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ENVIRONMENTAL PROTECTION

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Chevron

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September 24, 1998

Ms. Eva Chu
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Chevron Service Station #9-0290
1802 Webster Street
Alameda, California

Dear Ms. Chu:

As noted in the previously sent Third Quarter Groundwater Monitoring report for 1998, dated September 3, 1998, bio-parameters were taken at six of the wells sampled, and this information was to be evaluated to determine the presence of intrinsic bioremediation within the hydrocarbon plume at the above noted site.

The evaluation of indicator parameters across a dissolved contaminant plume can be used in the demonstration of intrinsic bioremediation. One or more trends observed across a dissolved plume with increasing contaminant concentration would suggest the potential occurrence of intrinsic bioremediation.

With increasing BTEX concentrations, the expected trend in indicator parameter concentrations would be:

Relative Decrease In:	Relative Increase In:
Dissolved Oxygen	Dissolved Iron (Ferrous)
Oxidation-Reduction Potential (ORP)	Alkalinity
Nitrate	
Sulfate	

In the attached charts, only four of the six sampled wells are presented on the X-axis from the up-gradient wells to the down-gradient wells through the contaminant plume. The resulting order of the wells is B-13, B-12, B-11 and B-5 through the plume. The sum of the BTEX results for each well and the indicator bio-parameter analytical results for each well are plotted on the Y-axis to create the plots on the attached charts. The plots are than evaluated by observation for apparent trends in the data.

The dissolved oxygen vs. BTEX plot shows that as the BTEX concentrations are increasing from wells B-12 to B-11, the dissolved oxygen concentrations are decreasing, which indicates biological activity is occurring within this range of the contaminant plume. The plume is consuming the dissolved oxygen during the conversion of BTEX to carbon dioxide and water. This indicates intrinsic bioremediation is partial occurring at this site.

The ORP vs. BTEX plot indicates that ORP is decreasing with increasing BTEX values. The expected trend is a decrease in ORP values with increasing BTEX values. Therefore, this trend would be a good indicator of the presence of intrinsic bioremediation at this site.

The nitrate vs. BTEX plot indicates that nitrate is present where BTEX concentrations are high at well B-11 but are decreasing at well B-12 when the BTEX concentrations are increasing. What is shown at well B-12 is an expected trend for nitrate in the presence of BTEX and intrinsic bioremediation. The observed nitrate trend through well B-12 and the BTEX plume suggests the intrinsic bioremediation is occurring in this area in the groundwater while not occurring downgradient of well B-12. This indicates that partial intrinsic bioremediation is occurring at this site.

The sulfate vs. BTEX plot shows that as the BTEX concentrations are increasing from wells B-12 to B-11, the sulfate concentrations are decreasing, which indicates biological activity is occurring within this range of the contaminant plume. The observed sulfate trend at the other wells does not indicate that intrinsic bioremediation is occurring, therefore, only partial intrinsic bioremediation is occurring at this site.

The alkalinity vs. BTEX plot indicates that the upgradient waters at this site are low in alkalinity and the interior plume waters are higher in alkalinity. An increase in alkalinity across a contaminant plume is a potential indicator of biologic activity. Therefore, the observed trend for alkalinity is consistent with the occurrence of intrinsic bioremediation in the groundwater at this site.

The dissolved iron (ferrous) vs. BTEX plot indicates that dissolved iron increases with increasing BTEX values. The expected trend would be an increase in dissolved iron. Therefore, this trend would be a good indicator of the presence of intrinsic bioremediation at this site.

The plots of the indicator parameters for ORP, alkalinity and dissolved iron vs. total BTEX for site wells upgradient, within and downgradient of the plume indicates the presence of intrinsic bioremediation occurring in the groundwater plume associated with this site. While the plots of the indicator parameters for dissolved oxygen, nitrate and sulfate vs. total BTEX for site wells upgradient, within and downgradient of the plume indicates the

partial presence of intrinsic bioremediation occurring in the groundwater plume associated with this site. A trend in four of the six indicator parameters is acceptable to indicate that intrinsic bioremediation is occurring at a site. Therefore, it appears that some intrinsic bioremediation is occurring at this site, particularly in the area from wells B-12 to B-11.

