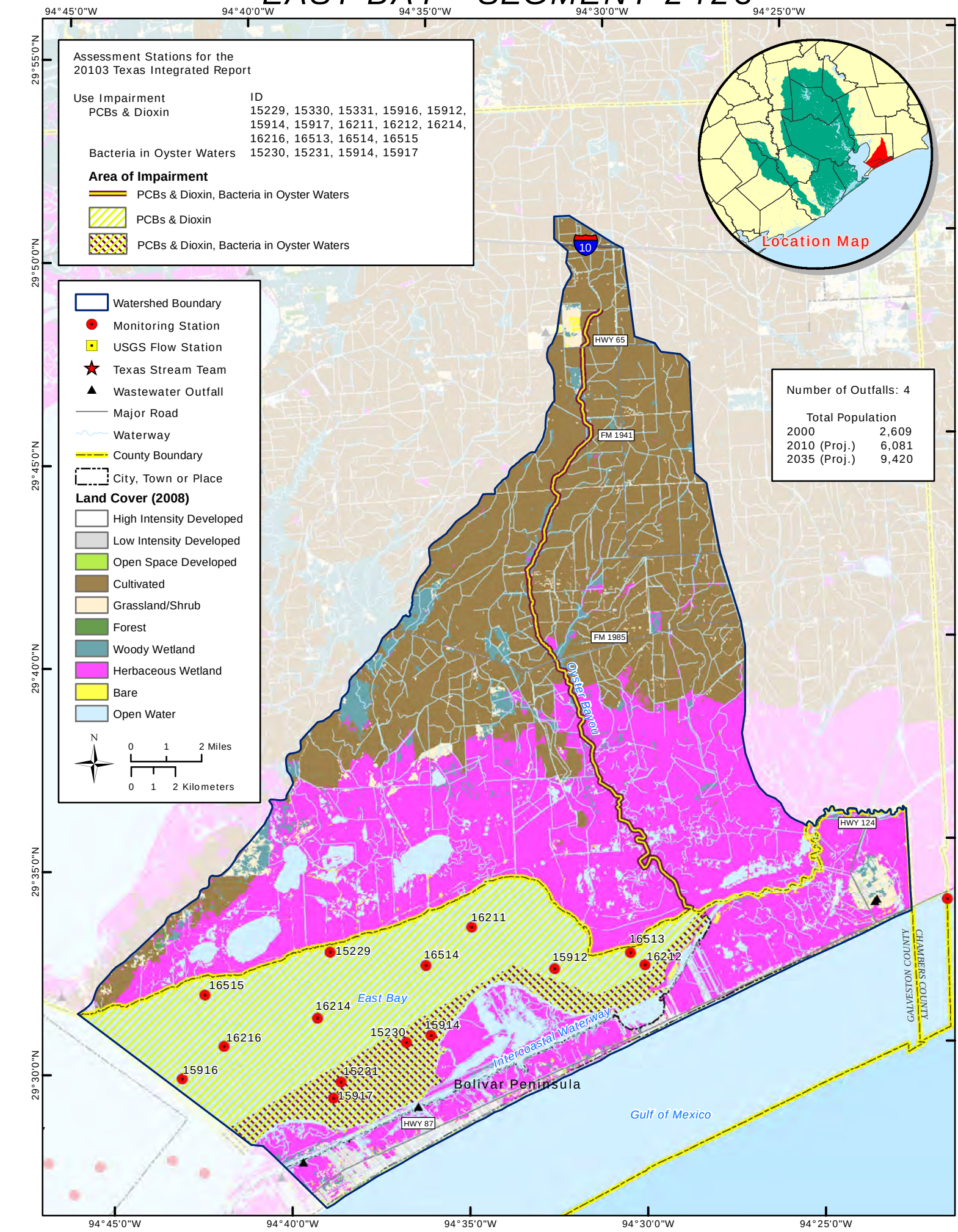
EAST BAY - SEGMENT 2423



Segment Number:	2423	Name:	East Galveston Bay		
Area:	52.1 square miles	Miles of Shoreline:	38.3 miles	Designated Uses:	Contact Recreation; High Aquatic Life Use; Oyster Waters
Number of Active Monitoring Stations:	6	Texas Stream Team Monitors:	0	Permitted Outfalls:	1
Description:	A 134.9 square kilometer (52.1 square mile) portion of Galveston Bay located on the landward side of Bolivar Peninsula extending westward from the Galveston County line east of High Island to an imaginary north-south line extending from Smith Point southeast to approximately ½ mile east of Pepper Grove Cove on Elm Grove Point and east of Bluewater Subdivision on Bolivar Peninsula Sub-Segment 2423A: Oyster Bayou (unclassified water body)—From the East Bay confluence to a point 2.2 km (1.4 mi) upstream from SH 65 in Chambers County				

Degree of Impairment and Overall Trends

Segment ID	Dissolved Oxygen	Bacteria	Nutrients	PCBs/Dioxin	Chlorophyll *a*	Other
2423				100	100	
2423A	100			100	100	

Indicates general improvement Indicates general degradation Numbers indicate percent of segment impaired

