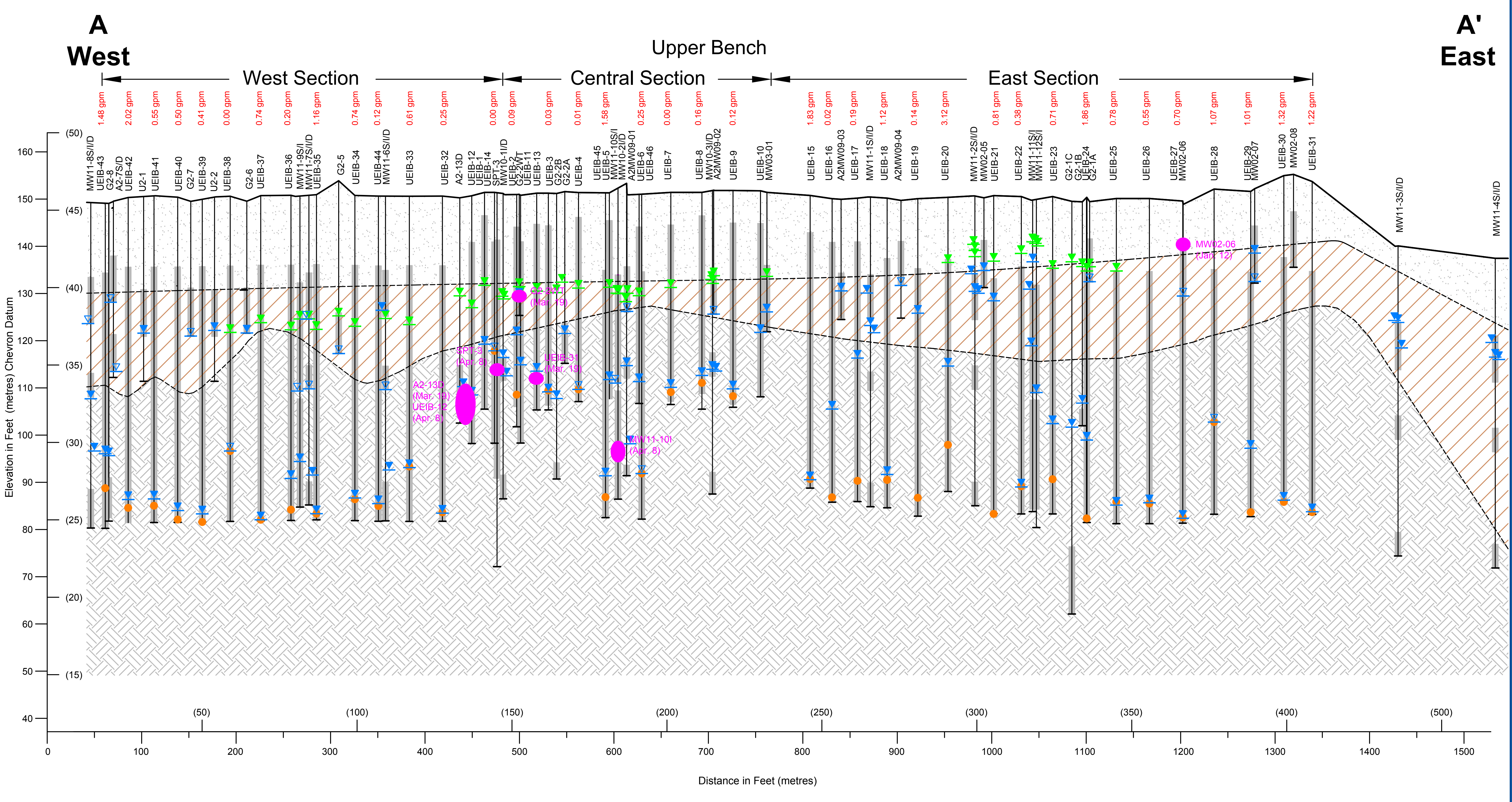


LEGEND:

Fill	Monitoring Well
Alluvium/colluvium	Well Screen
Till	

Static Groundwater Elevation, January 23, 2012

Pumping Groundwater Elevation, April 7-15, 2015

Dry (<10cm)

Extraction Pump

Average Fluid Extraction Rate 0.06 gpm

ABBREVIATIONS:
gpm gallons per minute
NAPL Non-Aqueous Phase Liquid

Extraction rate shown for UEIB 42 is from March 30, 2015.

NAPL Detected in 2015

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet: 0 50 100
metres: 0 20 40
1:5 H/V

AECOM

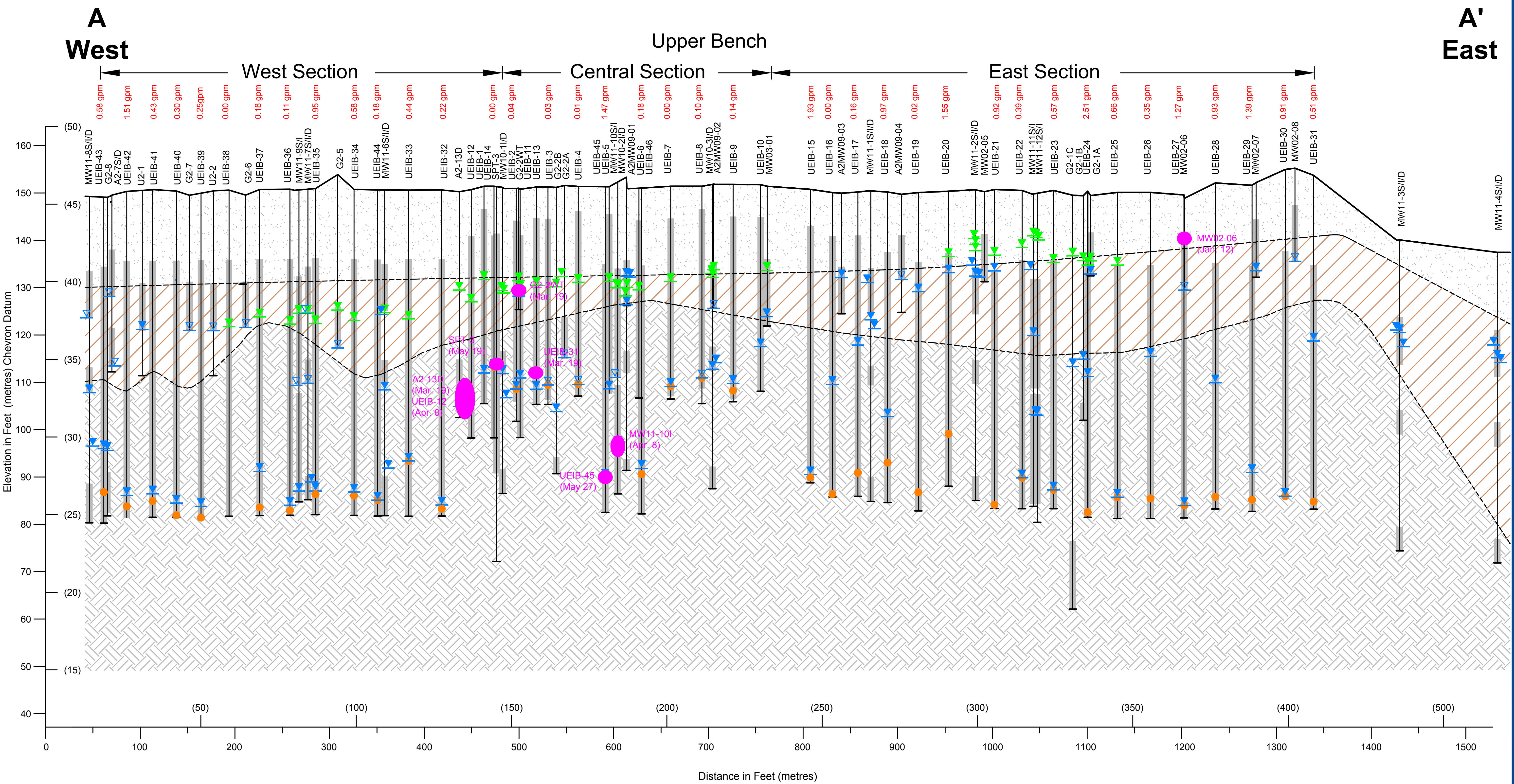
UPPER BENCH EXTRACTION WELL LOCATIONS AND PUMP RATES APRIL 2015

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-9

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C09 Q1 2015 UB Crs Ex Wells and Pump Rates.dwg



LEGEND:

Fill

Alluvium/colluvium

Till

Monitoring Well

Well Screen

Static Groundwater Elevation, January 23, 2012

Pumping Groundwater Elevation, May 19-28, 2015

Dry (<10cm)

Extraction Pump Elevation, May 26-28, 2015 (UEIB-45 was not measured so it is not shown)

Average Fluid Extraction Rate 0.58 gpm

ABBREVIATIONS:
gpm gallons per minute
NAPL Non-Aqueous Phase Liquid

NAPL Detected in 2015

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet
0 50 100

metres
0 20 40

1:5 H/V

AECOM

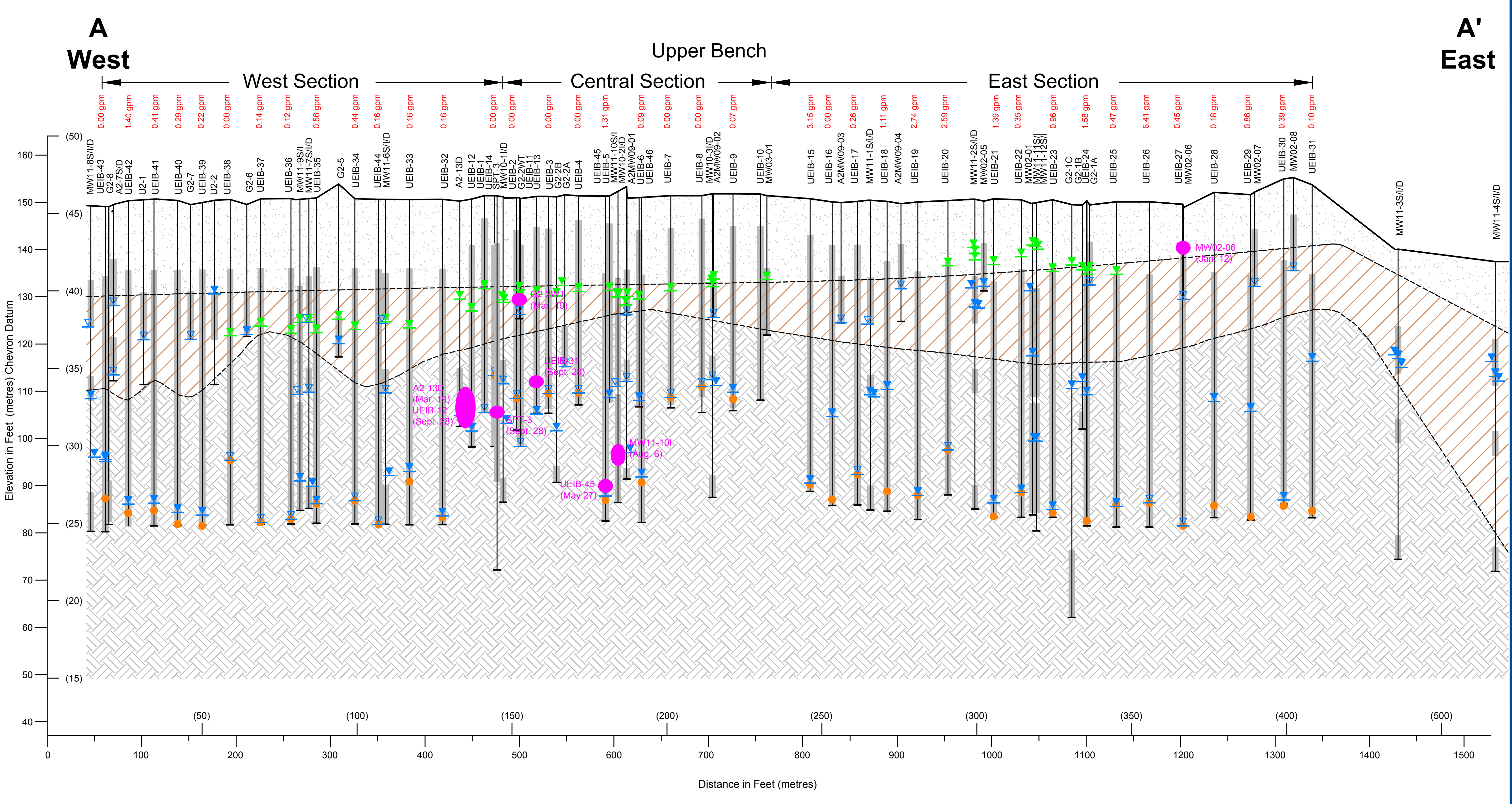
UPPER BENCH EXTRACTION WELL LOCATIONS AND PUMP RATES MAY 2015

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-10

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C10 Q2 2015 UB Crs Ex Wells and Pump Rates.dwg



LEGEND:

Fill	
Alluvium/colluvium	
Till	

Monitoring Well

Well Screen

Static Groundwater Elevation, January 23, 2012

Pumping Groundwater Elevation, August 5-13, 2015

Dry (<10cm)

Extraction Pump August 2015

Average Fluid Extraction Rate 0.06 gpm

ABBREVIATIONS:
gpm gallons per minute
NAPL Non-Aqueous Phase Liquid

NAPL Detected in 2015 (last date detected in 2015)

