any data gaps and a description of steps taken to fill those data gaps.

[95] 23 CCR § 354.32
[96] Alternative Report, Section 4.5 and Figure 4-1, p. 33
[97] Alternative Report, Section 4.5.1, p. 33

E. Projects and Management Actions

GSP Regulations require a description of the projects and management actions the submitting agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[98]

The Alternative Report states that the sustainability goal for the Basin is being met and will continue to be met for at least the next five years. Therefore, the County concludes that periodic monitoring of the basin is sufficient and projects or additional management actions are not needed to attain the sustainability goal.[99] A process to address adverse conditions discovered during future monitoring is included in the documentation.[100]

VI. Assessment

The following describes the evaluation and assessment of the Alternative for the Eel River Valley Basin as determined by Department staff. In undertaking this assessment, Department staff did not conduct geologic or engineering studies, although Department staff may have relied on publicly available geologic or engineering or other technical information to verify claims or assumptions presented in the Alternative.[101] As discussed above, Department staff have determined that the Eel River Valley Basin Alternative satisfied the conditions for submission of an alternative.[102] The Alternative was submitted within the statutory period, the Basin was found to be in compliance with the reporting requirements of CASGEM, and staff finds the Alternative to be complete and to cover the entire Basin (*see* Required Conditions, above). However, based on its evaluation and assessment of the Eel River Valley Alternative, Department staff do not believe that the Alternative is able to satisfy the objectives of SGMA and recommends that the Alternative not be approved.[103]

A. Evaluation of Alternative Contents

The Alternative Report demonstrated a reasonable understanding of general geologic and hydrologic conditions of the Basin, as demonstrated by the hydrogeologic conceptual model of the Eel River Valley Basin, and appropriately acknowledged where there are gaps in understanding. The County provided evidence that an abundant groundwater supply has historically been available from relatively shallow depth within the Basin.

[98] 23 CCR § 354.44
[99] Alternative Report, Section 5.0, p. 35
[100] Alternative Report, Section 4.5.4, p. 35
[101] Instances where the Department review relied upon publicly available data that was not part of the Alternative are specifically noted in the assessment.
[102] 23 CCR § 358.4(a)
[103] Water Code § 10733.6(a); and 23 CCR § 358.4(b)

However, the level of understanding of groundwater conditions in the deeper principle aquifer, the Carlotta Formation, is less than that of the shallow alluvial principle aquifer. The level of knowledge of the hydrogeology and operation of the Basin has been improved recently by the enhancement of the Basin's monitoring network. The improved scope and spatial distribution of data will help the County understand the dynamics of the basin with respect to surface and groundwater.

Department staff identified numerous flaws in the water budget provided in the Alternative and do not believe it is representative of the Basin. Instead of calculating the water budget for the Basin itself, the County calculated a water budget for watersheds contributing to the Eel River Valley Basin. In doing so, the water budget was simplified greatly and assumed that precipitation over the watershed area became an inflow to the Basin in its entirety. This is not realistic because the precipitation as described in the water budget report is broken down into three components, precipitation used by plants and evaporation (evapotranspiration), surface runoff, and recharge.[104] Of those components, only recharge enters the subsurface. Furthermore, recharge in areas outside of the groundwater basin would not necessarily become part of the groundwater in the Basin. The assumption that all precipitation enters groundwater has the effect of skewing wet years where runoff is higher and a lower percentage of precipitation recharges. This is apparent in the recharge estimates provided where very large infiltration coefficients are assumed that are not limited by high groundwater levels or the slow rate of infiltration that occurs on steeper slopes with shallow or exposed bedrock. Given that the precipitation is used in part to estimate flow in the Van Duzen River outside of the Basin, it also appears that recharge is being double counted. Within the Van Duzen watershed, there are no other sources of water besides precipitation, i.e. no imported water, and as a result any water flowing in the river and accounted for separately as recharge to the Basin is effectively double counted. Recharge is provided as an inflow from the Salt Creek – Lower Eel Watershed. However, this is not present in any of the calculations or maps used to explain the water budget. Department staff assume that this is the same as the Salt River-Eel River watershed, but the average numbers provided for recharge and runoff in Tables 11 and 12, respectively, do not match the average provided in the combined water budget.[105] These recharge values effectively assume that the river is losing in all years regardless of how much precipitation was received. This appears to be in conflict with the discussion on groundwater surface water interactions based on monitoring performed in Fall of 2016.[106] These flaws contributed to errors in the water budget and, as a result, appears to have overestimated the positive changes in storage