FY 2011 Active Monitoring Stations

Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups
10655	Oyster Bayou upstream of East Bay	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a
10655	Oyster Bayou upstream of East Bay	Twice / Year	TCEQ	24-Hour DO
16211	East Bay at 97gb017	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a
16211	East Bay at 97gb017	Once / Year	TCEQ	Benthics, Metals in Sediment
16212	East Bay at 97gb018	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a
16214	East Bay at 97gb020	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll-a
16214	East Bay at 97gb020	Once / Year	TCEQ	Benthics, Metals in Sediment
16216	East Bay at 97gb022	Quarterly	TCEQ	Field, Conventional, Bacteria

Segment 2423			
Standards		**Screening Levels**	
Temperature (°C):	35	Ammonia-N (mg/L):	0.10
Dissolved Oxygen *(24-Hr Average)* (mg/L):	4.0	Nitrate-N (mg/L):	0.17
Dissolved Oxygen *(Absolute Minima)* (mg/L):	3.0	Orthophosphate Phosphorus (mg/L):	0.19
pH (standard units):	6.5-9.0	Total Phosphorus-P (mg/L):	0.21
Enterococci (MPN/100mL) (grab):	89	Chlorophyll-*a* (µg/L):	11.6
Enterococci (MPN/100mL) (geometric mean):	35		
Fecal Coliform in Oyster Waters (CFU/100mL) (median/grab):	14/43		

Water Quality Issues Summary					
Issue	**2008 Assessment**	***Draft* 2010 Assessment**	**Affected Area**	**Possible Causes/Influences / Concerns Voiced by Stakeholders**	**Possible Solutions / Actions To Be Taken**
Elevated Levels of Bacteria in Oyster Waters			2423OW_01	- WWTP non-compliance, overflows, collection system by-passes - Small, privately-run WWTP - Developments with septic tanks - Rapid urbanization and increased impervious cover - Constructed storm water controls failing - Direct and dry weather discharges - Waste haulers illegal discharges/improper disposal - Improper or no pet waste disposal - Animal waste from agricultural production, ranches, hobby farms, and riding stables - Bird rookeries on islands throughout the bay and along the shoreline - Improper disposal of waste from boats	- Increase monitoring requirements for self-reporting - Impose new or stricter bacteria limits than those designated by TCEQ - Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations or provide alternative power supplies during outages - Regionalize wastewater treatment to minimize number of small package plants and reduce OSSF dependency - Require larger partials of land in developments platted to use OSSFs - More public education regarding OSSF operations and maintenance - More public education regarding pet waste disposal - Improve storm water controls in new developments by adding bacteria reduction measures

					- Improve compliance and enforcement of existing storm water quality permits to minimize contaminated runoff - Improve construction oversight to minimize TSS discharges to waterways - Implement stream fencing or alternative water supplies to keep livestock out of or away from waterways - Promote and implement Water Quality Management Plans for individual agricultural properties - Protect or install vegetative buffers along waterways
Dioxin/PCBs	I	I	Entire segment	- Waste pits located along the San Jacinto River immediately upstream of I-10 bridge are now a National Priority List Superfund site managed by EPA - Concentrated deposits outside boundaries of the waste pits - Unknown industrial or urban sources	- Encourage EPA and responsible parties to work together to remediate Superfund site - Remove or contain contamination from locations already identified - Encourage additional testing to locate all unknown sources/deposits - Participate in planning meetings, etc
Low Dissolved Oxygen Concentrations		C	2423A	- Excessive nutrients and organic matter from WWTP effluent, sanitary sewer overflows, malfunctioning OSSFs, illegal disposal of grease trap waste, biodegradable solid waste such as grass clippings and pet waste - Excessive nutrients and organic matter from agricultural production and related activities	- Improve compliance and enforcement of existing storm water quality permits - Improve operation and maintenance of existing WWTP and collection systems - Regionalize wastewater treatment to minimize number of small package plants and reduce OSSFs dependency - More public education regarding pet waste disposal - More public education regarding disposal of household fats, oils, and grease - More stringent OSSF maintenance and education - Create and implement Water Quality Management Plans for individual agricultural properties - Install and/or maintain riparian buffer areas between agricultural fields and waterways

					- Conserve or plant canopy trees and habitat along waterways to maintain/create shade to cool water. - Work with drainage districts and agencies to change practices of clear cutting waterways to protect from solar heating
Elevated Chlorophyll *a* Concentrations	C	C	Entire segment	- Fertilizer runoff from surrounding watershed promote algal growth in waterways - Nutrient loading from WWTPs effluent, sanitary sewer overflows, and malfunctioning OSSFs promote algal growth	- Improve storm water controls in new developments - Improve compliance and enforcement of existing storm water quality permits. - Support/continue/initiate public education regarding nutrients and consequences - Reduce or manage fertilizer runoff from agricultural areas
Elevated Heavy Metals - Iron in Sediment		C	2423_02	- Discharges from domestic, agricultural or industrial sources. - Build up in pipelines, pressure tanks, water heaters and water softeners from industrial point sources - Particles deposition and resuspension processes due to dredging processes or tidal movements - Dissolution from natural deposits	- Increase monitoring and enforcement efforts to identify and control industrial point sources - Encourage additional testing to locate all unknown sources/deposits