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet 0 50 100

metres 0 20 40

1:5 H/V

AECOM

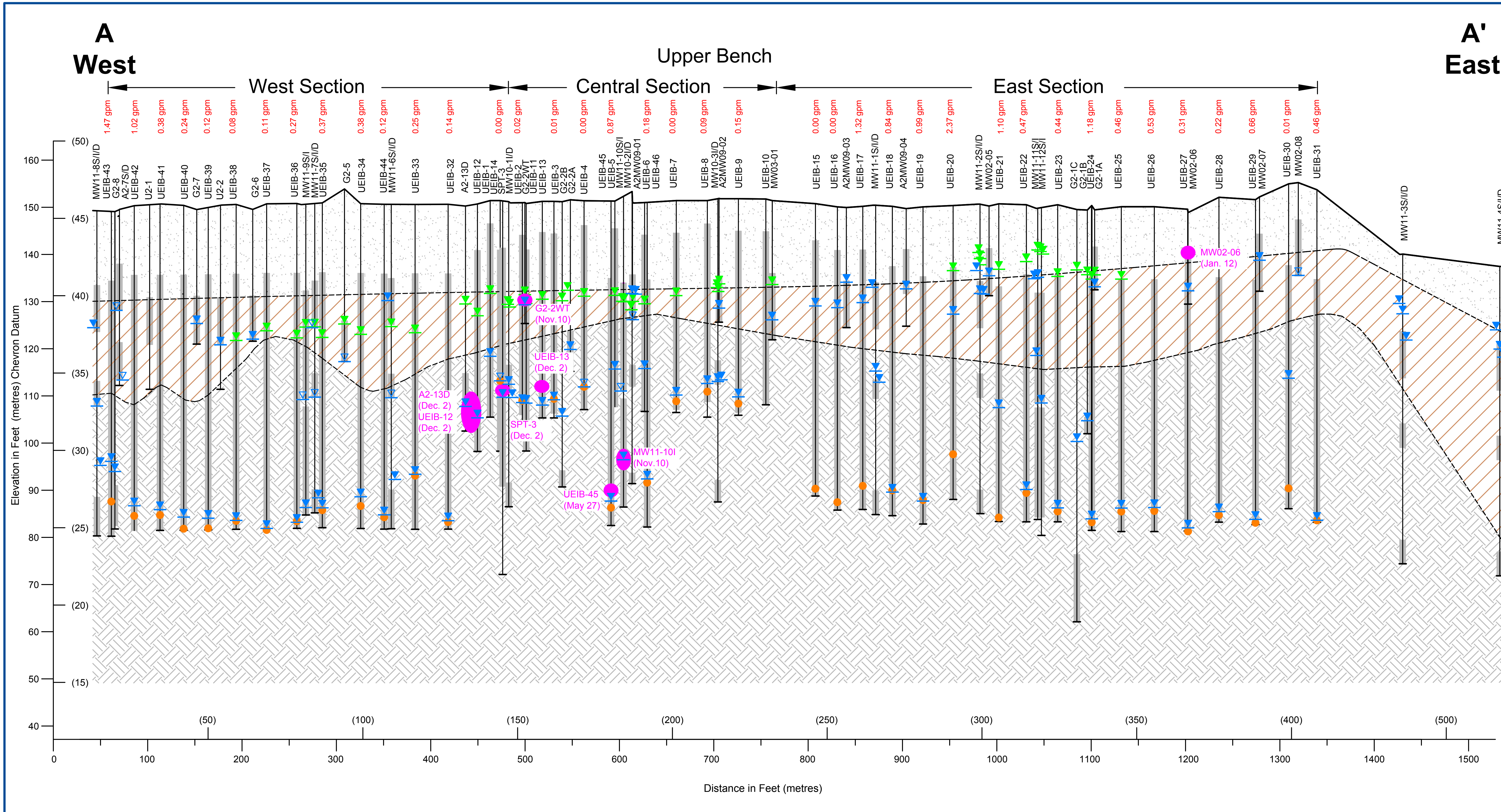
UPPER BENCH EXTRACTION WELL LOCATIONS, GROUNDWATER ELEVATIONS AND PUMP RATES AUGUST 5-13, 2015

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-11

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C11 Q3 2015 UB Crs Ex Wells and Pump Rates.dwg



LEGEND:

Fill

Alluvium/colluvium

Till

Monitoring Well

Well Screen

Static Groundwater Elevation, January 23, 2012

Pumping Groundwater Elevation, November 9-19, 2015

Dry (<10cm)

Extraction Pump November 10-19, 2015

Average Fluid Extraction Rate 0.06 gpm

ABBREVATIONS:
gpm gallons per minute
NAPL Non-Aqueous Phase Liquid

NAPL Detected in 2015 (last date detected in 2015)

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet 0 50 100

metres 0 20 40

1:5 H/V

AECOM

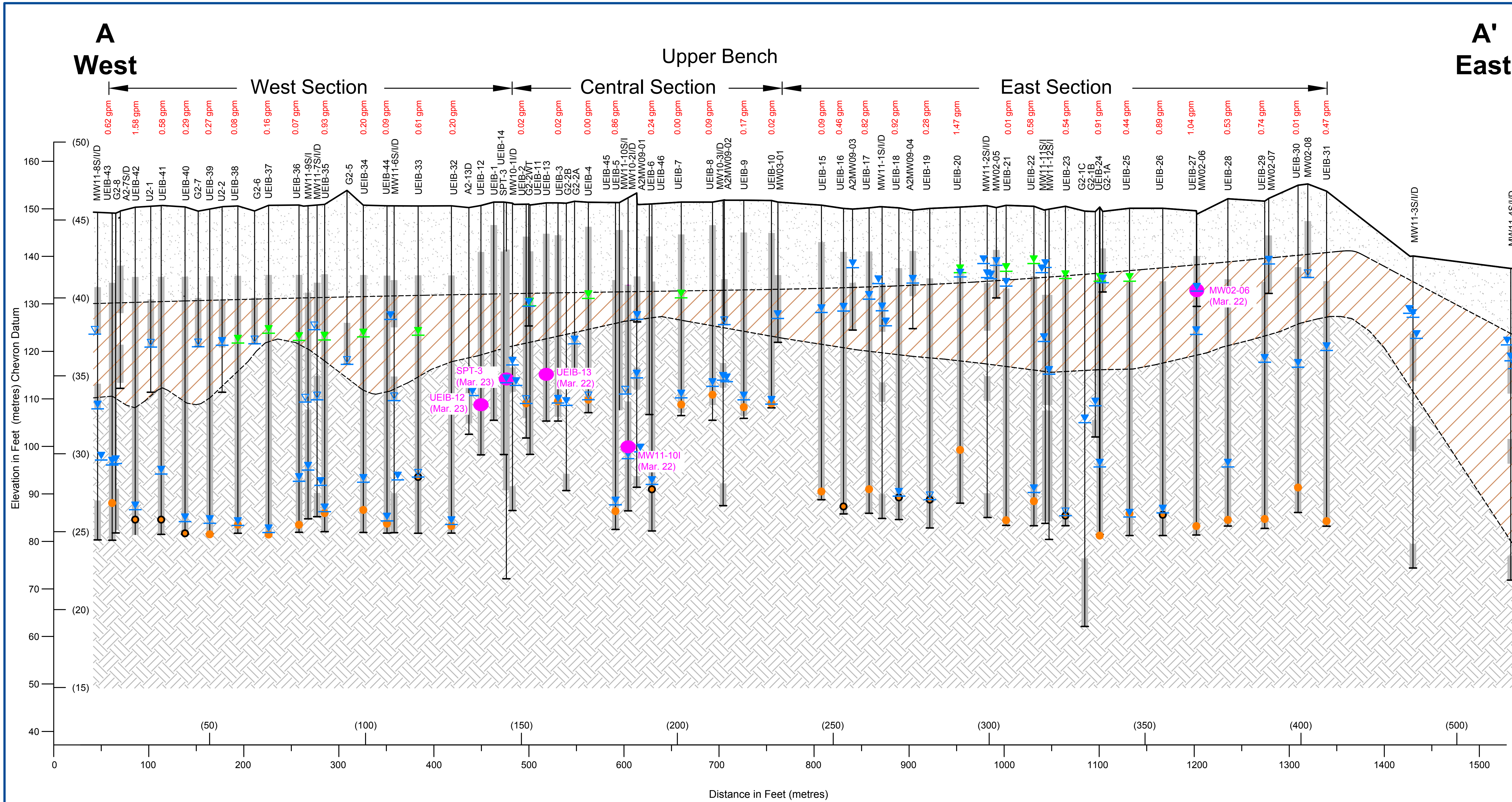
UPPER BENCH EXTRACTION WELL LOCATIONS, GROUNDWATER ELEVATIONS AND PUMP RATES NOVEMBER 10/16/17/19, 2015

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-12

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C12 Q4 2015 UB Crs Ex Wells and Pump Rates.dwg



LEGEND:

Fill	
Alluvium/colluvium	
Till	
Monitoring Well	
Well Screen	
Static Groundwater Elevation, January 23, 2012	
Pumping Groundwater Elevation, March 29/30, 2016	
Dry (<10cm)	
Short Body Extraction Pump Elevation March 29/30, 2016	
Long Body Extraction Pump Elevation March 29/30, 2016	
Average Fluid Extraction Rate February 1/2/3, 2016	0.06 gpm
NAPL Detected in 2016 (last date detected in 2016)	

ABBREVIATIONS:
gpm gallons per minute
NAPL Non-Aqueous Phase Liquid

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet 0 50 100
metres 0 20 40
1:5 H/V

AECOM

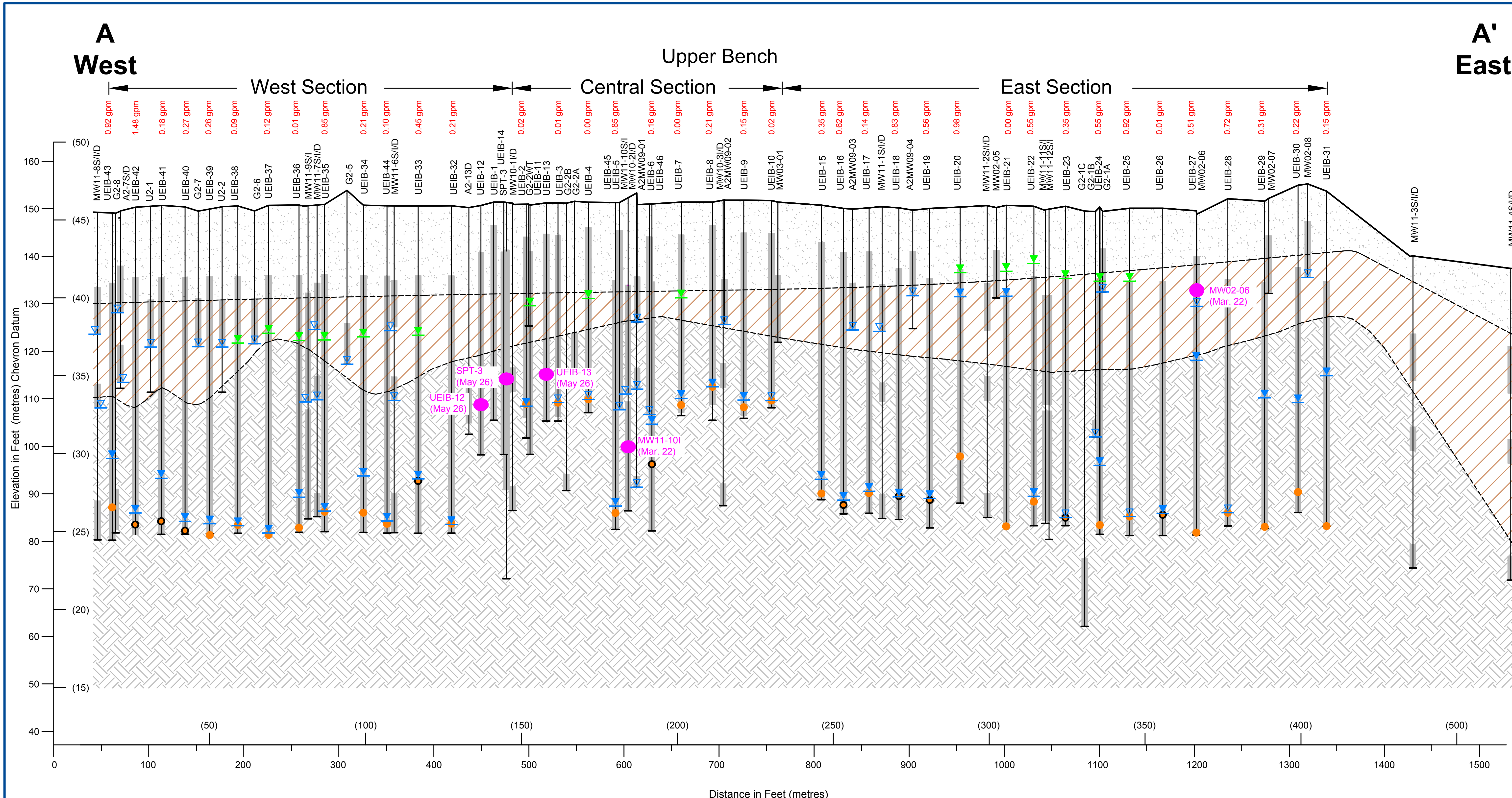
UPPER BENCH EXTRACTION WELL LOCATIONS, GROUNDWATER ELEVATIONS AND PUMP RATES MARCH 2016

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-13

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C13 UB Crs Ex Wells and Pump Rates Mar 2016.dwg



LEGEND:

Fill	Monitoring Well	Static Groundwater Elevation, January 23, 2012
Alluvium/colluvium	Well Screen	Pumping Groundwater Elevation, May 26 to June 9, 2016
Till		Dry (<10cm)
		Short Body Extraction Pump Elevation May 26 to June 9, 2016

Long Body Extraction Pump Elevation May 26 to June 9, 2016

Average Fluid Extraction Rate May 26 to June 9, 2016 — 0.06 gpm

ABBREVIATIONS:
gpm — gallons per minute
NAPL — Non-Aqueous Phase Liquid

NAPL Detected in 2016 (last date detected in 2016)

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet: 0, 50, 100
metres: 0, 20, 40
1:5 H/V

AECOM

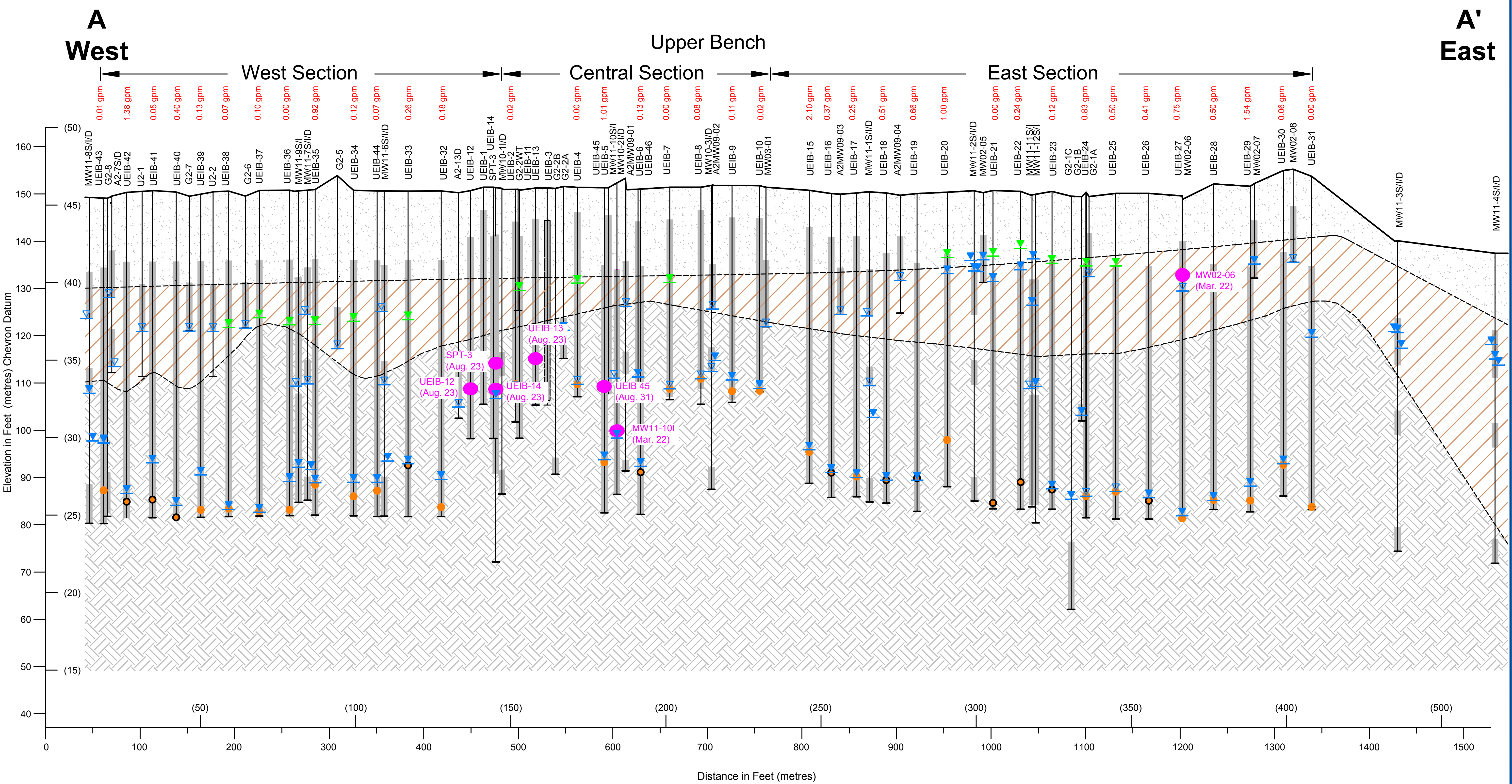
UPPER BENCH EXTRACTION WELL LOCATIONS, GROUNDWATER ELEVATIONS AND PUMP RATES May 26 to June 9, 2016