The effect of the intrinsic bioremediation process will be to stabilize the contaminant plume and reduce the size of the plume as the source area concentrations are reduced.

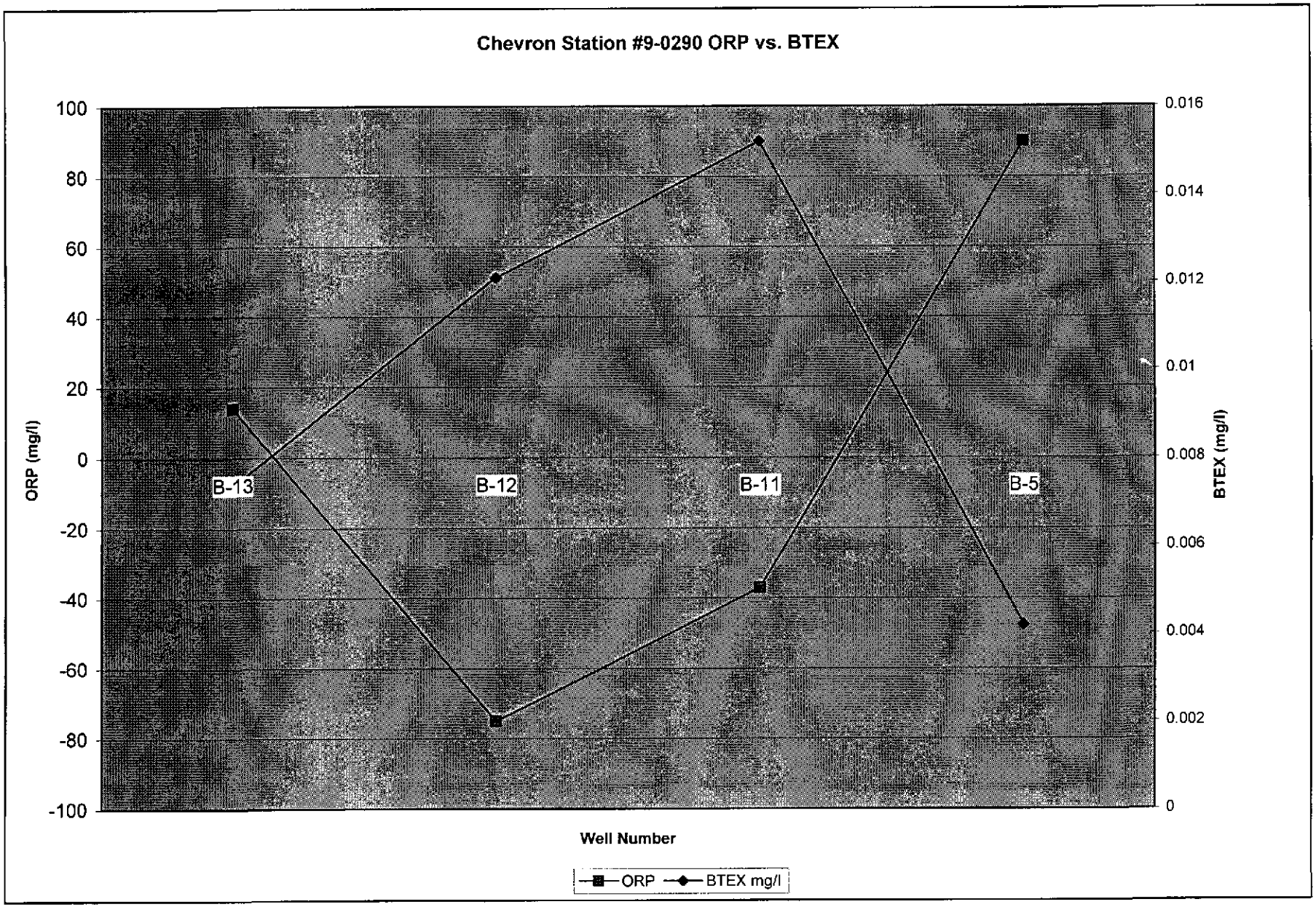
If you have any questions or comments, call me at (925) 842-9136.