[104] Alternative Report, Appendix H, Section 4.1, p. 26
[105] Alternative Report, Appendix H, Sections 4.3.1 and 4.3.2, Tables 11 and 12, p. 31-35
[106] Alternative Report, Appendix H, Section 3.5, Report p. 20

by several times. The errors also contributed to overestimates in negative changes in storage, though likely by lesser amounts.

The lack of any definition of what would constitute undesirable results in the Basin or the establishment of minimum thresholds for any of the sustainability indicators (or for some functional equivalent) creates an insurmountable obstacle for Department staff in its review of whether the Alternative has achieved sustainable groundwater management for the Basin. An alternative based on an analysis of basin conditions requires a demonstration that the basin has operated within its sustainable yield, which SGMA defines with reference to the absence of undesirable results.[107] The County claims that there is sufficient information to demonstrate that undesirable results are not present within the Basin and unlikely to occur,[108] but the County misreads the regulatory exemption from the requirement of establishing criteria for undesirable results that are not present and are not likely to occur in a basin.[109] Because the avoidance of undesirable results is the keystone of SGMA, invoking an exemption from quantifying impacts that might cause undesirable results is reasonable only where the lack of such impacts is made both clear and compelling through the information provided. As described below, the County did not provide sufficient information to determine that criteria for undesirable results are not needed, particularly for depletions of interconnected surface water.

Consistent with the legislative intent of SGMA that groundwater management be undertaken locally to the greatest extent possible,[110] the local agency is responsible for defining what constitutes undesirable results.[111] The responsibility of the Department is to determine whether the assessment of the local agency is reasonable.[112] The Department does not expect local agencies to have anticipated and preemptively defined and identified unique management criteria for each of the undesirable results defined in SGMA. But, at a minimum, the local agency should be able to identify objective standards related to groundwater conditions that are functionally equivalent to one or more of the undesirable results, demonstrate they have managed the basin to those standards for at least ten years, and be able to show how those standards can reasonably be extrapolated to factors related to other undesirable results.[113] Because the County has not defined what would constitute undesirable results caused by groundwater conditions occurring

[107] Water Code § 10721(w)
[108] Alternative Report, Section 3.3, p. 29
[109] 23 CCR § 354.26(d)
[110] Water Code § 10720.1
[111] 23 CCR § 354.26
[112] 23 CCR § 355.4
[113] Management need not involve the implementation of projects and management actions so long as passive management will suffice. But the establishment of quantifiable criteria and monitoring of conditions to assure that thresholds associated with those criteria are not exceeded, and evidence that those thresholds were not in fact exceeded, would be required.

throughout the Eel River Valley Basin, the County has provided the Department with nothing to which a reasonableness review applies.

The Alternative Report acknowledges the interconnection of groundwater with surface water (*see* Groundwater Conditions, above) and public comments received by the Department indicate there are beneficial uses and users of that surface water that may be sensitive to depletion of flows (e.g., various fish species that use rivers in the Basin for migratory purposes). However, the Alternative contains no data or analysis describing the quantity and timing of depletions of the interconnected surface water due to groundwater use. It is well understood that groundwater pumping in basins with interconnected surface water leads to depletion of flow in those interconnected surface water bodies.[114] The source of water pumped by wells in these basins is either from storage, captured discharge (i.e., water pumped from a well that would otherwise flow to a connected surface water body), or induced recharge (i.e., an increase in recharge from an interconnected surface water body into groundwater beyond what would occur in the absence of that pumping). Given the assertion that storage in the basin is relatively stable, captured discharge and induced recharge are likely the primary source of groundwater pumped from wells in the Eel River Basin. It is, therefore, an almost unavoidable certainty that groundwater pumping results in depletion of streamflow from rivers in the Basin and that the depletion could, in some way, impact the beneficial uses and users of that surface water. An alternative based on 10 years of sustainable yield that is submitted for a basin with significant interconnected surface water must be able to demonstrate an understanding of those depletions and determine at what point they are significant and unreasonable. However, the Alternative Report contains no information about streamflow depletion over the past 10 years and has adopted no standard whose reasonableness the Department can evaluate. The County identifies a variety of other factors that could contribute to adverse streamflow conditions in the Basin, as discussed below. While those factors may be important and relevant for water managers, they do not obviate the requirement of SGMA to evaluate streamflow depletion due to groundwater use in the Basin and decide what constitutes an undesirable result associated with that depletion.