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-14

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C14 UB Crs Ex Wells and Pump Rates May 2016.dwg



LEGEND:

Fill

Alluvium/colluvium

Till

Monitoring Well

Well Screen

Static Groundwater Elevation, January 23, 2012

Pumping Groundwater Elevation, August 23-31, 2016

Dry (<10cm)

Short Body Extraction Pump

Short Body Extraction Pump Stuck

Long Body Extraction Pump

Fluid Extraction Rate (August 29-30, 2016) 0.08 gpm

ABBREVIATIONS:
gpm gallons per minute
NA Not Available

NAPL Detected in 2016 (last date detected in 2016)

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet 0 50 100

metres 0 20 40

1:5 H/V

AECOM

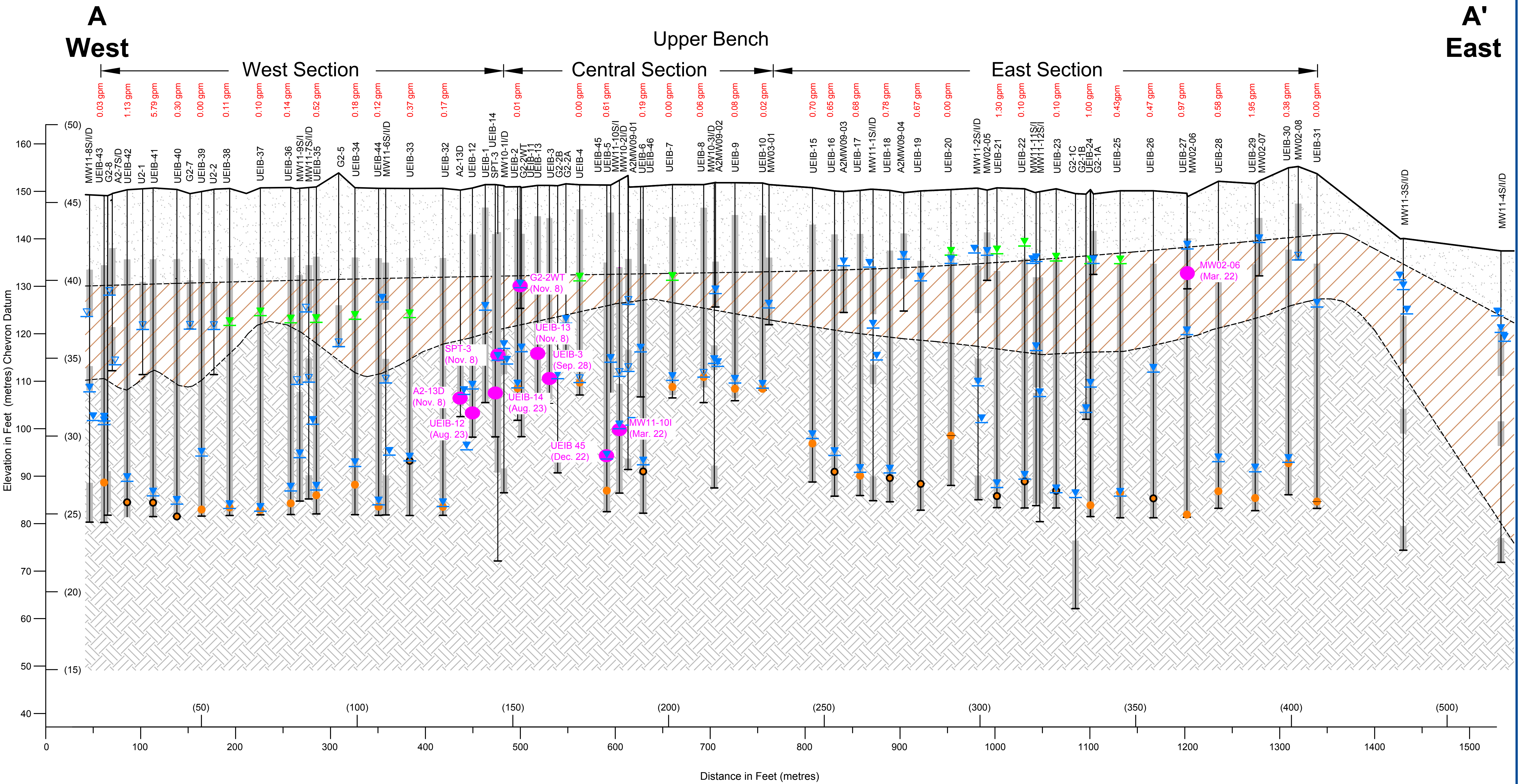
UPPER BENCH EXTRACTION WELL GROUNDWATER ELEVATIONS AND PUMPING RATES FOR AUGUST 23-31, 2016

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-15

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C15 UB Crs Ex Wells and Pump Rates Aug 2016.dwg



LEGEND:

Fill	Monitoring Well
Alluvium/colluvium	Well Screen
Till	

- Static Groundwater Elevation, January 23, 2012
- Pumping Groundwater Elevation, November 14, 16 and 17, 2016
- Dry (<10cm)
- Short Body Extraction Pump
- Short Body Extraction Pump Stuck
- Long Body Extraction Pump
- Fluid Extraction Rate (November 14, 16 and 17, 2016) — 0.08 gpm

ABBREVIATIONS:
gpm gallons per minute
NA Not Available

NAPL Detected in 2016 (last date detected in 2016)

NOTE: NAPL detections not shown on UEIB wells were detected on monitoring wells located along the perimeter extraction system.

feet 0 50 100
metres 0 20 40
1:5 H/V

AECOM

UPPER BENCH EXTRACTION WELL GROUNDWATER ELEVATIONS AND PUMPING RATES FOR NOV. 14, 16 AND 17, 2016

The 2015 and 2016 Perimeter Monitoring Program and Perimeter Extraction System
Chevron Burnaby Refinery, Burnaby, BC

CHEVRON CANADA LIMITED

DATE:	PROJECT NO.:	DRAWN BY:	REVISION NO.:	DRAWING NO.:
June 2017	60486755	TS	0	FIGURE C-16

FILE NAME: H:\URS-CHEVRON\60486755. 2016 PMP\5. Deliverables\2015 and 2016 MOE PMP PES Report\Figures\C16 UB Crs Ex Wells and Pump Rates Nov 2016.dwg

TABLE C-1
SUMMARY OF EXTRACTION RATES
PERIMETER EXTRACTION SYSTEM
OPERATIONS AND PERFORMANCE
CHEVRON BURNABY REFINERY

Extraction Well	December 8, 2010				April 7, 2011				September 12-14, 2011				December 7-8, 2011		
	Total Fluids Extracted (m^3)	Fluid Extraction Rate[7, 13] (gpm)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Fluid Extraction Rate[7, 13] (gpm)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Fluid Extraction Rate[7, 13] (gpm)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)
UEIB-1[1]	38	0	1,414	11	78	0	2,680	13	78	N/A	2,680	N/A	78	2,680	N/A
UEIB-2[2]	8	0	270	14	53	0	1,272	5	100	0	1,549	2	116	N/A	N/A
UEIB-3	87	0	3,817	30	204	0	4,346	4	316	0	4,402	0	353	N/A	N/A
UEIB-4	49	0	0	0	122	0	0	0	226	0	113	1	242	N/A	N/A
UEIB-5[8]	82	0	0	0	170	0	0	0	265	0	132	1	286	N/A	N/A
UEIB-6[9]	34	0	1,459	12	85	0	4,697	27	134	0	5,988	8	148	N/A	N/A
UEIB-7	30	0	74	1	112	0	3,097	25	185	0	5,591	16	197	N/A	N/A
UEIB-8	435	1	0	0	717	0	0	0	761	0	0	0	912	N/A	N/A
UEIB-9	500	1	0	0	1,105	1	0	0	1,453	0	0	0	1,530	N/A	N/A
UEIB-10[4]	8	0	0	0	215	0	0	0	732	0	0	0	759	N/A	N/A
UEIB-11[3]	8	0	0	0	10	N/A	0	N/A	10	N/A	0	N/A	10	0	N/A
UEIB-14[1,4]	N/A	N/A	N/A	N/A	12	0	0	0	78	0	789	4	84	N/A	N/A
UEIB-15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	170	1	0	0	228	N/A	N/A
UEIB-16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	188	1	0	0	373	N/A	N/A
UEIB-17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	82	0	0	0	119	N/A	N/A
UEIB-18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	116	1	0	0	176	N/A	N/A
UEIB-19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	163	1	0	0	382	N/A	N/A
UEIB-20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	407	2	0	0	659	N/A	N/A
UEIB-21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	400	2	0	0	529	N/A	N/A
UEIB-22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	122	1	0	0	246	N/A	N/A
UEIB-23	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61	0	0	0	150	N/A	N/A
UEIB-24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	416	2	0	0	662	N/A	N/A
UEIB-25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100	2	0	0	156	N/A	N/A
UEIB-26	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	133	1	0	0	215	N/A	N/A
UEIB-27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	359	2	0	0	486	N/A	N/A
UEIB-28	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	382	2	0	0	648	N/A	N/A
UEIB-29	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	408	2	0	0	515	N/A	N/A
UEIB-30	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	130	1	0	0	209	N/A	N/A
UEIB-31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	124	1	0	0	198	N/A	N/A
UEIB-32	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	154	N/A	N/A
UEIB-33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	383	N/A	N/A
UEIB-34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	97	N/A	N/A
UEIB-35	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	112	N/A	N/A
UEIB-36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	144	N/A	N/A
UEIB-37[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	85	N/A	N/A
UEIB-38	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-39[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	5	N/A	N/A
UEIB-40[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	45	N/A	N/A
UEIB-41[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	70	N/A	N/A
UEIB-42[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	1	N/A	N/A
UEIB-43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	110	N/A	N/A
UEIB-45[8]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-46[9]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CPR-1[11]	N/A	UK	N/A	N/A	355	UK	N/A	N/A	N/A	1	N/A	N/A	631	N/A	N/A
CPR-2[11]	N/A	UK	N/A	N/A	64	UK	N/A	N/A	N/A	0	N/A	N/A	82	N/A	N/A
EX-1[11]	4,477	UK	0	0	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	N/A	N/A
EX-2[11]	429	UK	0	0	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	N/A	N/A
EX-3[11]	1,639	UK	0	0	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	N/A	N/A
EX-4[11]	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	N/A	N/A
U2-5[11]	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	UK	N/A	N/A	N/A	N/A	N/A
Total	1,277	2.41	7,033	67.3	3,303	2.40	16,092	74.3	8,100	33	21,244	31.9	11,870	2,680	0.0