Segment Discussion:

Watershed Characteristics: The East Bay watershed includes East Bay, the Upper Bolivar Peninsula, and part of Chambers County and is primarily undeveloped. The majority of the area is wetlands, marsh, and coastal prairie. On the peninsula, development is mostly limited to single family homes, most of which are vacation homes, and small commercial operations. There are several industrial areas on Bolivar Peninsula, including oil and gas production, commercial shrimping, and oyster harvesting. There are a few small unincorporated communities, such as Gilcrest, Crystal Beach, and High Island, located along the peninsula. Homes and businesses in the watershed are exclusively using on-site septic systems (OSSF). In 2008, Hurricane IKE demolished the majority of the homes and businesses on the peninsula, piling up all the debris in Chambers County. There has been rapid redevelopment of the peninsula since. Chambers County, which drains to East Bay, maintains ranching as the primary activity in the area. There are two wildlife refuges, a wildlife management area, and a bird sanctuary located in the watershed.

Water Quality Issues: In the 2008 Texas Integrated Report (IR), chlorophyll *a* was identified as a concern for the assessment unit representing the open bay portion of the main segment. However, in the *Draft* 2010 IR, chlorophyll *a* is listed as a concern for the entire watershed with 36% of the samples (43 out of 118) exceeding the screening level of 11.6 µg/L.

In the unclassified segment 2423A (Oyster Bayou), dissolved oxygen (DO) is a concern. According to the *Draft* 2010 IR, 20% of the samples (5 out of 25) exceeded the DO grab screen level of 4.0 mg/L. There is also a concern for near nonattainment for the DO 24-hour minimum, with 33% of the samples (two out of six), exceeding the standard of 3.0 mg/L.

Iron in sediment is listed as a concern for the assessment unit representing the open portion of the bay, with 100% of the samples (13) exceeding well over the level of 3.70 mg. The entire watershed is also under an advisory by the Texas Department of State Health Services for fish consumption due to PCBs and dioxin in fish tissue.

Special Studies/Projects: This segment is included in one TMDL project, the Galveston Bay System Survey for Dioxin and PCBs, which is currently under way. For more information, please refer to the detailed discussions located at the beginning of the water quality section of the 2011 Basin Summary Report regarding dioxin and PCB contamination.

Trends: The East Bay watershed (segment 2423) is one of the few watersheds in the Houston-Galveston region not presently listed as impaired for bacteria by TCEQ. The watershed is divided into three assessment units (AU) with the *Draft* 2010 IR identifying depressed DO impairments in one AU, PCBs and dioxin impairments in each AU, and chlorophyll *a* concerns in each AU. Regression of the annual median on the year for a pooled dataset, differentiated by classification status, indicates a statistically-significant upward trend in chlorophyll *a,* and a slight downward trend in nitrate nitrogen (nitrate) in the unclassified AU.

The chlorophyll *a* trend is strongly supported by analysis of both single-sample and annual median concentrations reported for individual monitoring stations. Samples collected at 15 stations within the watershed are analyzed for chlorophyll *a.* Statistically-significant trends were seen at 14 of the stations when single sample results are analyzed and at nine when annual median concentrations are evaluated. All of the trends were positive and provide strong support for a claim that the concentration is increasing over time throughout the watershed. However, the value of the trends identified at these stations is limited by the relatively small sample sizes and gaps of one to two years between sampling events (in most cases).

A sufficient number of samples were collected at station 10655 in Oyster Bayou (AU 2423A_01) to allow one to conclude that a trend exists at that location (37 samples between 1990 and 2010, with no significant gaps in monitoring effort). The trend is also evident in analysis of the annual median concentration. The remaining trends may reflect long-term tendencies but further monitoring is necessary to assess the validity of this claim. Nitrate and orthophosphate phosphorus (OP) exhibit statistically-significant declines at station 10655 over the period of record. A plot of chlorophyll *a* data from station 10655 follows along with plots of chlorophyll *a* combined with phosphate concentrations. Variations in chlorophyll *a* concentration do not correlate closely with total phosphorus (TP) concentration.

Several trends in nutrient concentrations were detected. Nitrate concentrations are declining at three stations on the basis of both single-sample and annual median analysis. OP concentrations are declining at two stations when one analyzes annual medians and at five stations when individual results are considered. A similar negative trend for TP concentrations was seen at two stations. Again, caution is advised when making inferences from these trends as the same data gaps

discussed for chlorophyll *a* exist for other parameters. Plots of the nitrate and OP data over time for station 10655 follow. A graph displaying TP and chlorophyll *a* results at this station also follows.

Forty-two percent of enterococci data collected at station 10655 exceeded 35 MPN/100 mL and likely account for most of the exceedances observed in this watershed. A graph of annual percent excursions for the watershed as a whole follows.