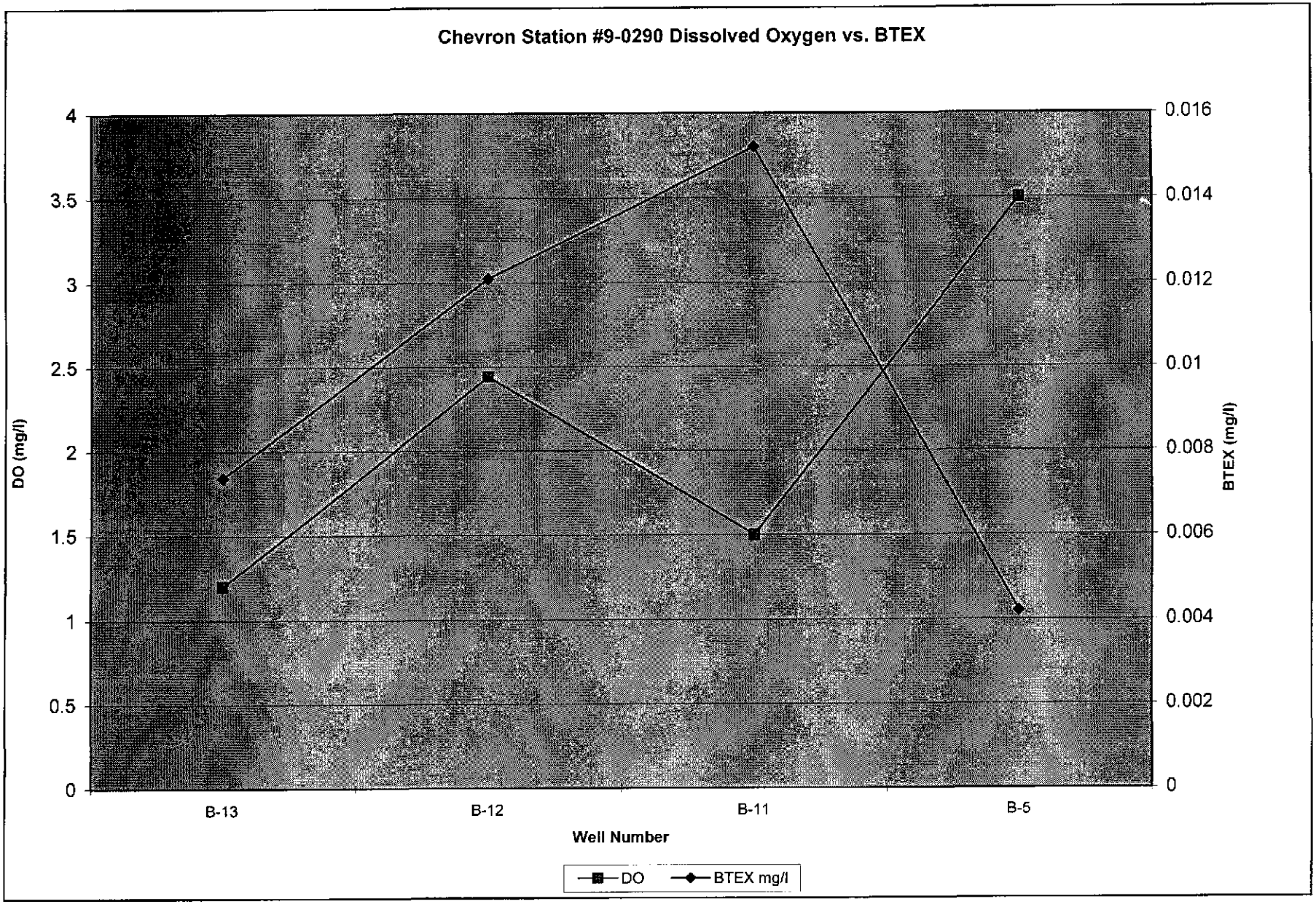
Sincerely,
CHEVRON PRODUCTS COMPANY