Extraction Well	June 27, 2012		July 25, 2012					November 22, 2012					December 19, 2012					
	Total Fluids Extracted (m^3)	Fluid Extraction Rate[10] (gpm)	Total Fluids Extracted (m^3)	Fluid Extraction Rate[13] (m^3/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Fluid Extraction Rate[13] (m^3/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Fluid Extraction Rate (m^3/day)	Fluid Extraction Rate (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)
UEIB-1[1]	78	N/A	78	N/A	N/A	2,680	N/A	78	N/A	N/A	2,680	N/A	78	N/A	N/A	2,680	0	N/A
UEIB-2[2]	157	0	158	0	0	1,578	0	158	0	0	1,578	0	164	0	0	1,578	0	0
UEIB-3	442	0	442	0	0	4,465	0	446	0	0	4,465	0	452	0	0	4,465	0	0
UEIB-4	308	0	308	0	0	154	0	308	0	0	154	0	309	0	0	154	0	0
UEIB-5[8]	358	N/A	358	1	0	184	0	358	N/A	N/A	184	N/A	358	N/A	N/A	184	0	N/A
UEIB-6[9]	209	N/A	209	0	0	6,025	0	209	N/A	N/A	6,025	N/A	209	N/A	N/A	6,025	0	N/A
UEIB-7	292	0	292	0	0	5,644	0	293	0	0	5,644	0	294	0	0	5,644	0	0
UEIB-8	1,099	0	1,108	0	0	0	0	1,108	0	0	0	0	1,123	0	0	0	0	0
UEIB-9	1,645	0	1,651	0	0	0	0	1,657	0	0	0	0	1,669	0	0	0	0	0
UEIB-10[4]	792	0	792	0	0	0	0	792	0	0	0	0	792	0	0	0	0	0
UEIB-11[3]	10	N/A	10	N/A	N/A	0	N/A	10	N/A	N/A	0	N/A	10	N/A	N/A	0	0	N/A
UEIB-14[1,4]	85	0	85	0	0	825	0	85	N/A	N/A	825	N/A	85	0	0	825	0	N/A
UEIB-15	579	1	1,013	5	1	0	0	1,282	5	1	0	0	1,415	5	1	0	0	0
UEIB-16	413	0	416	0	0	0	0	543	2	0	0	0	714	5	1	0	0	0
UEIB-17	277	0	309	1	0	0	0	499	2	0	0	0	602	4	1	0	0	0
UEIB-18	491	1	553	2	0	0	0	894	3	1	0	0	1,009	4	1	0	0	0
UEIB-19	1,083	1	1,232	5	1	0	0	2,040	5	1	0	0	2,372	11	2	0	0	0
UEIB-20	1,786	3	2,093	10	2	0	0	3,021	7	1	0	0	3,235	7	1	0	0	0
UEIB-21	1,453	2	1,672	8	1	0	0	2,863	10	2	0	0	3,179	11	2	0	0	0
UEIB-22	559	0	619	2	0	0	0	823	2	0	0	0	889	2	0	0	0	0
UEIB-23	420	0	429	0	0	0	0	478	1	0	0	0	490	1	0	0	0	0
UEIB-24	1,185	2	1,426	9	2	0	0	2,808	10	2	0	0	3,100	10	2	0	0	0
UEIB-25	309	1	446	5	1	0	0	1,361	4	1	0	0	1,486	4	1	0	0	0
UEIB-26	407	1	459	2	0	0	0	854	5	1	0	0	1,023	5	1	0	0	0
UEIB-27	738	1	883	5	1	0	0	1,494	8	1	0	0	1,494	0	0	0	0	0
UEIB-28	809	0	834	1	0	0	0	1,166	3	1	0	0	1,322	5	1	0	0	0
UEIB-29	1,201	2	1,415	8	1	0	0	2,232	7	1	0	0	2,520	8	1	0	0	0
UEIB-30	490	0	542	2	0	0	0	1,304	9	2	0	0	1,459	7	1	0	0	0
UEIB-31	536	1	577	3	1	0	0	974	3	1	0	0	1,067	3	1	0	0	0
UEIB-32	1,455	2	1,762	9	2	0	0	2,105	3	1	0	0	2,219	5	1	0	0	0
UEIB-33	1,378	N/A	1,379	0	0	0	0	1,379	0	0	0	0	1,379	0	0	0	0	0
UEIB-34	1,097	1	1,167	2	0	0	0	1,296	1	0	0	0	1,401	3	1	0	0	0
UEIB-35	1,021	1	1,171	6	1	0	0	1,759	4	1	0	0	1,858	4	1	0	0	0
UEIB-36	656	1	722	2	0	0	0	937	2	0	0	0	1,080	4	1	0	0	0
UEIB-37[6]	241	0	285	2	0	0	0	353	0	0	0	0	359	0	0	0	0	0
UEIB-38	43	0	72	1	0	0	0	174	1	0	0	0	217	2	0	0	0	0
UEIB-39[6]	359	0	420	2	0	0	0	627	2	0	0	0	702	3	0	0	0	0
UEIB-40[6]	151	0	176	1	0	0	0	402	2	0	0	0	483	3	0	0	0	0
UEIB-41[6]	278	0	308	1	0	0	0	601	4	1	0	0	764	6	1	0	0	0
UEIB-42[6]	336	0	395	2	0	0	0	1,377	12	2	0	0	1,730	14	3	0	0	0
UEIB-43	553	1	1,085	7	1	0	0	1,775	8	2	0	0	1,972	9	2	0	0	0
UEIB-44	456	1	548	3	1	0	0	800	2	0	0	0	883	3	1	0	0	0
UEIB-45[8]	367	2	566	9	2	57	1	1,544	8	1	106	0	1,779	9	2	106	0	0
UEIB-46[9]	37	0	69	2	0	0	0	185	1	0	0	0	247	2	0	0	0	0
CPR-1[11]	1,502	0	1,505	1	0	49	0	1,548	0	0	53	0	1,895	3	1	53	0	0
CPR-2[11]	143	0	143	0	0	14	0	143	0	0	14	0	143	0	0	14	0	0
EX-1[11]	5,169	0	5,169	2	0	N/A	N/A	5,208	0	0	N/A	N/A	5,313	2	0	N/A	NA	N/A
EX-2[11]	520	0	524	0	0	N/A	N/A	524	0	0	N/A	N/A	532	0	0	N/A	NA	N/A
EX-3[11]	1,979	0	1,979	1	0	N/A	N/A	1,987	0	0	N/A	N/A	2,005	0	0	N/A	NA	N/A
EX-4[11]	501	0	501	0	0	N/A	N/A	502	0	0	N/A	N/A	506	0	0	N/A	NA	N/A
U2-5[11]	503	0	503	0	0	N/A	N/A	503	0	0	N/A	N/A	503	0	0	N/A	NA	N/A
Total	36,956	28	40,860	125	22	21,674	2.62	55,867	138	25	21,728	0.51	60,888	166	30	21,728	0	0.24

Notes:

1 UEIB-1 operated from August 5, 2010 to March 17, 2011. On March 17, UEIB-1 was replaced with UEIB-14.
2 UEIB-2 operated from August 5 to 25, 2010 and continuously since February 1, 2011.
3 UEIB-11 operated from August 25, 2010 to February 1, 2011.
4 UEIB-10 operated from December 2010 to July 2012. In July 2012, UEIB-10 was replaced with UEIB-32. On December 17, 2015, pump in UEIB-14 was moved to UEIB-10.
5 NAPL extraction rate measured as total NAPL extracted since previous measuring event.
6 No pump tests done before July 2012. Assumed rate of 0.90 L/count.
7 Pumps UEIB-32 to UEIB-44 not started until September 27, 2011. Rates listed for those pumps are taken from measurements completed from September 27 to October 24, 2011. Due to this exception, cummulative extracted fluids and NAPL were not calculated.
8 Pump operated in UEIB-5 until June 2012, then it was moved into UEIB-45.
9 Pump operated in UEIB-6 until June 2012, then it was moved into UEIB-46.
10 Extraction rate values calculated from change in counter readings between June 21 to June 27.
11 For November 22, 2012 Summary Table results, CPR-(1,2), EX-(1,2,3,4) and U2-5 data was collected on Oct.22,24, 2012.
12 Transducer Data - during rebound testing, all pumps were shut off from Oct.11-12, 2011 to Mar.14-22, 2012 with the exception of test pumps (UEIB-5,6,22,23,35 and 36).
13 Fluid extraction rate based on the average of the last five measurements.

Abbreviations:

N/A - Not available (pump not installed/running at this time.
UK - Unknown (not enough data).
NAPL - Non-Aqueous Phase Liquids
PHC - Petroleum Hydrocarbons
m - Metres
L - Litres
Kg - Kilograms
gpm - Gallons per minute

TABLE C-1
SUMMARY OF EXTRACTION RATES
PERIMETER EXTRACTION SYSTEM
OPERATIONS AND PERFORMANCE
CHEVRON BURNABY REFINERY

Extraction Well	February 14, 2013						June 6, 2013					
	Total Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	Total Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)
UEIB-1[1]	78	N/A	N/A	2,680	0	N/A	78	N/A	N/A	2,680	0	N/A
UEIB-2[2]	179	0	0	1,578	0	0	201	0	0	1,578	0	0
UEIB-3	466	0	0	4,465	0	0	491	0	0	4,465	0	0
UEIB-4	311	0	0	154	0	0	315	0	0	154	0	0
UEIB-5[8]	358	N/A	N/A	184	0	N/A	358	N/A	N/A	184	0	N/A
UEIB-6[9]	209	N/A	N/A	6,025	0	N/A	209	N/A	N/A	6,025	0	N/A
UEIB-7	295	0	0	5,644	0	0	298	0	0	5,644	0	0
UEIB-8	1,151	1	0	0	0	0	1,180	0	0	0	0	0
UEIB-9	1,706	1	0	0	0	0	1,780	1	0	0	0	0
UEIB-10[4]	792	N/A	N/A	0	0	N/A	792	N/A	N/A	0	0	N/A
UEIB-11[3]	10	N/A	N/A	0	0	N/A	10	N/A	N/A	0	0	N/A
UEIB-14[1,4]	85	0	0	825	0	0	85	0	0	825	0	0
UEIB-15	1,674	4	1	0	0	0	2,205	5	1	0	0	0
UEIB-16	975	4	1	0	0	0	1,467	4	1	0	0	0
UEIB-17	752	2	0	0	0	0	1,071	3	1	0	0	0
UEIB-18	1,224	4	1	0	0	0	1,669	4	1	0	0	0
UEIB-19	2,614	5	1	0	0	0	2,821	4	1	0	0	0
UEIB-20	3,466	5	1	0	0	0	4,827	13	2	0	0	0
UEIB-21	3,883	12	2	0	0	0	3,908	N/A	N/A	0	0	N/A
UEIB-22	1,020	2	0	0	0	0	1,318	3	0	0	0	0
UEIB-23	545	1	0	0	0	0	739	2	0	0	0	0
UEIB-24	3,559	8	2	0	0	0	4,188	8	1	0	0	0
UEIB-25	1,732	4	1	0	0	0	2,194	4	1	0	0	0
UEIB-26	1,329	5	1	0	0	0	1,704	3	1	0	0	0
UEIB-27	1,494	0	0	0	0	0	2,074	8	1	0	0	0
UEIB-28	1,670	6	1	0	0	0	2,190	5	1	0	0	0
UEIB-29	3,091	10	2	0	0	0	3,656	4	1	0	0	0
UEIB-30	1,722	5	1	0	0	0	2,375	6	1	0	0	0
UEIB-31	1,203	2	0	0	0	0	1,496	3	0	0	0	0
UEIB-32	2,404	3	1	9	9	0	2,679	2	0	23	14	0
UEIB-33	1,379	0	0	0	0	0	1,820	4	1	0	0	0
UEIB-34	1,618	4	1	0	0	0	2,257	6	1	0	0	0
UEIB-35	2,191	6	1	0	0	0	4,191	18	3	0	0	0
UEIB-36	1,756	12	2	0	0	0	2,239	4	1	0	0	0
UEIB-37[6]	394	1	0	0	0	0	721	3	1	0	0	0
UEIB-38	312	2	0	0	0	0	490	2	0	0	0	0
UEIB-39[6]	813	2	0	0	0	0	1,034	2	0	0	0	0
UEIB-40[6]	650	3	1	0	0	0	925	2	0	0	0	0
UEIB-41[6]	857	2	0	0	0	0	1,413	5	1	0	0	0
UEIB-42[6]	2,539	14	3	0	0	0	3,808	11	2	0	0	0
UEIB-43	2,716	14	3	0	0	0	4,012	12	2	0	0	0
UEIB-44	1,045	3	1	8	8	0	1,215	2	0	17	8	0
UEIB-45[8]	2,147	7	1	106	0	0	2,878	7	1	142	37	0
UEIB-46[9]	328	1	0	0	0	0	402	1	0	8	8	0
CPR-1[11]	2,102	5	1	109	56	1	2,232	4	1	131	22	0
CPR-2[11]	161	0	0	31	17	0	313	2	0	31	0	0
EX-1[11]	5,433	2	0	N/A	NA	N/A	5,564	1	0	N/A	NA	N/A
EX-2[11]	540	0	0	N/A	NA	N/A	554	0	0	N/A	NA	N/A
EX-3[11]	2,024	0	0	N/A	NA	N/A	2,057	0	0	N/A	NA	N/A
EX-4[11]	509	0	0	N/A	NA	N/A	516	0	0	N/A	NA	N/A
U2-5[11]	503	0	0	N/A	NA	N/A	503	0	0	N/A	NA	N/A
Total	70,014	163	30	21,818	90	1.19	87,523	168	31	21,907	89	0.91

Extraction Well	September 26, 2013							
	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	0	N/A	NA
UEIB-2[2]	210	9	0	0	1,578	0	0	0
UEIB-3	506	15	0	0	4,465	0	0	0
UEIB-4	319	4	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	0	N/A	NA
UEIB-6[9]	209	N/A	N/A	N/A	6,025	0	N/A	NA
UEIB-7	307	9	0	0	5,644	0	0	0
UEIB-8	1,190	10	0	0	0	0	0	0
UEIB-9	1,811	31	0	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	0	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	0	N/A	N/A
UEIB-14[1,4]	86	0	0	0	825	0	0	0
UEIB-15	2,499	294	2	0	0	0	0	0
UEIB-16	1,731	263	2	0	0	0	0	0
UEIB-17	1,218	147	1	0	0	0	0	0
UEIB-18	1,908	239	2	0	0	0	0	0
UEIB-19	3,091	270	2	0	0	0	0	1
UEIB-20	5,609	782	7	1	0	0	0	2
UEIB-21	3,988	80	1	0	0	0	0	1
UEIB-22	1,477	158	1	0	0	0	0	0
UEIB-23	1,048	309	3	1	0	0	0	1
UEIB-24	4,402	213	1	0	0	0	0	1
UEIB-25	2,532	338	3	1	0	0	0	0
UEIB-26	1,877	173	2	0	0	0	0	0
UEIB-27	2,598	525	5	1	0	0	0	1
UEIB-28	2,268	78	1	0	0	0	0	0
UEIB-29	4,331	675	6	1	0	0	0	2
UEIB-30	2,612	238	2	0	0	0	0	1
UEIB-31	1,679	182	2	0	0	0	0	1
UEIB-32	2,786	107	1	0	23	0	0	1
UEIB-33	2,247	427	4	1	11	11	0	2
UEIB-34	2,579	323	3	1	0	0	0	0
UEIB-35	6,057	1,866	16	3	0	0	0	5
UEIB-36	2,870	631	5	1	0	0	0	0
UEIB-37[6]	1,021	300	3	0	0	0	0	1
UEIB-38	550	60	1	0	0	0	0	0
UEIB-39[6]	1,197	163	1	0	0	0	0	0
UEIB-40[6]	1,097	173	2	0	0	0	0	0
UEIB-41[6]	1,819	405	4	1	0	0	0	1
UEIB-42[6]	4,493	685	4	1	0	0	0	2
UEIB-43	4,945	933	7	1	0	0	0	3
UEIB-44	1,294	79	1	0	19	2	0	0
UEIB-45[8]	3,381	503	4	1	156	14	0	3
UEIB-46[9]	478	76	1	0	10	2	0	1
CPR-1[11]	2,345	114	2	0	132	1	0	0
CPR-2[11]	320	8	1	0	32	0	0	0
EX-1[11]	5,648	84	1	0	N/A	NA	N/A	N/A
EX-2[11]	563	8	0	0	N/A	NA	N/A	N/A
EX-3[11]	2,082	25	0	0	N/A	NA	N/A	N/A
EX-4[11]	520	5	0	0	N/A	NA	N/A	N/A
U2-5[11]	503	N/A	0	0	N/A	NA	N/A	N/A
Total	99,539	12,017	103	19	21,938	31	0.58	31.20