Recommendations:

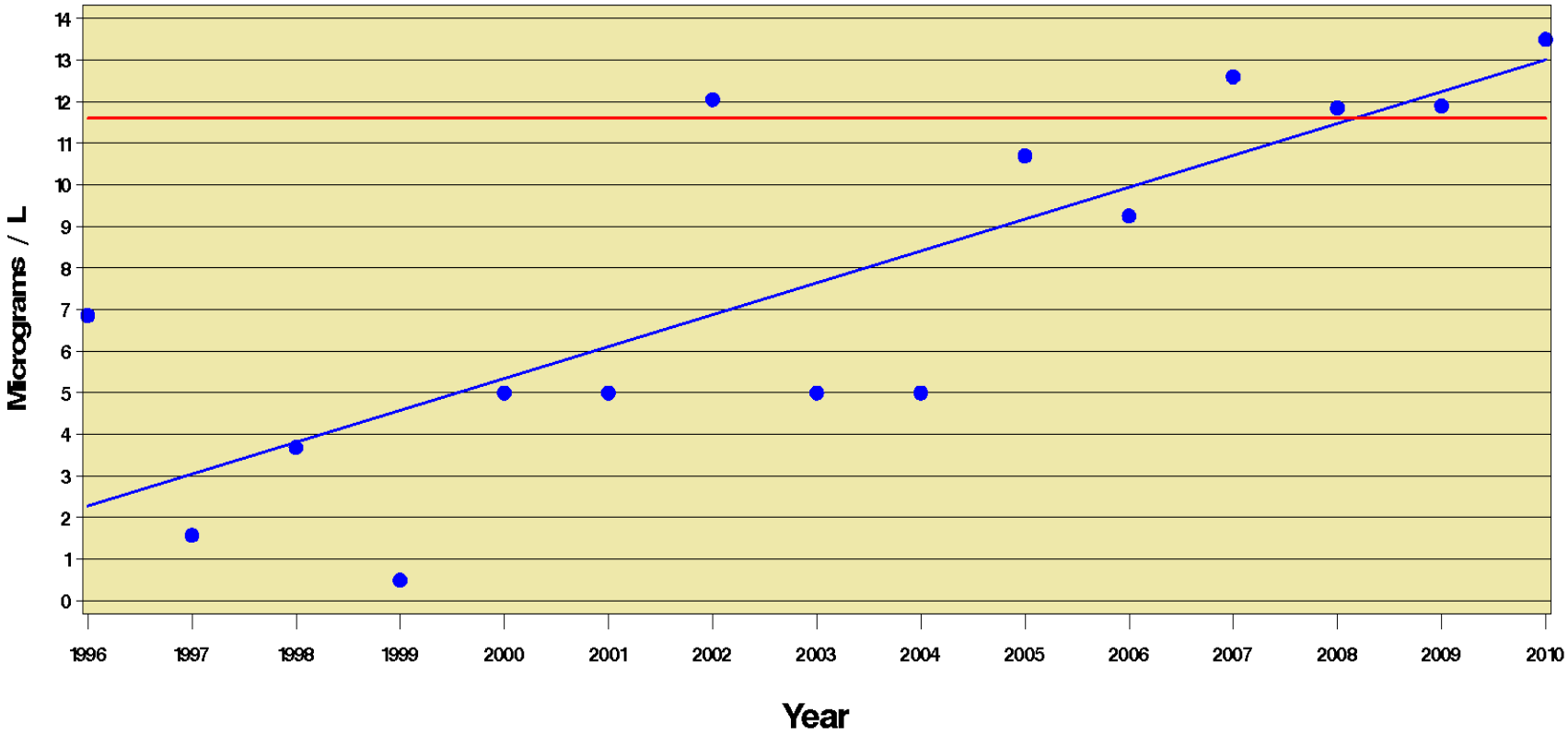
- Increase the frequency of sampling at representative stations in the watershed to decrease data gaps.
- Continue collecting water quality data to support actions associated with WPP development and future modeling.
- Pursue new local partners to Clean Rivers Program to collect addition data that would help better isolate problem areas.
- Work with local partner and contract labs to lower detection limits for nutrients to better understand the effect on chlorophyll *a*, since concentrations are increasing and they have a direct effect on nutrients.

East Bay

Segment: 2423 Parameter: Chlorophyll a Annual Median

Water Body Type: Classified Estuary

2010 Nutrient Screening Level : 11.6 Micrograms / L



Trends are considered significant if the p-value is < 0.10

Trend is significant at p= 0.0004 R-Square = 0.6381 T-Value = 4.788 Number of samples: 172