The County identifies stable groundwater levels as one piece of evidence that undesirable results associated with depletions of interconnected surface water are not present and not likely to occur.[115] The Alternative Report includes hydrographs demonstrating relatively stable groundwater-level trends at seven monitoring wells in a portion of the Basin. While Department staff do not dispute that groundwater-level trends at those wells appear stable, that stability does not preclude the fact that groundwater use could cause a significant and unreasonable depletion of interconnected surface water. Because

[114] See e.g., Barlow, P.M., and Leake, S.A., 2012, Streamflow depletion by wells—Understanding and managing the effects of groundwater pumping on streamflow: U.S. Geological Survey Circular 1376, 84 p.
[115] Alternative Report, Section 4.2.6, p. 31

recharge from the Eel River is likely supporting high groundwater levels, a fact noted by the County in the Alternative, this information provides support for the need to quantify the impact to surface water systems.[116]

The County identifies that groundwater extraction has been steady since the 1960s and that the extraction is dispersed spatially across the valley as further evidence that undesirable results associated with depletions of interconnected surface water are not present and not likely to occur.[117] Pumping groundwater in a Basin with interconnected surface water will eventually lead to a depletion of that interconnected surface water whether the trends in pumping are stable or not. Stable pumping volumes through time, and the stable groundwater levels noted above, supports the County's claim that the Basin is recharged annually, but does not indicate the nature of the impact of pumping to interconnected surface waters. The fact that pumping volumes are consistent through time may mean that the impact is similar from year to year but doesn't describe what the impact is. Department staff were unable to find evidence in the Alternative Report to support the claim that pumping is dispersed across the valley but, even if it is true, distance from an interconnected surface water body impacts the timing but not the quantity of depletion and is not evidence that undesirable results related to depletion of interconnected surface water are not present and not likely to occur.

The County identifies that groundwater use represents only four percent of annual recharge to the Basin as further evidence that undesirable results associated with depletions of interconnected surface water are not present and not likely to occur.[118] The Alternative does not explain why the percentage of groundwater pumping relative to annual basin recharge is a useful proxy for impacts to the beneficial uses and users of interconnected surface water. The Basin may receive adequate recharge to maintain stable groundwater levels, but that recharge, particularly during drier portions of the year, may be sourced from the interconnected surface water bodies and the Alternative does not analyze the quantity of the depletion to support the claim that it is not an undesirable result. It should also be noted that the cited volumes of recharge appear to be skewed high by including unrealistically high recharge volumes during wet years, as noted above.

In its demonstration that undesirable results related to depletion of interconnected surface water are not present and not likely to occur, the Alternative Report cites a 2015 study[119] indicating the Lower Eel River normally maintains pools between 7- to 14-feet deep through the low flow season.[120] (Comments submitted to the Department indicate that

[116] Alternative Report, Section 3.2.1.1, p. 19
[117] Alternative Report, Section 4.2.6, p. 31
[118] Alternative Report, Section 4.2.6, p. 31
[119] Stillwater Sciences, 2015. 2015 Fisheries Monitoring Program Report for Gravel Extraction Operations on the Mad, Lower Eel, South Fork Eel, Van Duzen, and Trinity Rivers, California. Prepared for Humboldt County Gravel Operators. 24 p. + appendices.
[120] Alternative Report, Section 4.2.6, p. 31

other studies have not found such pools. [121]) Regardless, the presence or absence of such pools does not define the presence or absence of undesirable results, and the County had never established the presence of pools as defining acceptable conditions regarding the depletion of interconnected surface waters.