Extraction Well	December 20, 2013							
	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	NA	N/A	NA
UEIB-2[2]	219	9	0	0	1,578	0	0	0
UEIB-3	525	18	0	0	4,465	0	0	1
UEIB-4	321	1	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	NA	N/A	NA
UEIB-6[9]	209	N/A	N/A	N/A	6,025	NA	N/A	NA
UEIB-7	307	0	0	0	5,644	0	0	0
UEIB-8	1,190	0	0	0	0	0	0	0
UEIB-9	1,836	24	0	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	0	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	0	N/A	N/A
UEIB-14[1,4]	86	0	0	0	825	0	0	0
UEIB-15	2,816	317	4	1	0	0	0	0
UEIB-16	2,076	346	4	1	0	0	0	0
UEIB-17	1,531	313	4	1	0	0	0	0
UEIB-18	2,235	327	9	2	0	0	0	3
UEIB-19	3,149	59	0	0	0	0	0	7
UEIB-20	6,199	589	12	2	0	0	0	13
UEIB-21	4,410	423	11	2	0	0	0	31
UEIB-22	1,670	193	2	0	0	0	0	4
UEIB-23	1,088	40	1	0	0	0	0	3
UEIB-24	5,069	667	8	1	0	0	0	15
UEIB-25	2,883	351	5	1	0	0	0	1
UEIB-26	2,074	197	2	0	0	0	0	1
UEIB-27	3,057	459	7	1	0	0	0	6
UEIB-28	2,293	25	0	0	0	0	0	6
UEIB-29	4,925	594	7	1	0	0	0	14
UEIB-30	2,914	302	5	1	0	0	0	8
UEIB-31	1,849	170	2	0	0	0	0	5
UEIB-32	2,875	89	1	0	28	5	0	38
UEIB-33	3,038	791	10	2	54	43	0	12
UEIB-34	2,803	224	3	0	0	0	0	1
UEIB-35	7,304	1,247	14	3	0	0	0	21
UEIB-36	3,023	153	2	0	0	0	0	1
UEIB-37[6]	1,438	417	5	1	0	0	0	4
UEIB-38	618	68	1	0	0	0	0	0
UEIB-39[6]	1,321	124	2	0	0	0	0	4
UEIB-40[6]	1,295	197	3	0	0	0	0	4
UEIB-41[6]	2,406	588	7	1	0	0	0	7
UEIB-42[6]	4,493	0	0	0	0	0	0	13
UEIB-43	5,197	253	4	1	0	0	0	15
UEIB-44	1,359	65	1	0	23	4	0	5
UEIB-45[8]	3,910	529	7	1	188	32	0	27
UEIB-46[9]	533	55	1	0	10	0	0	4
CPR-1[11]	2,412	67	0	0	135	2	0	7
CPR-2[11]	326	5	0	0	32	0	0	1
EX-1[11]	5,730	82	1	0	N/A	NA	N/A	N/A
EX-2[11]	570	7	0	0	N/A	NA	N/A	N/A
EX-3[11]	2,091	9	0	0	N/A	NA	N/A	N/A
EX-4[11]	527	6	0	0	N/A	NA	N/A	N/A
U2-5[11]	503	N/A	0	0	N/A	NA	N/A	N/A
Total	109,942	10,403	136	25	22,025	88	0.84	281.21

Extraction Well	March 26, 2014							
	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	NA
UEIB-2[2]	234	14	0	0	1,578	0	0	0
UEIB-3	561	36	0	0	4,465	0	0	0
UEIB-4	334	13	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	NA
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	NA
UEIB-7	311	4	0	0	5,644	0	0	0
UEIB-8	1,220	30	0	0	0	0	0	0
UEIB-9	1,904	68	1	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-14[1,4]	86	1	0	0	825	0	0	0
UEIB-15	3,033	217	1	0	0	0	0	0
UEIB-16	3,536	1,460	18	3	0	0	0	1
UEIB-17	1,869	338	3	1	0	0	0	0
UEIB-18	2,593	357	2	0	0	0	0	1
UEIB-19	3,519	370	3	1	0	0	0	1
UEIB-20	6,510	312	3	0	0	0	0	1
UEIB-21	5,065	655	8	2	0	0	0	5
UEIB-22	1,979	309	3	1	0	0	0	1
UEIB-23	1,465	376	5	1	0	0	0	1
UEIB-24	5,429	360	4	1	0	0	0	1
UEIB-25	3,317	434	4	1	0	0	0	0
UEIB-26	4,486	2,413	33	6	0	0	0	1
UEIB-27	3,563	506	5	1	0	0	0	1
UEIB-28	2,307	14	0	0	0	0	0	0
UEIB-29	5,604	679	7	1	0	0	0	2
UEIB-30	3,162	248	3	0	0	0	0	1
UEIB-31	2,157	308	5	1	0	0	0	1
UEIB-32	2,966	91	1	0	39	11	0	1
UEIB-33	3,792	753	7	1	54	0	0	3
UEIB-34	3,057	253	3	0	0	0	0	0
UEIB-35	7,997	692	7	1	0	0	0	2
UEIB-36	3,264	242	3	1	0	0	0	0
UEIB-37[6]	1,892	454	5	1	0	0	0	1
UEIB-38	713	96	1	0	0	0	0	0
UEIB-39[6]	1,572	251	3	1	0	0	0	1
UEIB-40[6]	1,617	322	4	1	0	0	0	1
UEIB-41[6]	2,871	464	5	1	0	0	0	1
UEIB-42[6]	4,577	83	1	0	0	0	0	0
UEIB-43	6,242	1,044	11	2	0	0	0	3
UEIB-44	1,432	73	1	0	24	1	0	0
UEIB-45[8]	4,713	803	8	2	255	67	1	6
UEIB-46[9]	662	129	1	0	10	0	0	1
CPR-1[11]	2,806	393	3	1	155	21	0	1
CPR-2[11]	377	51	0	0	34	3	0	0
EX-1[11]	5,779	49	1	0	N/A	N/A	N/A	N/A
EX-2[11]	576	6	0	0	N/A	N/A	N/A	N/A
EX-3[11]	2,124	33	0	0	N/A	N/A	N/A	N/A
EX-4[11]	534	7	0	0	N/A	N/A	N/A	N/A
U2-5[11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	125,755	15,813	174	32	22,127	102	1.14	38.55

Notes:
1 UEIB-1 operated from August 5, 2010 to March 17, 2011. On March 17, UEIB-1 was replaced with UEIB-14.
2 UEIB-2 operated from August 5 to 25, 2010 and continuously since February 1, 2011.
3 UEIB-11 operated from August 25, 2010 to February 1, 2011.
4 UEIB-10 operated from December 2010 to July 2012. In July 2012, UEIB-10 was replaced with UEIB-32. On December 17, 2015, pump in UEIB-14 was moved to UEIB-10.
5 NAPL extraction rate measured as total NAPL extracted since previous measuring event.
6 No pump tests done before July 2012. Assumed rate of 0.90 L/count.
7 Pumps UEIB-32 to UEIB-44 not started until September 27, 2011. Rates listed for those pumps are taken from measurements completed from September 27 to October 24, 2011. Due to this exception, cummulative extracted fluids and NAPL were not calculated.
8 Pump operated in UEIB-5 until June 2012, then it was moved into UEIB-45.
9 Pump operated in UEIB-6 until June 2012, then it was moved into UEIB-46.
10 Extraction rate values calculated from change in counter readings between June 21 to June 27.
11 For November 22, 2012 Summary Table results, CPR-(1,2), EX-(1,2,3,4) and U2-5 data was collected on Oct.22,24, 2012.
12 Transducer Data - during rebound testing, all pumps were shut off from Oct.11-12, 2011 to Mar.14-22, 2012 with the exception of test pumps (UEIB-5,6,22,23,35 and 36).
13 Fluid extraction rate based on the average of the last five measurements.

Abbreviations:
N/A - Not available (pump not installed/running at this time.
UK - Unknown (not enough data).
NAPL - Non-Aqueous Phase Liquids
PHC - Petroleum Hydrocarbons
m - Metres
L - Litres
Kg - Kilograms
gpm - Gallons per minute

TABLE C-1
SUMMARY OF EXTRACTION RATES
PERIMETER EXTRACTION SYSTEM
OPERATIONS AND PERFORMANCE
CHEVRON BURNABY REFINERY

Extraction Well	June 24-25 and July 7, 2014								September 29-30, 2014							
	Total Fluids Extracted (m³)	Quarter Fluids Extracted (m³)	Fluid Extraction Rate[13] (m³/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)	Total Fluids Extracted (m³)	Quarter Fluids Extracted (m³)	Fluid Extraction Rate[13] (m³/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	NA	78	N/A	N/A	N/A	2,680	N/A	N/A	NA
UEIB-2[2]	248	15	0	0	1,578	0	0	5	256	8	0	0	1,578	0	0	2
UEIB-3	595	34	0	0	4,465	0	0	13	605	10	0	0	4,465	0	0	2
UEIB-4	346	12	0	0	154	0	0	5	353	6	0	0	154	0	0	2
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	NA	358	N/A	N/A	N/A	184	N/A	N/A	NA
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	NA	209	N/A	N/A	N/A	6,025	N/A	N/A	NA
UEIB-7	315	4	0	0	5,644	0	0	2	316	0	0	0	5,644	0	0	0
UEIB-8	1,274	54	1	0	0	0	0	0	1,299	25	0	0	0	0	0	6
UEIB-9	1,970	66	1	0	0	0	0	25	2,020	50	0	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	N/A	N/A	N/A	792	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	N/A	N/A	N/A	10	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-14[1,4]	90	4	0	0	825	0	0	2	91	0	0	0	825	0	0	0
UEIB-15	3,152	119	1	0	0	0	0	0	3,616	464	2	0	0	0	0	0
UEIB-16	4,053	516	5	1	0	0	0	0	4,679	626	2	0	0	0	0	153
UEIB-17	2,057	188	1	0	0	0	0	0	2,257	200	3	0	0	0	0	49
UEIB-18	2,826	233	2	0	0	0	0	87	3,002	177	2	0	0	0	0	0
UEIB-19	4,013	493	5	1	0	0	0	1	4,301	288	1	0	0	0	0	71
UEIB-20	6,667	157	2	0	0	0	0	0	7,003	336	4	1	0	0	0	0
UEIB-21	6,581	1,516	4	1	0	0	0	11	6,924	343	6	1	0	0	0	84
UEIB-22	2,293	315	3	1	0	0	0	0	2,557	264	3	0	0	0	0	0
UEIB-23	1,946	482	5	1	0	0	0	1	2,453	507	6	1	0	0	0	0
UEIB-24	5,439	10	0	0	0	0	0	0	5,548	109	1	0	0	0	0	0
UEIB-25	3,317	0	1	0	0	0	0	0	3,598	281	4	1	0	0	0	69
UEIB-26	4,783	297	3	1	0	0	0	1	4,961	178	2	0	0	0	0	44
UEIB-27	3,918	355	3	1	0	0	0	1	4,412	493	8	1	0	0	0	1
UEIB-28	2,428	121	2	0	0	0	0	0	2,547	119	2	0	0	0	0	29
UEIB-29	5,937	334	3	0	0	0	0	125	6,185	248	3	1	0	0	0	61
UEIB-30	3,167	5	1	0	0	0	0	0	3,409	242	3	1	0	0	0	0
UEIB-31	2,545	388	4	1	0	0	0	146	3,942	1,397	22	4	0	0	0	342
UEIB-32	3,071	105	1	0	45	5	0	3	3,177	105	1	0	45	0	0	1
UEIB-33	3,792	0	0	0	54	0	0	0	3,808	16	0	0	54	0	0	0
UEIB-34	3,472	415	4	1	0	0	0	1	3,952	480	4	1	24	24	0	0
UEIB-35	8,328	331	4	1	0	0	0	0	8,401	74	0	0	0	0	0	5
UEIB-36	3,498	234	3	0	0	0	0	88	3,833	335	4	1	17	17	0	82
UEIB-37 [6]	2,207	315	3	1	0	0	0	118	3,359	1,152	17	3	0	0	0	282
UEIB-38	802	89	1	0	0	0	0	33	810	8	0	0	0	0	0	2
UEIB-39 [6]	1,750	178	2	0	0	0	0	67	1,921	171	2	0	0	0	0	0
UEIB-40 [6]	1,904	288	3	1	0	0	0	108	2,168	264	4	1	0	0	0	0
UEIB-41 [6]	3,100	229	3	1	0	0	0	86	4,721	1,621	3	1	0	0	0	0
UEIB-42 [6]	4,843	266	3	1	0	0	0	100	5,083	240	3	0	0	0	0	0
UEIB-43	6,533	291	8	1	0	0	0	109	7,879	1,346	11	2	0	0	0	329
UEIB-44	1,584	153	2	0	30	6	0	1	1,714	130	1	0	43	13	0	2
UEIB-45 [8]	5,294	581	5	1	338	83	1	4,535	6,477	1,182	11	2	456	118	2	5,659
UEIB-46 [9]	812	150	2	0	10	0	0	1	937	124	1	0	10	0	0	1
CPR-1 [11]	2,969	163	3	1	155	0	0	61	2,970	1	0	0	155	0	0	0
CPR-2 [11]	386	9	0	0	35	0	0	3	386	0	0	0	35	0	0	0
EX-1 [11]	5,888	109	1	0	N/A	N/A	N/A	N/A	5,947	59	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	591	15	0	0	N/A	N/A	N/A	N/A	599	9	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,177	54	1	0	N/A	N/A	N/A	N/A	2,200	22	0	0	N/A	N/A	N/A	N/A
EX-4 [11]	541	6	0	0	N/A	N/A	N/A	N/A	544	3	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	135,456	9,700	95	17	22,222	94	1.43	5737.47	149,167	13,712	136	25	22,394	172	2.21	7279.78