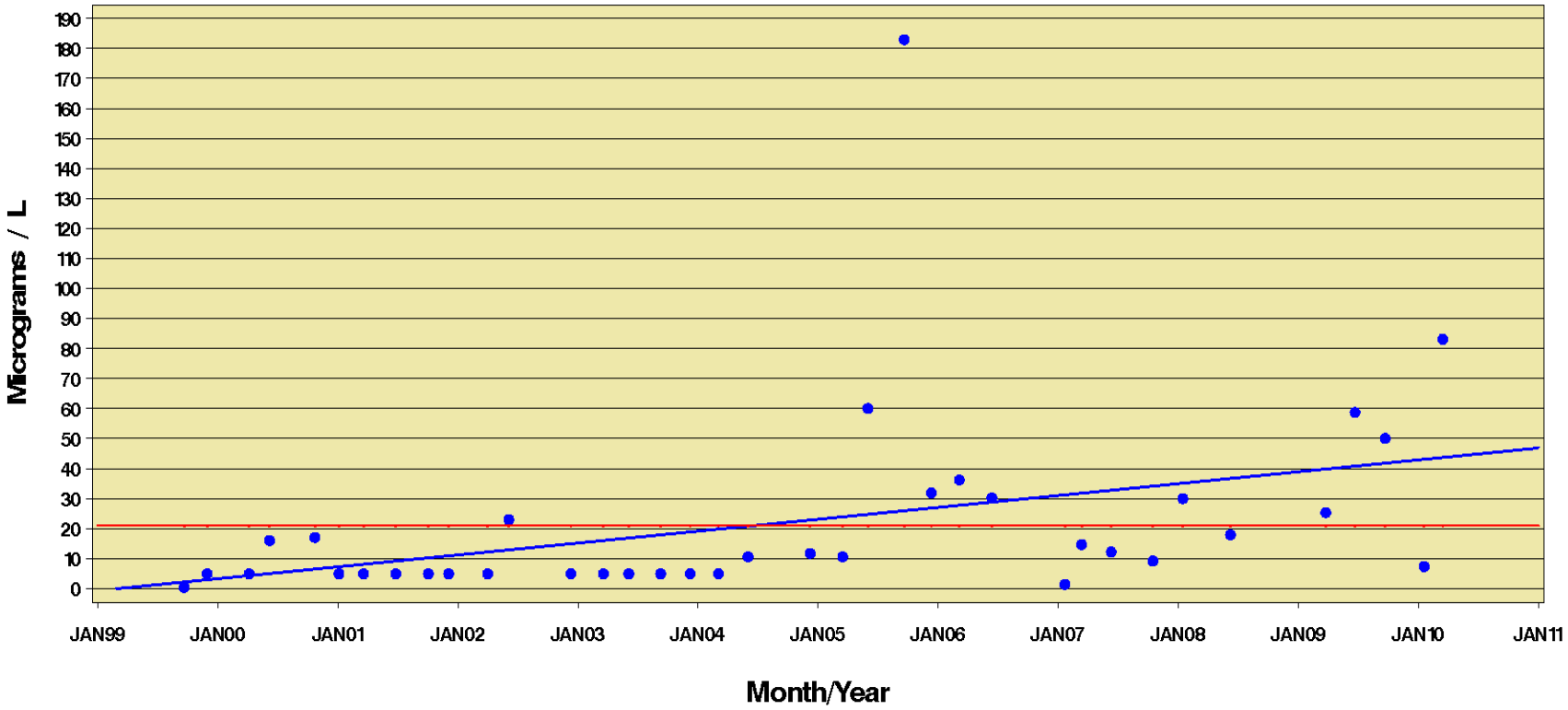
If present, the dashed red line indicates the 2010 2010 Nutrient Screening Level

East Bay

Station: 10655 Segment: 2423 Parameter: Chlorophyll a

2010 Nutrient Screening Level: 21.0 Micrograms / L

Assessment Unit: 2423A_01



Trends are considered significant if the p–value is < 0.10

Trend is significant at p= 0.0002 R–Square= 0.3257 T–Value= 4.1120 Number of Samples= 37

The blue regression line applies to the plot of actual values ; regression statistics are derived from regression of log–transformed data