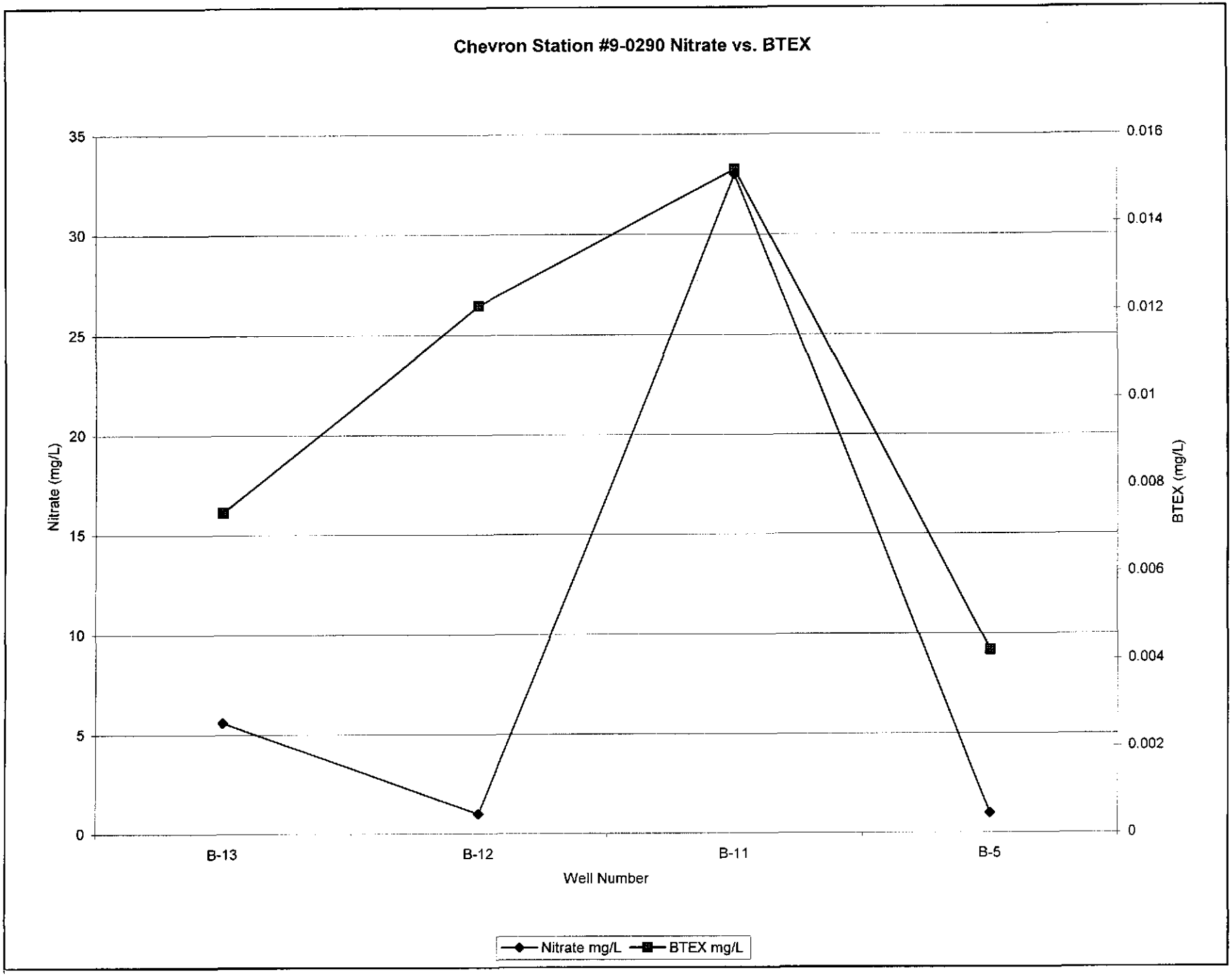
Philip R. Briggs
Site Assessment and Remediation Project Manager