Extraction Well	December 15-17, 2014								February 24-25, 2015							
	Total Fluids Extracted (m³)	Quarter Fluids Extracted (m³)	Fluid Extraction Rate[13] (m³/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)	Total Fluids Extracted (m³)	Quarter Fluids Extracted (m³)	Fluid Extraction Rate[13] (m³/day)	Fluid Extraction Rate[13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	NA	78	N/A	N/A	N/A	2,680	N/A	N/A	NA
UEIB-2[2]	280	24	0	0	1,578	0	0	0	303	23	0	0	1,578	0	0	0
UEIB-3	633	28	0	0	4,465	0	0	0	648	15	0	0	4,465	0	0	0
UEIB-4	383	30	0	0	154	0	0	1	390	7	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	NA	358	N/A	N/A	N/A	184	N/A	N/A	NA
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	NA	209	N/A	N/A	N/A	6,025	N/A	N/A	NA
UEIB-7	320	5	0	0	5,644	0	0	0	323	3	0	0	5,644	0	0	0
UEIB-8	1,345	46	1	0	3	3	0	0	1,431	86	1	0	7	4	0	0
UEIB-9	2,104	84	1	0	0	0	0	0	2,159	55	1	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	N/A	N/A	N/A	792	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	N/A	N/A	N/A	10	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-14[1,4]	92	1	0	0	825	0	0	0	93	2	0	0	825	0	0	0
UEIB-15	4,442	826	11	2	0	0	0	1	5,558	1,116	9	2	0	0	0	1
UEIB-16	5,294	615	10	2	0	0	0	1	5,298	4	0	0	0	0	0	0
UEIB-17	2,444	187	2	0	0	0	0	0	2,819	375	2	0	0	0	0	1
UEIB-18	3,374	372	4	1	0	0	0	0	3,788	414	6	1	0	0	0	1
UEIB-19	4,308	7	0	0	0	0	0	0	4,343	35	0	0	0	0	0	0
UEIB-20	7,584	581	4	1	0	0	0	1	8,094	510	6	1	0	0	0	0
UEIB-21	7,647	723	9	2	0	0	0	4	8,362	715	7	1	0	0	0	4
UEIB-22	3,322	765	10	2	0	0	0	2	3,477	155	2	0	0	0	0	0
UEIB-23	4,145	1,692	24	4	0	0	0	3	4,598	453	6	1	0	0	0	1
UEIB-24	5,820	272	2	0	0	0	0	0	5,979	158	12	2	0	0	0	0
UEIB-25	4,126	528	7	1	0	0	0	1	4,672	547	4	1	0	0	0	1
UEIB-26	5,425	463	1	0	0	0	0	1	5,524	99	5	1	0	0	0	0
UEIB-27	5,512	1,101	12	2	0	0	0	7	6,042	529	1	0	0	0	0	3
UEIB-28	2,864	317	4	1	0	0	0	1	3,191	326	10	2	0	0	0	1
UEIB-29	6,621	436	3	1	0	0	0	0	7,007	386	4	1	0	0	0	0
UEIB-30	3,844	435	5	1	0	0	0	0	4,403	559	8	1	0	0	0	0
UEIB-31	3,947	5	0	0	0	0	0	0	3,993	46	3	1	0	0	0	0
UEIB-32	3,315	138	2	0	45	0	0	1	3,442	128	1	0	45	0	0	1
UEIB-33	3,968	161	2	0	54	0	0	1	4,276	307	3	1	54	0	0	2
UEIB-34	4,337	385	3	1	40	16	0	3	4,703	366	4	1	40	0	0	1
UEIB-35	8,891	489	7	1	0	0	0	15	9,479	588	7	1	0	0	0	0
UEIB-36	4,193	360	3	1	33	16	0	0	4,326	133	2	0	33	0	0	0
UEIB-37 [6]	3,926	567	6	1	0	0	0	6	4,443	517	6	1	0	0	0	1
UEIB-38	810	0	0	0	0	0	0	0	810	0	0	0	0	0	0	0
UEIB-39 [6]	2,142	221	3	0	0	0	0	0	2,396	254	3	1	0	0	0	0
UEIB-40 [6]	2,493	325	4	1	0	0	0	0	2,793	299	3	1	0	0	0	0
UEIB-41 [6]	5,132	411	4	1	0	0	0	12	5,440	309	4	1	0	0	0	1
UEIB-42 [6]	5,666	583	7	1	0	0	0	0	6,620	954	11	2	0	0	0	0
UEIB-43	8,870	992	9	2	0	0	0	30	9,694	824	10	2	0	0	0	3
UEIB-44	1,714	0	0	0	43	0	0	0	1,732	18	0	0	43	0	0	0
UEIB-45 [8]	7,018	541	5	1	501	45	1	391	7,738	720	9	2	558	57	1	19
UEIB-46 [9]	1,111	174	2	0	10	0	0	2	1,232	121	1	0	10	0	0	1
CPR-1 [11]	3,330	359	5	1	170	15	0	11	3,558	228	3	1	170	0	0	1
CPR-2 [11]	494	108	1	0	35	0	0	3	586	93	1	0	35	0	0	0
EX-1 [11]	6,049	103	1	0	N/A	N/A	N/A	N/A	6,137	88	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	616	17	0	0	N/A	N/A	N/A	N/A	630	14	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,272	73	1	0	N/A	N/A	N/A	N/A	2,326	54	1	0	N/A	N/A	N/A	N/A
EX-4 [11]	549	6	0	0	N/A	N/A	N/A	N/A	554	5	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	164,724	15,556	178	33	22,489	95	1.20	499.60	177,362	12,638	157	29	22,550	61	0.89	44.55

Notes:

1 UEIB-1 operated from August 5, 2010 to March 17, 2011. On March 17, UEIB-1 was replaced with UEIB-14.
2 UEIB-2 operated from August 5 to 25, 2010 and continuously since February 1, 2011.
3 UEIB-11 operated from August 25, 2010 to February 1, 2011.
4 UEIB-10 operated from December 2010 to July 2012. In July 2012, UEIB-10 was replaced with UEIB-32. On December 17, 2015, pump in UEIB-14 was moved to UEIB-10.
5 NAPL extraction rate measured as total NAPL extracted since previous measuring event.
6 No pump tests done before July 2012. Assumed rate of 0.90 L/count.
7 Pumps UEIB-32 to UEIB-44 not started until September 27, 2011. Rates listed for those pumps are taken from measurements completed from September 27 to October 24, 2011. Due to this exception, cummulative extracted fluids and NAPL were not calculated.
8 Pump operated in UEIB-5 until June 2012, then it was moved into UEIB-45.
9 Pump operated in UEIB-6 until June 2012, then it was moved into UEIB-46.
10 Extraction rate values calculated from change in counter readings between June 21 to June 27.
11 For November 22, 2012 Summary Table results, CPR-(1,2), EX-(1,2,3,4) and U2-5 data was collected on Oct.22,24, 2012.
12 Transducer Data - during rebound testing, all pumps were shut off from Oct.11-12, 2011 to Mar.14-22, 2012 with the exception of test pumps (UEIB-5,6,22,23,35 and 36).
13 Fluid extraction rate based on the average of the last five measurements.

Abbreviations:

N/A - Not available (pump not installed/running at this time.
UK - Unknown (not enough data).
NAPL - Non-Aqueous Phase Liquids
PHC - Petroleum Hydrocarbons
m - Metres
L - Litres
Kg - Kilograms
gpm - Gallons per minute

TABLE C-1
SUMMARY OF EXTRACTION RATES
PERIMETER EXTRACTION SYSTEM
OPERATIONS AND PERFORMANCE
CHEVRON BURNABY REFINERY

May 26-28, 2015

Extraction Well	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	NA
UEIB-2[2]	317	13	0	0	1,578	0	0	1
UEIB-3	653	5	0	0	4,465	0	0	0
UEIB-4	391	1	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	N/A
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A
UEIB-7	324	1	0	0	5,644	0	0	0
UEIB-8	1,467	36	0	0	7	0	0	2
UEIB-9	2,222	63	1	0	0	0	0	0
UEIB-10[4]	792	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-14[1,4]	94	0	0	0	825	0	0	0
UEIB-15	6,305	747	8	1	0	0	0	0
UEIB-16	5,299	0	0	0	0	0	0	0
UEIB-17	2,873	54	1	0	0	0	0	3
UEIB-18	4,272	484	6	1	0	0	0	0
UEIB-19	4,355	12	0	0	0	0	0	1
UEIB-20	8,837	743	6	1	0	0	0	1
UEIB-21	8,850	488	7	1	0	0	0	3
UEIB-22	3,824	348	4	1	0	0	0	1
UEIB-23	4,942	344	5	1	0	0	0	0
UEIB-24	6,894	915	9	2	0	0	0	45
UEIB-25	4,965	293	3	1	0	0	0	0
UEIB-26	8,175	2,651	46	8	0	0	0	129
UEIB-27	6,540	499	4	1	0	0	0	1
UEIB-28	3,494	303	2	0	0	0	0	0
UEIB-29	7,706	699	5	1	0	0	0	0
UEIB-30	4,750	347	3	1	0	0	0	0
UEIB-31	4,160	167	0	0	0	0	0	8
UEIB-32	3,544	102	1	0	45	0	0	1
UEIB-33	4,458	183	1	0	54	0	0	1
UEIB-34	4,970	266	3	1	40	0	0	0
UEIB-35	9,896	417	4	1	0	0	0	20
UEIB-36	4,392	66	1	0	33	0	0	3
UEIB-37 [6]	4,521	77	1	0	0	0	0	4
UEIB-38	810	0	0	0	0	0	0	0
UEIB-39 [6]	2,518	122	1	0	0	0	0	0
UEIB-40 [6]	2,946	153	2	0	0	0	0	7
UEIB-41 [6]	5,653	213	2	0	0	0	0	10
UEIB-42 [6]	7,210	591	8	1	0	0	0	29
UEIB-43	9,760	66	0	0	0	0	0	3
UEIB-44	1,821	89	1	0	43	0	0	0
UEIB-45 [8]	8,450	711	7	1	632	75	1	667
UEIB-46 [9]	1,299	67	1	0	10	0	0	0
CPR-1 [11]	3,680	123	1	0	170	0	0	6
CPR-2 [11]	610	24	0	0	35	0	0	1
EX-1 [11]	6,239	102	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	646	16	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,378	52	0	0	N/A	N/A	N/A	N/A
EX-4 [11]	559	5	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	190,019	12,657	146	27	22,624	75	0.95	947.83

August 11-13, 2015

Extraction Well	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A
UEIB-2[2]	317	0	0	0	1,578	0	0	0
UEIB-3	653	0	0	0	4,465	0	0	0
UEIB-4	391	0	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	N/A
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A
UEIB-7	324	0	0	0	5,644	0	0	0
UEIB-8	1,467	0	0	0	7	0	0	0
UEIB-9	2,255	32	0	0	0	0	0	1
UEIB-10[4]	792	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-11[3]	10	N/A	N/A	N/A	0	N/A	N/A	N/A
UEIB-14[1,4]	94	0	0	0	825	0	0	0
UEIB-15	7,443	1,138	3	0	0	0	0	0
UEIB-16	5,313	15	0	0	0	0	0	0
UEIB-17	3,149	276	5	1	0	0	0	9
UEIB-18	4,795	523	5	1	0	0	0	0
UEIB-19	5,232	877	4	1	0	0	0	28
UEIB-20	9,712	875	8	2	0	0	0	0
UEIB-21	9,623	772	9	2	0	0	0	3
UEIB-22	3,981	157	1	0	0	0	0	0
UEIB-23	5,381	438	4	1	0	0	0	14
UEIB-24	7,546	652	3	1	0	0	0	21
UEIB-25	5,177	212	2	0	0	0	0	7
UEIB-26	8,339	164	2	0	0	0	0	5
UEIB-27	6,739	199	2	0	0	0	0	0
UEIB-28	3,594	100	1	0	0	0	0	3
UEIB-29	7,983	278	2	0	0	0	0	0
UEIB-30	5,006	256	3	1	0	0	0	8
UEIB-31	4,237	77	1	0	0	0	0	2
UEIB-32	3,619	74	1	0	45	0	0	0
UEIB-33	4,528	69	1	0	54	0	0	0
UEIB-34	5,150	180	2	0	40	0	0	0
UEIB-35	10,162	266	3	0	0	0	0	9
UEIB-36	4,463	71	1	0	33	0	0	2
UEIB-37 [6]	4,607	86	1	0	0	0	0	3
UEIB-38	814	3	0	0	0	0	0	0
UEIB-39 [6]	2,619	102	1	0	0	0	0	3
UEIB-40 [6]	3,080	134	1	0	0	0	0	4
UEIB-41 [6]	5,872	218	2	0	0	0	0	7
UEIB-42 [6]	7,883	673	7	1	0	0	0	22
UEIB-43	9,828	68	1	0	0	0	0	2
UEIB-44	1,893	72	1	0	43	0	0	0
UEIB-45 [8]	8,982	532	6	1	688	56	1	224
UEIB-46 [9]	1,354	55	1	0	10	0	0	0
CPR-1 [11]	3,688	7	0	0	170	0	0	0
CPR-2 [11]	610	0	0	0	35	0	0	0
EX-1 [11]	6,327	88	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	658	12	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,427	48	0	0	N/A	N/A	N/A	N/A
EX-4 [11]	562	4	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	199,824	9,805	84	15	22,680	56	0.71	381.84

November 16-19, 2015

Extraction Well	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A
UEIB-2[2]	326	9	0	0	1,578	0	0	0
UEIB-3	660	8	0	0	4,465	0	0	0
UEIB-4	391	0	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	N/A
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A
UEIB-7	327	3	0	0	5,644	0	0	0
UEIB-8	1,512	45	0	0	7	0	0	0
UEIB-9	2,337	83	1	0	0	0	0	0
UEIB-10[4]	793	2	0	0	0	0	0	0
UEIB-11[3]	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-14[1,4]	95	1	0	0	825	0	0	0
UEIB-15	7,540	98	2	0	0	0	0	0
UEIB-16	5,379	65	1	0	0	0	0	1
UEIB-17	3,524	375	3	0	0	0	0	7
UEIB-18	5,147	352	5	1	0	0	0	7
UEIB-19	5,589	357	1	0	0	0	0	0
UEIB-20	10,734	1,023	11	2	0	0	0	1
UEIB-21	10,243	620	7	1	0	0	0	2
UEIB-22	4,203	221	3	0	0	0	0	0
UEIB-23	5,609	228	2	0	0	0	0	4
UEIB-24	7,974	428	5	1	0	0	0	8
UEIB-25	5,377	200	2	0	0	0	0	4
UEIB-26	8,628	289	4	1	0	0	0	6
UEIB-27	7,005	265	3	1	0	0	0	1
UEIB-28	3,749	155	2	0	0	0	0	3
UEIB-29	8,405	421	5	1	0	0	0	0
UEIB-30	5,011	5	0	0	0	0	0	0
UEIB-31	4,455	218	3	0	0	0	0	4
UEIB-32	3,695	77	1	0	45	0	0	1
UEIB-33	4,718	190	3	0	54	0	0	1
UEIB-34	5,270	120	1	0	40	0	0	0
UEIB-35	10,419	257	3	1	0	0	0	0
UEIB-36	4,579	115	1	0	33	0	0	2
UEIB-37 [6]	4,664	57	1	0	0	0	0	1
UEIB-38	852	38	0	0	0	0	0	1
UEIB-39 [6]	2,700	81	1	0	0	0	0	2
UEIB-40 [6]	3,213	134	2	0	0	0	0	3
UEIB-41 [6]	6,090	218	3	0	0	0	0	4
UEIB-42 [6]	8,471	588	7	1	0	0	0	11
UEIB-43	10,403	575	5	1	0	0	0	11
UEIB-44	1,942	49	1	0	43	0	0	1
UEIB-45 [8]	9,386	404	4	1	728	40	0	117
UEIB-46 [9]	1,437	83	1	0	10	0	0	0
CPR-1 [11]	3,803	116	2	0	177	6	0	0
CPR-2 [11]	641	31	1	0	36	2	0	1
EX-1 [11]	6,441	114	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	676	18	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,506	79	1	0	N/A	N/A	N/A	N/A
EX-4 [11]	566	4	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	208,643	8,819	98	18	22,728	48	0.64	203.83