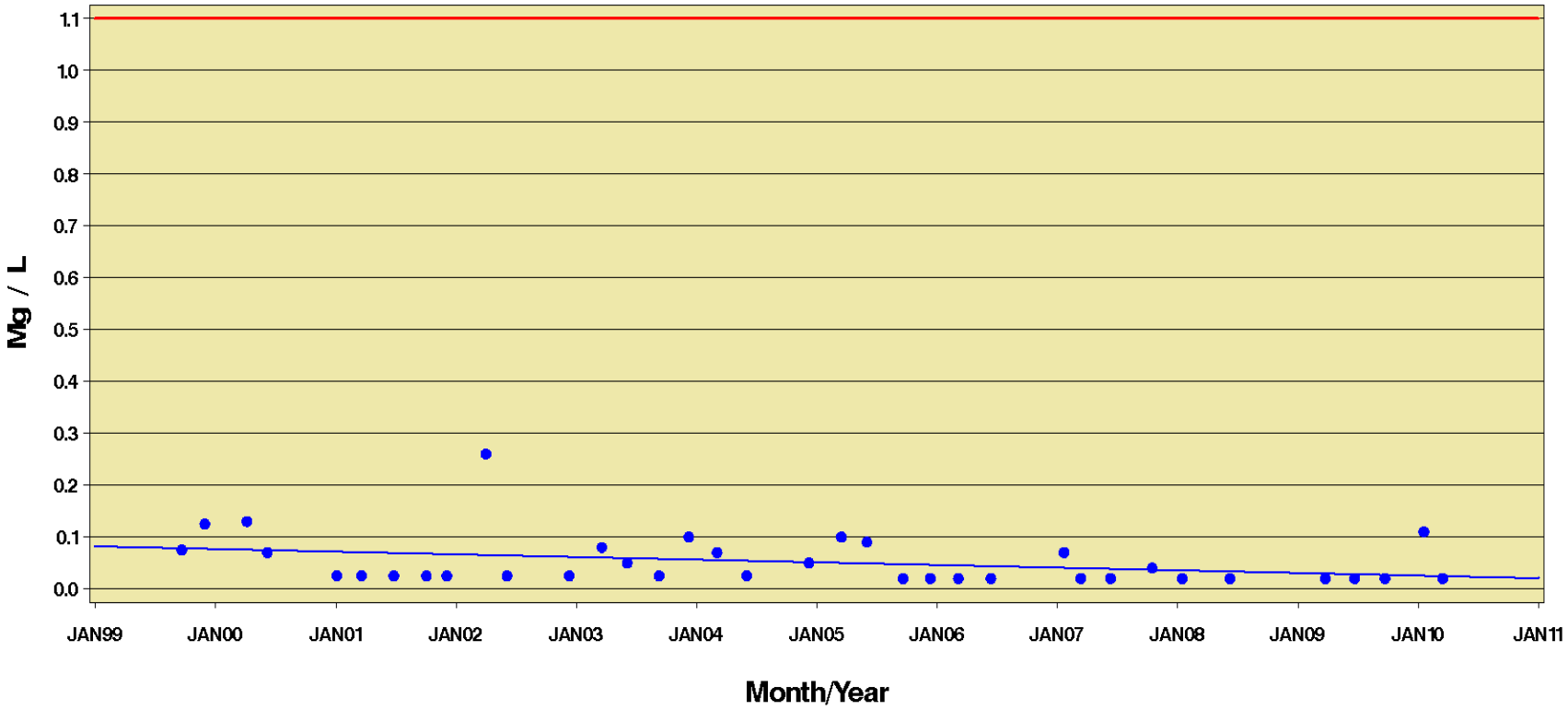
Red line indicates the applicable 2010 Nutrient Screening Level

East Bay

Station: 10655 Segment: 2423 Parameter: Nitrate—N

2010 Nutrient Screening Level: 1.10 Mg / L

Assessment Unit: 2423A_01



Trends are considered significant if the p—value is < 0.10

Trend is significant at p= 0.0217 R—Square= 0.1456 T—Value= —2.407 Number of Samples= 36

The blue regression line applies to the plot of actual values ; regression statistics are derived from regression of log—transformed data

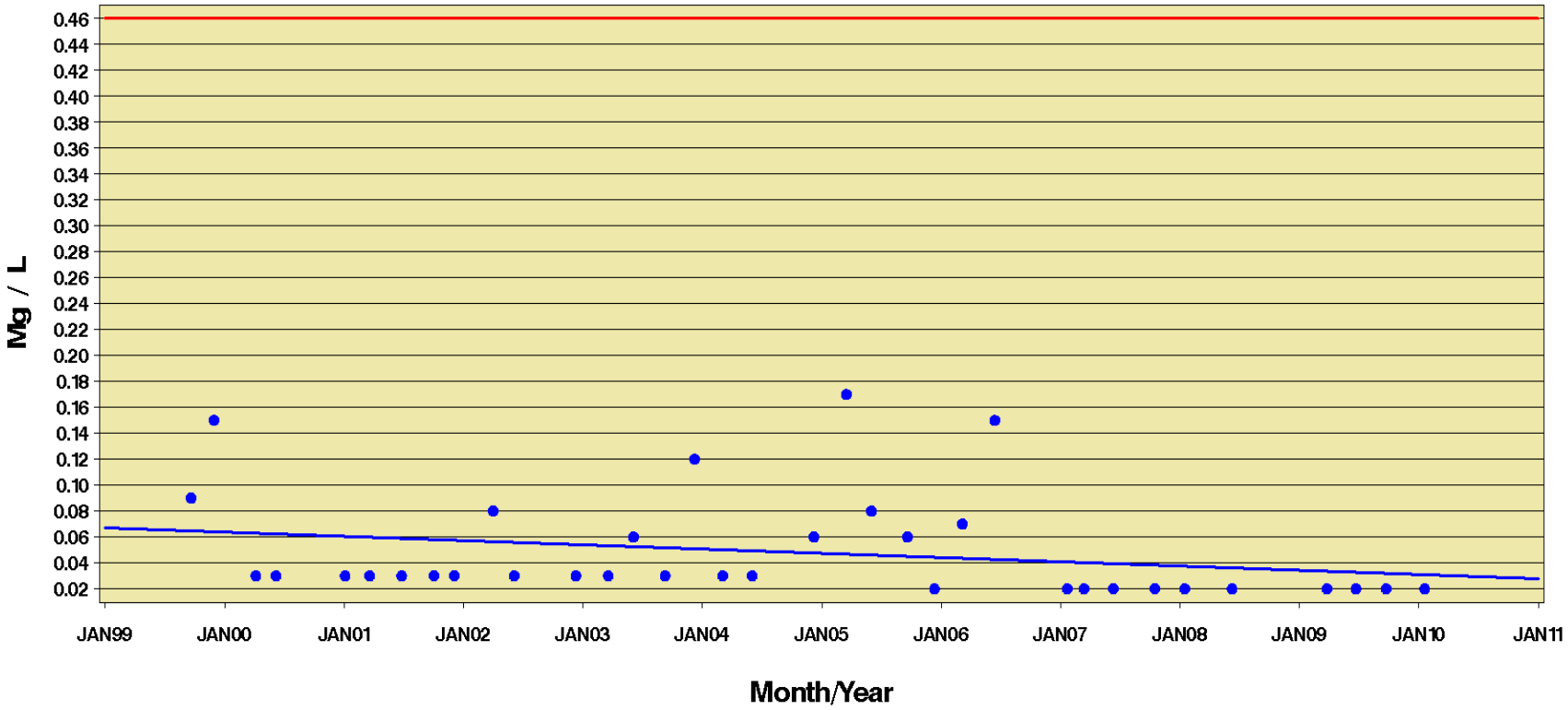
Red line indicates the applicable 2010 Nutrient Screening Level

