STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

SUPPLEMENTAL SHEET FOR REGULAR MEETING OF MAY 22-23, 2014
Prepared May 13, 2014

ITEM NUMBER: **13**

SUBJECT: **Morro Bay Nitrate Degradation**

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SUMMARY

This Supplemental Sheet provides staff's responses to Ms. Stedjee's May 8, 2014 email to Ken Harris contending that sewer exfiltration is the primary source for the elevated nitrates in the City of Morro Bay's municipal supply wells located near the intersection of Highway 41 and Highway 1.

Staff's Response

Staff commends Ms. Stedjee's efforts towards getting to the bottom of the nitrate pollution in the four City supply wells located near the intersection of Highways 41 and 1. It is in everyone's best interests to restore the beneficial use of groundwater. Despite the additional discussion provided by Ms. Stedjee and fellow concerned citizens in support of the contention that sewer leaks are the major cause of the nitrate pollution, Central Coast Water Board staff still concurs with Cleath and Associate's 2007 report that concluded irrigated agriculture in the lower Morro Valley is the primary cause of the elevated nitrate in the City's wells.

The primary supporting factors for irrigated agriculture as the primary source for nitrate pollution:

- Groundwater flowing through Morro Valley gets funneled from east to west through the bedrock narrows directly upstream of the City's wells. The wells are positioned to capture that funneled groundwater flowing through the narrows. Therefore, any nitrate discharged to groundwater in the lower Morro Valley has a very high probability of impacting the City's wells. Under ambient conditions, groundwater generally flows parallel to the creek from east to west and preferentially within buried stream channels within the alluvial aquifer.

- The Cleath Report demonstrates via data on land use and crop rotations that nitrate loading in the lower Morro Valley has increased significantly since the 1980s. This is accompanied by the beginning of a significant increase in nitrate concentrations in the City's wells in the 1990s. The decade delay between nitrate loading increases and concentration increases in the City's wells is reasonable considering the distance between the lower Morro Valley and the City's wells and available information on groundwater transport parameters.

- The Cleath Report indicates that nitrate concentrations in lower Morro Valley wells were significantly lower before land-use related loaded began, based on samples collected from wells in 1980 (pre-increased loading) and 2007.

- Growers in the lower Morro Valley enrolled in the irrigated lands program and their irrigation wells became part of a monitoring program in 2010. The growers indicated that they were applying nitrate at well above crop uptake values (allowing unused nitrate to percolate below the root zone and mix with groundwater) for their row crops, a common practice to ensure high yields. This information supports the Cleath Report's findings about land use and nitrate loading. Growers have voluntarily reduced nitrate loads since that time; however, it will likely take several years to decades for excess nitrate to completely flush out of the soils and the lower Morro Valley.

- Samples collected from lower Morro Valley irrigation wells in 2011 show that nitrate concentrations have increased, with a maximum concentration of 300 milligrams per liter, higher than concentrations detected in the 2007 sampling event. Staff anticipates that reductions in nitrate loading will likely require several years for elevated nitrate concentrations to completely flush from the unsaturated zone and lower Morro Valley aquifer.

- These elevated nitrate concentrations in the lower Morro Valley groundwater are funneled through the narrows and are captured by the City's wells. Drought apparently has exacerbated the problem and maximum nitrate concentrations recently spiked at 170 milligrams per liter in City Well MB3.

Primary factors that refute the theory of sewer discharges near Highway 41/1 intersection (former Shell Station) being the primary cause of nitrate:

- Nitrate is detected in the sewer water at a maximum of 40 milligrams per liter (from Cayucos wastewater), which is lower in concentration than detected at water well MB3.

- If one made the assumption that all of the nitrogen compounds (ammonia, nitrite, and organic nitrogen) in the sewage are completely converted to nitrate (with no losses from volatilization or denitrification), the resultant calculated nitrate concentration is 228 milligrams per liter (Cleath, 2007) in the exfiltrated sewer water, which is higher in concentration than the maximum detected at City Well MB3. However, one is relying on the assumption that all forms of nitrogen are nearly all converted to nitrate. Otherwise, it is impossible for sewage to cause the elevated nitrate concentrations in well MB3, because natural physical processes act to attenuate and dilute rather than concentrate nitrate in aquifers. Neither the Cleath report nor Ms. Stedjee provide case examples of nitrate concentration estimates in groundwater from leaky sewer pipes. It seems unlikely that there is enough oxygen in the groundwater to convert all of the nitrogen in other compounds to nitrate; additionally, there would be some nitrogen loss from the denitrification process that would likely occur in oxygen-poor zones near the hypothesized sewer leak(s).

- Even with complete conversion of nitrogen in other forms to nitrate, exfiltrated sewage from the former Shell Station area would have to flow in a 1) crossgradient direction from the former Shell Station (relative to the E-W ambient gradient in the area), 2) across the E-W fabric of the buried stream channels in the alluvium (i.e., through silts and clays), and 3) in sufficient quantity to impact MB3 and the three other the City wells that are located farther crossgradient from the former Shell Station.

- Information regarding the former MTBE plume provides several pertinent observations. The MTBE plume core that emanated from the former Shell Station was oriented parallel to the ambient E-W gradient, and MTBE was detected in groundwater 30 feet below ground surface (before cleanup of MTBE began), and was not deflected towards the MB3 well by the drawdown created from its pumping. There have been no MTBE detections in the City's wells, suggesting that ambient gradient and geology, along with the cleanup efforts, have protected the City wells from a real MTBE threat. It follows that this ambient gradient and geology affords the same protection to the City wells from a potential sewage leak near the former Shell Station.

CONCLUSION

Staff still concurs with the Cleath Report that the primary source of nitrate pollution in the City's wells is from irrigated agriculture. We anticipate that the grower's efforts to reduce loading will over time result in cleanup of nitrate. That said, staff suggests that the City research case studies, etc., for what are reasonably expected maximum nitrate concentrations in groundwater from leaky sewer lines. Given the delicate balance of water supply and water quality in the Morro Bay coastal setting, it is prudent to ensure that pollution sources that could potentially impact drinking water are understood and under control.

ATTACHMENTS:

1. Email from Linda Stedjee dated May 8, 2014
2. Email from Linda Stedjee dated May 10, 2014
3. Email from Linda Stedjee dated May 12, 2014

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