February 1-3, 2016

Extraction Well	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A
UEIB-2[2]	340	14	0	0	1,578	0	0	0
UEIB-3	672	11	0	0	4,465	0	0	0
UEIB-4	392	1	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	N/A
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A
UEIB-7	329	2	0	0	5,644	0	0	0
UEIB-8	1,618	106	1	0	7	0	0	2
UEIB-9	2,419	81	1	0	0	0	0	3
UEIB-10[4]	803	10	0	0	0	0	0	0
UEIB-11[3]	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-14[1,4]	95	N/A	N/A	N/A	825	N/A	N/A	N/A
UEIB-15	7,709	169	2	0	0	0	0	0
UEIB-16	5,707	329	4	1	0	0	0	5
UEIB-17	3,875	351	4	1	0	0	0	5
UEIB-18	5,568	421	4	1	0	0	0	6
UEIB-19	5,798	209	3	0	0	0	0	0
UEIB-20	11,244	510	5	1	0	0	0	0
UEIB-21	10,371	128	2	0	0	0	0	0
UEIB-22	4,494	291	3	1	0	0	0	0
UEIB-23	5,948	339	4	1	0	0	0	5
UEIB-24	8,325	351	3	1	0	0	0	5
UEIB-25	5,733	357	5	1	0	0	0	5
UEIB-26	9,030	401	4	1	0	0	0	6
UEIB-27	7,381	376	3	1	0	0	0	2
UEIB-28	4,111	362	5	1	0	0	0	0
UEIB-29	8,665	261	2	0	0	0	0	4
UEIB-30	5,024	12	0	0	0	0	0	0
UEIB-31	4,667	211	2	0	0	0	0	3
UEIB-32	3,803	108	1	0	45	0	0	1
UEIB-33	5,039	321	4	1	54	0	0	1
UEIB-34	5,376	106	1	0	40	0	0	0
UEIB-35	10,964	545	6	1	0	0	0	8
UEIB-36	4,591	12	0	0	33	0	0	0
UEIB-37 [6]	4,747	83	1	0	0	0	0	1
UEIB-38	901	49	1	0	0	0	0	1
UEIB-39 [6]	2,867	167	2	0	0	0	0	2
UEIB-40 [6]	3,345	131	1	0	0	0	0	2
UEIB-41 [6]	6,398	308	4	1	0	0	0	4
UEIB-42 [6]	9,225	754	8	2	0	0	0	11
UEIB-43	10,700	297	4	1	0	0	0	4
UEIB-44	1,992	50	1	0	43	0	0	0
UEIB-45 [8]	9,820	434	5	1	763	34	0	70
UEIB-46 [9]	1,550	113	1	0	10	0	0	1
CPR-1 [11]	4,333	530	4	1	177	0	0	7
CPR-2 [11]	720	79	1	0	36	0	0	1
EX-1 [11]	6,558	117	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	699	22	0	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,603	97	1	0	N/A	N/A	N/A	N/A
EX-4 [11]	571	5	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	218,278	9,635	107	20	22,762	34	0.45	164.89

Notes:

1 UEIB-1 operated from August 5, 2010 to March 17, 2011. On March 17, UEIB-1 was replaced with UEIB-14.
2 UEIB-2 operated from August 5 to 25, 2010 and continuously since February 1, 2011.
3 UEIB-11 operated from August 25, 2010 to February 1, 2011.
4 UEIB-10 operated from December 2010 to July 2012. In July 2012, UEIB-10 was replaced with UEIB-32. On December 17, 2015, pump in UEIB-14 was moved to UEIB-10.
5 NAPL extraction rate measured as total NAPL extracted since previous measuring event.
6 No pump tests done before July 2012. Assumed rate of 0.90 L/count.
7 Pumps UEIB-32 to UEIB-44 not started until September 27, 2011. Rates listed for those pumps are taken from measurements completed from September 27 to October 24, 2011. Due to this exception, cummulative extracted fluids and NAPL were not calculated.
8 Pump operated in UEIB-5 until June 2012, then it was moved into UEIB-45.
9 Pump operated in UEIB-6 until June 2012, then it was moved into UEIB-46.
10 Extraction rate values calculated from change in counter readings between June 21 to June 27.
11 For November 22, 2012 Summary Table results, CPR-(1,2), EX-(1,2,3,4) and U2-5 data was collected on Oct.22,24, 2012.
12 Transducer Data - during rebound testing, all pumps were shut off from Oct.11-12, 2011 to Mar.14-22, 2012 with the exception of test pumps (UEIB-5,6,22,23,35 and 36).
13 Fluid extraction rate based on the average of the last five measurements.

Abbreviations:

N/A - Not available (pump not installed/running at this time.
UK - Unknown (not enough data).
NAPL - Non-Aqueous Phase Liquids
PHC - Petroleum Hydrocarbons
m - Metres
L - Litres
Kg - Kilograms
gpm - Gallons per minute

Extraction Well	May 30,31 June 8, 9, and 15, 2016								August 29-31, 2016								November 14, 16, and 17, 2016							
	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)	Total Fluids Extracted (m^3)	Quarter Fluids Extracted (m^3)	Fluid Extraction Rate [13] (m^3/day)	Fluid Extraction Rate [13] (gpm)	Total NAPL Extracted (L)	NAPL Extracted (quarterly basis) (L)	NAPL Extraction Rate[5] (L/day)	PHC Mass Extracted (quarterly basis) (Kg)
UEIB-1[1]	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A	78	N/A	N/A	N/A	2,680	N/A	N/A	N/A
UEIB-2[2]	350	10	0	0	1,578	0	0	0	356	6	0	0	1,578	0	0	0	365	10	0	0	1,578	0	0	0
UEIB-3	675	3	0	0	4,465	0	0	0	675	NA	0	0	4,465	N/A	N/A	N/A	675	NA	0	0	4,465	N/A	N/A	N/A
UEIB-4	393	1	0	0	154	0	0	0	394	1	0	0	154	0	0	0	399	5	0	0	154	0	0	0
UEIB-5[8]	358	N/A	N/A	N/A	184	N/A	N/A	N/A	358	N/A	N/A	N/A	184	N/A	N/A	N/A	358	N/A	N/A	N/A	184	N/A	N/A	N/A
UEIB-6[9]	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A	209	N/A	N/A	N/A	6,025	N/A	N/A	N/A
UEIB-7	330	1	0	0	5,644	0	0	0	330	1	0	0	5,644	0	0	0	332	2	0	0	5,644	0	0	0
UEIB-8	1,713	95	1	0	7	0	0	0	1,742	29	0	0	7	0	0	0	1,793	50	1	0	7	0	0	0
UEIB-9	2,483	65	1	0	0	0	0	0	2,530	46	0	0	0	0	0	0	2,574	45	1	0	0	0	0	0
UEIB-10[4]	811	8	0	0	0	0	0	0	819	9	0	0	0	0	0	0	831	12	0	0	0	0	0	0
UEIB-11[3]	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UEIB-14[1,4]	95	N/A	N/A	N/A	825	N/A	N/A	N/A	95	N/A	N/A	N/A	825	N/A	N/A	N/A	95	N/A	N/A	N/A	825	N/A	N/A	N/A
UEIB-15	7,891	182	1	0	0	0	0	0	8,671	780	12	2	0	0	0	0	9,013	342	4	1	0	0	0	0
UEIB-16	5,951	244	2	0	0	0	0	4	6,163	212	3	0	0	0	0	1	6,430	267	3	1	0	0	0	1
UEIB-17	4,000	125	2	0	0	0	0	2	4,131	131	1	0	0	0	0	1	4,686	556	9	2	0	0	0	2
UEIB-18	5,939	371	4	1	0	0	0	6	6,201	262	3	1	0	0	0	2	6,568	367	5	1	0	0	0	0
UEIB-19	6,053	255	3	0	0	0	0	0	6,422	369	5	1	0	0	0	0	6,574	152	1	0	0	0	0	1
UEIB-20	11,766	522	6	1	0	0	0	0	12,223	457	5	1	0	0	0	3	12,303	79	0	0	0	0	0	0
UEIB-21	10,371	0	0	0	0	0	0	0	10,633	262	4	1	0	0	0	2	11,179	546	7	1	0	0	0	2
UEIB-22	4,735	241	2	0	0	0	0	0	4,794	60	0	0	0	0	0	0	5,009	215	3	1	0	0	0	0
UEIB-23	6,100	151	1	0	0	0	0	3	6,150	50	0	0	0	0	0	0	6,268	118	2	0	0	0	0	1
UEIB-24	8,617	292	3	1	0	0	0	5	9,061	444	5	1	0	0	0	3	9,339	278	3	1	0	0	0	1
UEIB-25	6,134	401	4	1	0	0	0	7	6,379	244	2	0	0	0	0	2	6,578	200	2	0	0	0	0	1
UEIB-26	9,304	274	3	1	0	0	0	5	9,522	218	2	0	0	0	0	1	9,857	335	5	1	0	0	0	0
UEIB-27	7,570	188	2	0	0	0	0	1	8,076	507	7	1	0	0	0	2	8,225	149	0	0	0	0	0	0
UEIB-28	4,472	361	4	1	0	0	0	6	4,706	234	2	0	0	0	0	2	4,978	272	3	0	0	0	0	0
UEIB-29	8,840	174	2	0	0	0	0	3	9,642	802	11	2	0	0	0	5	10,612	970	12	2	0	0	0	4
UEIB-30	5,113	89	1	0	0	0	0	2	5,160	47	0	0	0	0	0	0	5,445	286	4	1	0	0	0	1
UEIB-31	4,667	0	0	0	0	0	0	0	4,667	0	0	0	0	0	0	0	4,667	0	0	0	0	0	0	0
UEIB-32	3,901	98	1	0	45	0	0	0	3,986	85	1	0	45	0	0	0	4,079	93	1	0	45	0	0	1
UEIB-33	5,228	189	2	0	54	0	0	1	5,341	114	1	0	54	0	0	0	5,489	148	2	0	54	0	0	0
UEIB-34	5,447	71	1	0	40	0	0	1	5,521	74	1	0	40	0	0	0	5,618	97	1	0	40	0	0	0
UEIB-35	11,335	371	4	1	0	0	0	6	11,605	269	3	1	0	0	0	2	11,914	309	4	1	0	0	0	1
UEIB-36	4,591	0	0	0	33	0	0	0	4,592	1	0	0	33	0	0	0	4,689	97	1	0	33	0	0	0
UEIB-37 [6]	4,797	50	0	0	0	0	0	1	4,847	50	1	0	0	0	0	0	4,908	61	1	0	0	0	0	0
UEIB-38	942	40	0	0	0	0	0	1	980	38	0	0	0	0	0	0	1,038	58	1	0	0	0	0	0
UEIB-39 [6]	2,980	114	1	0	0	0	0	2	3,018	38	0	0	0	0	0	0	3,022	4	0	0	0	0	0	0
UEIB-40 [6]	3,501	156	2	0	0	0	0	0	3,682	181	2	0	0	0	0	1	3,813	131	2	0	0	0	0	1
UEIB-41 [6]	6,404	6	0	0	0	0	0	0	6,643	240	3	1	0	0	0	2	8,580	1,937	4	1	0	0	0	8
UEIB-42 [6]	9,958	732	8	1	0	0	0	12	10,600	643	7	1	0	0	0	4	11,114	514	6	1	0	0	0	4
UEIB-43	11,035	335	3	1	0	0	0	6	11,035	0	0	0	0	0	0	0	11,071	36	1	0	0	0	0	0
UEIB-44	2,041	49	1	0	43	0	0	0	2,082	41	0	0	43	0	0	0	2,166	85	2	0	43	0	1	0
UEIB-45 [8]	10,240	421	5	1	817	55	7	80	10,695	455	3	1	867	50	1	17	10,995	300	4	1	894	27	0	7
UEIB-46 [9]	1,600	50	0	0	10	0	0	1	1,671	71	1	0	12	2	0	0	1,774	103	1	0	16	4	0	1
CPR-1 [11]	4,347	14	0	0	204	27	0	0	4,349	1	0	0	204	0	0	0	4,363	14	0	0	204	0	0	0
CPR-2 [11]	720	0	0	0	40	4	0	0	720	0	0	0	40	0	0	0	1,050	329	4	1	40	0	0	1
EX-1 [11]	6,640	82	1	0	N/A	N/A	N/A	N/A	6,709	69	1	0	N/A	N/A	N/A	N/A	6,760	51	1	0	N/A	N/A	N/A	N/A
EX-2 [11]	718	19	0	0	N/A	N/A	N/A	N/A	732	14	0	0	N/A	N/A	N/A	N/A	772	40	1	0	N/A	N/A	N/A	N/A
EX-3 [11]	2,651	48	1	0	N/A	N/A	N/A	N/A	2,678	27	0	0	N/A	N/A	N/A	N/A	2,713	35	1	0	N/A	N/A	N/A	N/A
EX-4 [11]	576	4	0	0	N/A	N/A	N/A	N/A	579	4	0	0	N/A	N/A	N/A	N/A	583	3	0	0	N/A	N/A	N/A	N/A
U2-5 [11]	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A	503	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	225,178	6,900	71	13	22,848	86	7.41	154.85	232,765	7,587	88	16	22,900	52	0.56	52.73	242,466	9,701	102	19	22,930	30	0.93	42.36

Notes:
1 UEIB-1 operated from August 5, 2010 to March 17, 2011. On March 17, UEIB-1 was replaced with UEIB-14.
2 UEIB-2 operated from August 5 to 25, 2010 and continuously since February 1, 2011.
3 UEIB-11 operated from August 25, 2010 to February 1, 2011.
4 UEIB-10 operated from December 2010 to July 2012. In July 2012, UEIB-10 was replaced with UEIB-32. On December 17, 2015, pump in UEIB-14 was moved to UEIB-10.
5 NAPL extraction rate measured as total NAPL extracted since previous measuring event.
6 No pump tests done before July 2012. Assumed rate of 0.90 L/count.
7 Pumps UEIB-32 to UEIB-44 not started until September 27, 2011. Rates listed for those pumps are taken from measurements completed from September 27 to October 24, 2011. Due to this exception, cummulative extracted fluids and NAPL were not calculated.
8 Pump operated in UEIB-5 until June 2012, then it was moved into UEIB-45.
9 Pump operated in UEIB-6 until June 2012, then it was moved into UEIB-46.
10 Extraction rate values calculated from change in counter readings between June 21 to June 27.
11 For November 22, 2012 Summary Table results, CPR-(1,2), EX-(1,2,3,4) and U2-5 data was collected on Oct.22,24, 2012.
12 Transducer Data - during rebound testing, all pumps were shut off from Oct.11-12, 2011 to Mar.14-22, 2012 with the exception of test pumps (UEIB-5,6,22,23,35 and 36).
13 Fluid extraction rate based on the average of the last five measurements.