East Bay

Station: 10655 Segment: 2423 Parameter: Orthophosphate—P

2010 Nutrient Screening Level: 0.46 Mg / L

Assessment Unit: 2423A_01



Trends are considered significant if the p—value is < 0.10

Trend is significant at p= 0.0267 R—Square= 0.1402 T—Value= —2.320 Number of Samples= 35

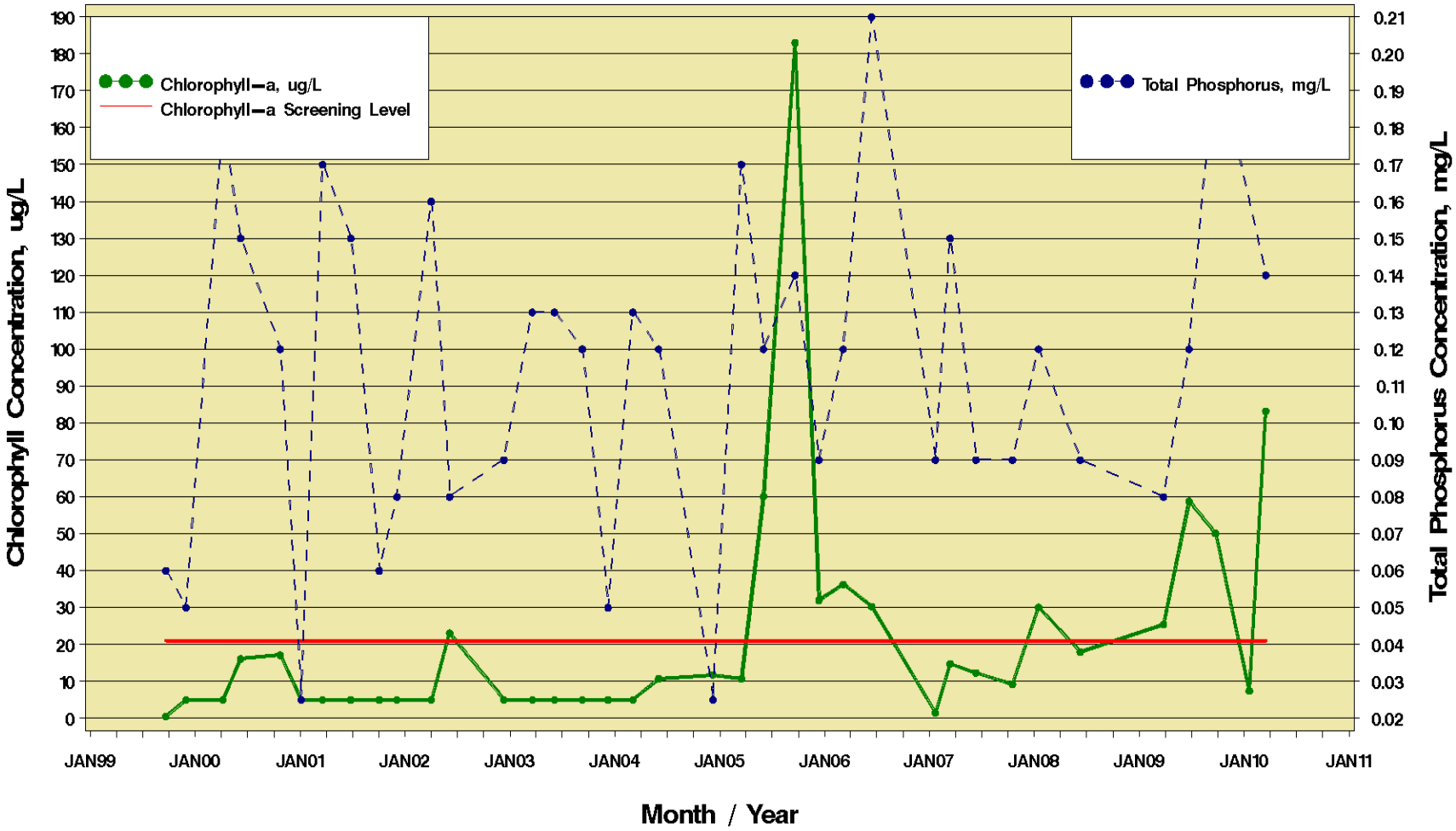
The blue regression line applies to the plot of actual values ; regression statistics are derived from regression of log—transformed data