Enclosure

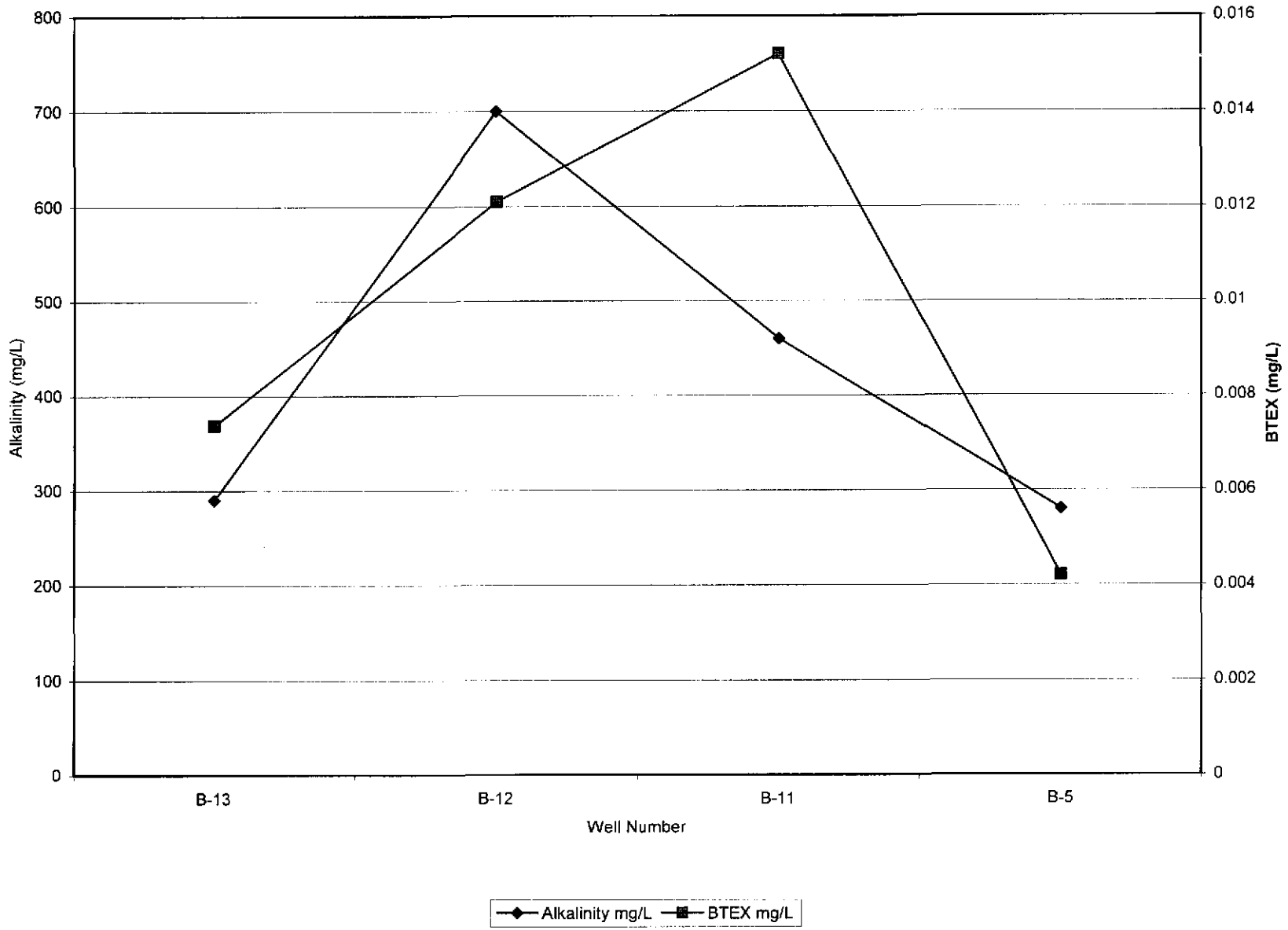
Cc. Mr. Bill Scudder, Chevron

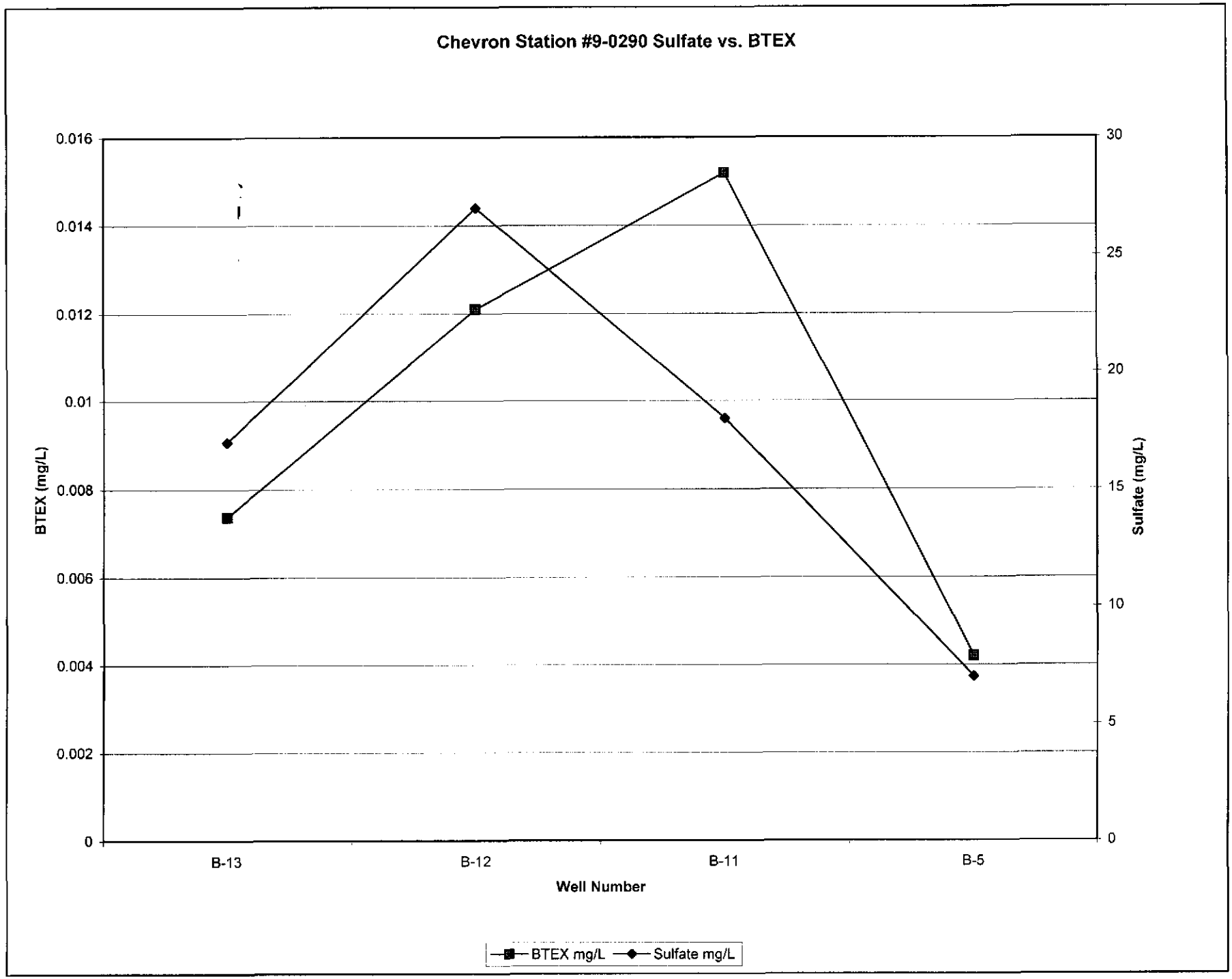

Chevron Station #9-0290 ORP vs. BTEX
100
80
60
40
20
0
-20
-40
-60
-80
-100
ORP (mg/l)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
BTEX (mg/l)
B-13
B-12
B-11
B-5
Well Number
ORP
BTEX mg/l


Chevron Station #9-0290 Dissolved Oxygen vs. BTEX
DO (mg/l)
BTEX (mg/l)
4
3.5
3
2.5
2
1.5
1
0.5
0
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
B-13
B-12
B-11
B-5
Well Number
DO
BTEX mg/l


Chevron Station #9-0290 Nitrate vs. BTEX
Nitrate (mg/L)
BTEX (mg/L)
35
30
25
20
15
10
5
0
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
B-13
B-12
B-11
B-5
Well Number
Nitrate mg/L
BTEX mg/L

Chevron Station #9-0290 **Alkalinity vs. BTEX**




Chevron Station #9-0290 Sulfate vs. BTEX
BTEX (mg/L)
Sulfate (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
30
25
20
15
10
5
0
B-13
B-12
B-11
B-5
Well Number
BTEX mg/L
Sulfate mg/L

Chevron Station #90290

Ferrous Iron vs. BTEX