The Alternative Report notes several factors, including upstream diversions and changes in forest composition, as the primary anthropogenic causes of reduced streamflow on the Eel and Van Duzen rivers.[122] As noted above (*see* Groundwater Conditions) the study referenced by the County that identified those factors evaluated changes in streamflow at the scale of the Eel River watershed and the most downstream gages in the study represent the points at which streamflow enters the Basin. That study, therefore, could not have evaluated impacts of groundwater use in the Basin on streamflow depletion in the Basin. The fact that groundwater pumping in the Basin is not listed in the study as a contributor to reduced streamflow on the Eel River upstream from the Basin is expected and is not evidence that depletions of interconnected surface water due to groundwater use are not present or likely to occur. It does not appear, based on information submitted with the Alternative, that any studies have been conducted to quantify the depletion of interconnected surface water due to groundwater use in the Basin or to determine the amount of depletion that would lead to an undesirable result.

Department staff's review also identified issues with the County's demonstrations for other undesirable results. The Alternative Report asserts that stable groundwater levels are the primary evidence that undesirable results associated with chronic lowering of groundwater levels, reduction of storage, and land subsidence are not present and not likely to occur. Groundwater level data provided from wells with long-term hydrographs do appear to show that groundwater levels have been relatively stable in the western portion of the basin. However, as noted (*see* Groundwater Conditions above) the Alternative Report did not contain any long-term groundwater level data in the portion of the Basin east of the confluence of the Eel and Van Duzen rivers. The Alternative Report doesn't explicitly quantify the groundwater use for that portion of the basin, but a map provided indicates that area has among the highest well densities in the basin.[123] Considering the lack of a long-term record of groundwater levels for a significant portion of the Basin, it does not appear reasonable to assume that undesirable results are both not present and not likely to occur throughout the basin and, thus, that groundwater level criteria are not required. Furthermore, except where conditions clearly and logically preclude a given undesirable result (e.g., seawater intrusion in groundwater basins in the North Lahontan region), it is generally not possible to determine that an undesirable result

[121] California Department of Fish and Game. 2010. Lower Eel River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game.
[122] Alternative Report, Section 4.2.6, p. 32
[123] Alternative Report, Figure 2-2

has not occurred absent criteria that define that undesirable result and direct evidence that the defined conditions have not occurred.

For degraded water quality, the County compiled water quality data from a State database and then calculated the decadal-average concentration for each constituent using all wells sampled in the basin during a particular decade. They showed that, for the last several decades, those decadal-averaged concentrations were below applicable drinking water and agricultural water quality standards. However, this methodology has a potential to mask potentially important details about the location of water quality concerns in a basin. For example, if a monitoring site with particularly high concentrations of a constituent was sampled infrequently in a given decade while other sites with lower concentrations were sampled more frequently, the resultant decadal average will likely not be useful to identify the areas where higher concentrations, potentially indicating a degradation of water quality, have occurred. Department staff do not conclude that significant and unreasonable degradation has occurred, but simply that the analysis presented in the Alternative is not sufficient support the conclusion that any sort of analysis is rendered unnecessary because undesirable results associated with water quality degradation are not present and not likely to occur.

As noted above (*see* Groundwater Conditions) the County describes the results from 1952, 1975, and 2016 as comparable and indicative that the seawater intrusion front has not advanced significantly in the upper aquifer. While the County's assessment of seawater intrusion conditions in the upper aquifer appear reasonable, provided maps and written descriptions also indicate that concentrations of chloride increase with depth, and several deep wells landward of the 1975 chloride contour have recent chloride concentrations above 100 mg/L, with one site up to 2,600 mg/L. The Alternative Report states that this is consistent with the understanding that chloride concentrations increase with depth. However, the analysis presented in the Alternative Report does not explore the increase in chloride concentration with depth and it is unclear whether the extent of elevated chloride concentrations in the deeper portions of the aquifer due to seawater intrusion are understood.

For the reasons cited above, Department staff determined the County's assertion that none of the undesirable results were present or likely to occur in the Eel River Basin and, thus, that no sustainable management criteria were required or applicable for the Basin, was not based on sufficiently thorough and reasonable analysis. The determination that the Basin has been operated within its sustainable yield for at least 10 years cannot be confirmed in the absence of any standards or criteria that are functionally equivalent to undesirable results and Department staff do not recommend the Alternative be approved.