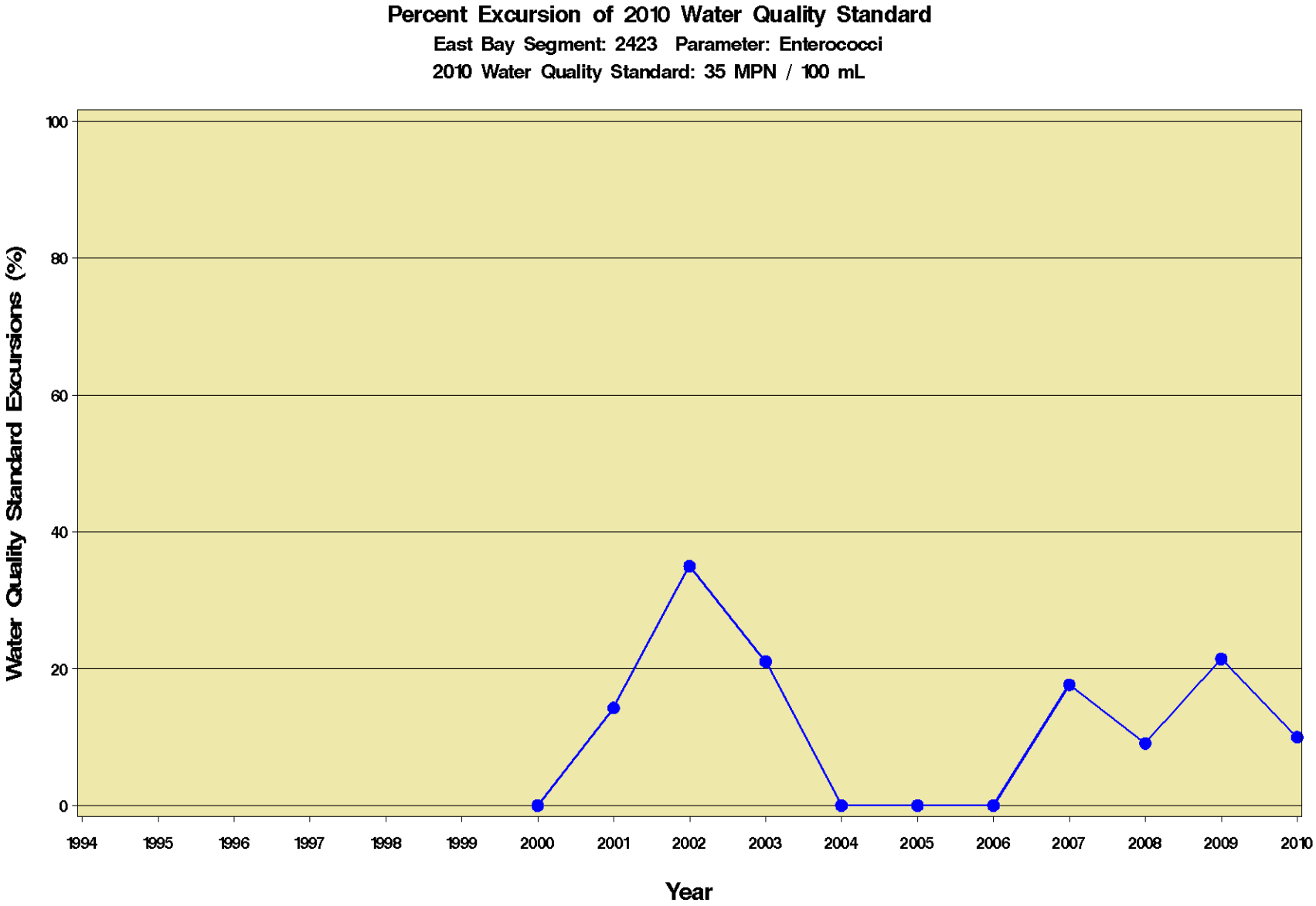
Red line indicates the applicable 2010 Nutrient Screening Level

Chlorophyll—a and Total Phosphorus Concentrations

Segment: 2423 Watershed: East Bay

Station: 10655 Assessment Unit: 2423A_01




Percent Excursion of 2010 Water Quality Standard
East Bay Segment: 2423 Parameter: Enterococci
2010 Water Quality Standard: 35 MPN / 100 mL
Water Quality Standard Excursions (%)
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year