Abbreviations:
N/A - Not available (pump not installed/running at this time.
UK - Unknown (not enough data).
NAPL - Non-Aqueous Phase Liquids
PHC - Petroleum Hydrocarbons
m - Metres
L - Litres
Kg - Kilograms
gpm - Gallons per minute

TABLE C-2
DRAWDOWN DATA AND CALCULATIONS
CHEVRON BURNABY REFINERY

	January 23, 2012	April 7-15, 2015	
Well ID	Groundwater Elev. (masl.)[1]	Groundwater Elev. (masl.)[1]	Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	33.613	5.8
G2-1A	42.2	nd	---
G2-1B	41.8	32.543	9.3
G2-1C	41.6	30.990	10.6
G2-2A	40.2	37.039	3.2
G2-2B	39.6	32.840	6.8
G2-2WT	40.0	39.449	0.5
MW03-01	40.6	38.433	2.2
A2MW09-02	40.7	nd	---
MW10-01I	39.3	35.488	3.9
MW10-01D	39.2	34.306	4.9
MW10-02I	39.0	34.963	4.0
MW10-02D	39.5	29.919	9.6
MW10-03I	40.4	34.726	5.7
MW10-03D	40.2	34.613	5.6
MW11-2S	42.7	40.900	1.8
MW11-2I	42.3	39.760	2.5
MW11-2D	42.3	39.635	2.7
MW11-4S	37.4	36.460	0.9
MW11-6S	38.8	38.540	0.3
MW11-6I	38.2	nd	---
MW11-6D	38.2	28.229	10.0
MW11-7S	nd	nd	---
MW11-7I	37.8	nd	---
MW11-7D	37.9	27.900	10.0
MW11-9S	37.7	nd	---
MW11-9I	37.7	28.770	9.0
MW11-10S	39.5	nd	---
MW11-10I	39.5	29.520	10.0
MW11-11S	42.9	39.900	3.0
MW11-11I	42.6	36.250	6.4
MW11-12S	42.8	41.670	1.1
MW11-12I	41.5	33.225	8.3
UEIB-1	40.1	36.350	3.7
UEIB-12	38.6	33.070	5.5
UEIB-13	39.7	34.605	5.1
UEIB-20	41.5	34.940	6.6
UEIB-21	41.6	39.150	2.5
Average Observed Drawdown (m)[2]			5.9
Lower Bench			
PW03-1A	36.6	35.549	1.1
PW03-1B	37.0	36.014	1.0
PW03-3	37.8	35.942	1.8
PW03-06	37.2	36.021	1.2
U8	36.8	34.855	1.9
U9	36.7	34.694	2.0
MW02-02	38.6	37.708	0.9
MW02-03	38.2	37.027	1.2
MW03-02	38.9	36.256	2.7
A2MW09-05I	36.2	34.200	2.0
A2MW09-10	36.4	34.530	1.8
A2MW09-11	38.3	37.097	1.2
A2MW09-12	38.1	37.791	0.4
A2MW09-14	39.1	38.084	1.0
A2MW09-15	39.2	38.608	0.6
Average Observed Drawdown (m)[2]			1.4

	January 23, 2012	May 19-26, 2015	
Well ID	Groundwater Elev. (masl.)[1]	Groundwater Elev. (masl.)[1]	Observed Drawdown (m)[2]
Upper Bench			
G2-1A	39.4	na	---
G2-1A	42.2	40.502	1.7
G2-1B	41.8	35.013	6.8
G2-1C	41.6	34.540	7.0
G2-2A	40.2	na	---
G2-2B	39.6	31.640	8.0
G2-2WT	40.0	39.074	0.9
MW03-01	40.6	37.753	2.9
A2MW09-02	40.7	na	---
MW10-01I	39.3	34.093	5.3
MW10-01D	39.2	32.531	6.6
MW10-02I	39.0	na	---
MW10-02D	39.5	29.974	9.5
MW10-03I	40.4	34.371	6.1
MW10-03D	40.2	34.788	5.4
MW11-2S	42.7	41.075	1.6
MW11-2I	42.3	40.365	1.9
MW11-2D	42.3	40.300	2.0
MW11-4S	37.4	35.935	1.4
MW11-6S	38.8	37.905	0.9
MW11-6I	38.2	33.040	---
MW11-6D	38.2	28.010	10.2
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	27.110	10.8
MW11-9S	37.7	na	---
MW11-9I	37.7	26.520	11.2
MW11-10S	39.5	na	---
MW11-10I	39.5	29.525	10.0
MW11-11S	42.9	40.785	2.1
MW11-11I	42.6	36.540	6.1
MW11-12S	42.8	39.925	2.8
MW11-12I	41.5	33.915	7.6
UEIB-1	40.1	34.125	5.9
UEIB-12	38.6	31.530	7.1
UEIB-13	39.7	33.110	6.6
UEIB-20	41.5	40.580	1.0
UEIB-21	41.6	40.700	0.9
Average Observed Drawdown (m)[2]			5.2
Lower Bench			
PW03-1A	36.6	na	---
PW03-1B	37.0	na	---
PW03-3	37.8	na	---
PW03-06	37.2	na	---
U8	36.8	na	---
U9	36.7	na	---
MW02-02	38.6	37.228	1.4
MW02-03	38.2	36.187	2.0
MW03-02	38.9	34.466	4.5
A2MW09-05I	36.2	31.520	4.7
A2MW09-10	36.4	33.875	2.5
A2MW09-11	38.3	34.987	3.3
A2MW09-12	38.1	35.551	2.6
A2MW09-14	39.1	38.204	---
A2MW09-15	39.2	38.868	0.4
Average Observed Drawdown (m)[2]			2.7

	January 23, 2012	August 5-13, 2015	
Well ID	Groundwater Elev. (masl.)[1]	Groundwater Elev. (masl.)[1]	Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	na	---
G2-1A	42.2	na	---
G2-1B	41.8	34.153	7.7
G2-1C	41.6	33.700	7.9
G2-2A	40.2	na	---
G2-2B	39.6	30.970	8.6
G2-2WT	40.0	38.479	1.5
MW03-01	40.6	na	---
A2MW09-02	40.7	na	---
MW10-01I	39.3	na	---
MW10-01D	39.2	31.461	7.7
MW10-02I	39.0	na	---
MW10-02D	39.5	29.559	10.0
MW10-03I	40.4	na	---
MW10-03D	40.2	33.908	6.3
MW11-2S	42.7	40.195	2.5
MW11-2I	42.3	38.965	3.3
MW11-2D	42.3	38.890	3.4
MW11-4S	37.4	35.440	1.9
MW11-6S	38.8	37.910	0.9
MW11-6I	38.2	na	---
MW11-6D	38.2	28.020	10.2
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	27.380	10.5
MW11-9S	37.7	na	---
MW11-9I	37.7	27.730	10.0
MW11-10S	39.5	na	---
MW11-10I	39.5	28.940	10.6
MW11-11S	42.9	40.010	2.8
MW11-11I	42.6	35.810	6.8
MW11-12S	42.8	40.405	2.3
MW11-12I	41.5	33.140	8.4
UEIB-1	40.1	na	---
UEIB-12	38.6	30.950	7.7
UEIB-13	39.7	32.060	7.6
UEIB-20	41.5	36.860	4.7
UEIB-21	41.6	38.330	3.3
Average Observed Drawdown (m)[2]			6.1
Lower Bench			
PW03-1A	36.6	na	---
PW03-1B	37.0	na	---
PW03-3	37.8	na	---
PW03-06	37.2	na	---
U8	36.8	na	---
U9	36.7	na	---
MW02-02	38.6	na	---
MW02-03	38.2	na	---
MW03-02	38.9	33.811	5.1
A2MW09-05I	36.2	30.280	5.9
A2MW09-10	36.4	na	---
A2MW09-11	38.3	na	---
A2MW09-12	38.1	na	---
A2MW09-14	39.1	36.214	2.8
A2MW09-15	39.2	38.098	1.1
Average Observed Drawdown (m)[2]			3.7

	January 23, 2012	November 9-19, 2015	
Well ID	Groundwater Elev. (masl.)[1]	Groundwater Elev. (masl.)[1]	Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	32.843	6.5
G2-1A	42.2	40.577	1.7
G2-1B	41.8	31.923	9.9
G2-1C	41.6	30.580	11.0
G2-2A	40.2	36.529	3.7
G2-2B	39.6	32.220	7.4
G2-2WT	40.0	39.416	0.5
MW03-01	40.6	38.443	2.2
A2MW09-02	40.7	39.202	1.5
MW10-01I	39.3	34.288	5.1
MW10-01D	39.2	33.426	5.7
MW10-02I	39.0	na	---
MW10-02D	39.5	29.729	9.8
MW10-03I	40.4	34.461	6.0
MW10-03D	40.2	34.568	5.6
MW11-2S	42.7	41.630	1.1
MW11-2I	42.3	40.145	2.2
MW11-2D	42.3	40.105	2.2
MW11-4S	37.4	37.795	-0.4
MW11-6S	38.8	39.690	-0.9
MW11-6I	38.2	na	---
MW11-6D	38.2	28.125	10.1
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	26.940	10.9
MW11-9S	37.7	na	---
MW11-9I	37.7	26.310	11.4
MW11-10S	39.5	na	---
MW11-10I	39.5	29.400	10.1
MW11-11S	42.9	41.100	1.8
MW11-11I	42.6	36.140	6.5
MW11-12S	42.8	41.190	1.6
MW11-12I	41.5	33.070	8.5
UEIB-1	40.1	36.085	4.0
UEIB-12	38.6	32.110	6.5
UEIB-13	39.7	31.420	8.3
UEIB-20	41.5	38.810	2.7
UEIB-21	41.6	32.770	8.8
Average Observed Drawdown (m)[2]			5.4
Lower Bench			
PW03-1A	36.6	35.649	1.0
PW03-1B	37.0	36.789	0.2
PW03-3	37.8	na	---
PW03-06	37.2	36.871	0.3
U8	36.8	34.985	1.8
U9	36.7	34.994	1.7
MW02-02	38.6	38.148	0.5
MW02-03	38.2	36.787	1.4
MW03-02	38.9	36.051	2.9
A2MW09-05I	36.2	34.335	1.8
A2MW09-10	36.4	34.650	1.7
A2MW09-11	38.3	37.557	0.7
A2MW09-12	38.1	37.996	0.1
A2MW09-14	39.1	37.284	1.8
A2MW09-15	39.2	38.618	0.6
Average Observed Drawdown (m)[2]			1.2

1. Elevations are in Chevron Datum = Geodetic Datum + 91.52 feet.
2. Drawdown is expressed as a positive value as the groundwater elevation decreased.

TABLE C-2
DRAWDOWN DATA AND CALCULATIONS
CHEVRON BURNABY REFINERY

Well ID	January 23, 2012 Groundwater Elev. (masl.)[1]	March 15-31, 2016 Groundwater Elev. (masl.)[1]	March 15-31, 2016 Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	33.738	5.6
G2-1A	42.2	40.977	1.3
G2-1B	41.8	33.083	8.8
G2-1C	41.6	32.000	9.6
G2-2A	40.2	37.059	3.2
G2-2B	39.6	33.110	6.5
G2-2WT	40.0	39.468	0.5
MW03-01	40.6	38.683	2.0
A2MW09-02	40.7	38.242	2.4
MW10-01I	39.3	35.703	3.6
MW10-01D	39.2	34.391	4.8
MW10-02I	39.0	34.873	4.1
MW10-02D	39.5	30.129	9.4
MW10-03I	40.4	34.726	5.7
MW10-03D	40.2	34.628	5.6
MW11-2S	42.7	42.210	0.5
MW11-2I	42.3	41.310	1.0
MW11-2D	42.3	41.230	1.1
MW11-4S	37.4	36.990	0.4
MW11-6S	38.8	38.625	0.2
MW11-6I	38.2	na	---
MW11-6D	38.2	28.330	9.9
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	28.060	9.8
MW11-9S	37.7	na	---
MW11-9I	37.7	28.960	8.8
MW11-10S	39.5	na	---
MW11-10I	39.5	29.690	9.8
MW11-11S	42.9	41.625	1.2
MW11-11I	42.6	37.210	5.4
MW11-12S	42.8	41.960	0.8
MW11-12I	41.5	35.110	6.4
UEIB-1	40.1	36.950	3.1
UEIB-12	38.6	33.145	5.5
UEIB-13	39.7	34.910	4.8
UEIB-20	41.5	40.700	0.8
UEIB-21	41.6	39.790	1.8
Average Observed Drawdown (m)[2]			4.9
Lower Bench			
PW03-1A	36.6	35.454	1.2
PW03-1B	37.0	35.699	1.3
PW03-3	37.8	35.692	2.1
PW03-06	37.2	35.461	1.8
U8	36.8	34.885	1.9
U9	36.7	34.744	2.0
MW02-02	38.6	na	---
MW02-03	38.2	na	---
MW03-02	38.9	36.321	2.6
A2MW09-05I	36.2	34.175	2.0
A2MW09-10	36.4	34.555	1.8
A2MW09-11	38.3	36.767	1.5
A2MW09-12	38.1	37.751	0.4
A2MW09-14	39.1	38.224	0.8
A2MW09-15	39.2	na	---
Average Observed Drawdown (m)[2]			1.6

Well ID	January 23, 2012 Groundwater Elev. (masl.)[1]	May 25-31, 2016 Groundwater Elev. (masl.)[1]	May 25-31, 2016 Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	na	---
G2-1A	42.2	na	---
G2-1B	41.8	na	---
G2-1C	41.6	29.610	12.0
G2-2A	40.2	36.249	4.0
G2-2B	39.6	32.040	7.6
G2-2WT	40.0	39.199	0.8
MW03-01	40.6	38.053	2.6
A2MW09-02	40.7	na	---
MW10-01I	39.3	34.448	4.9
MW10-01D	39.2	32.651	6.5
MW10-02I	39.0	na	---
MW10-02D	39.5	31.059	8.5
MW10-03I	40.4	34.371	6.1
MW10-03D	40.2	34.408	5.8
MW11-2S	42.7	41.360	1.3
MW11-2I	42.3	40.530	1.8
MW11-2D	42.3	40.500	1.8
MW11-4S	37.4	36.200	1.2
MW11-6S	38.8	37.900	0.9
MW11-6I	38.2	na	---
MW11-6D	38.2	28.080	10.1
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	27.640	10.2
MW11-9S	37.7	na	---
MW11-9I	37.7	28.130	9.6
MW11-10S	39.5	na	---
MW11-10I	39.5	29.770	9.8
MW11-11S	42.9	40.730	2.1
MW11-11I	42.6	36.160	6.4
MW11-12S	42.8	40.870	1.9
MW11-12I	41.5	33.330	8.2
UEIB-1	40.1	33.910	6.1
UEIB-12	38.6	31.720	6.9
UEIB-13	39.7	33.210	6.5
UEIB-20	41.5	40.080	1.5
UEIB-21	41.6	40.110	1.5
Average Observed Drawdown (m)[2]			5.2
Lower Bench			
PW03-1A	36.6	na	---
PW03-1B	37.0	na	---
PW03-3	37.8	na	---
PW03-06	37.2	na	---
U8	36.8	na	---
U9	36.7	na	---
MW02-02	38.6	na	---
MW02-03	38.2	35.927	2.3
MW03-02	38.9	34.246	4.7
A2MW09-05I	36.2	31.160	5.0
A2MW09-10	36.4	na	---
A2MW09-11	38.3	36.222	2.0
A2MW09-12	38.1	35.231	2.9
A2MW09-14	39.1	na	---
A2MW09-15	39.2	38.968	0.3
Average Observed Drawdown (m)[2]			2.9

Well ID	January 23, 2012 Groundwater Elev. (masl.)[1]	August 18-24, 2016 Groundwater Elev. (masl.)[1]	August 18-24, 2016 Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	na	---
G2-1A	42.2	na	---
G2-1B	41.8	31.443	10.4
G2-1C	41.6	26.030	15.5
G2-2A	40.2	36.929	3.3
G2-2B	39.6	32.230	7.4
G2-2WT	40.0	39.169	0.8
MW03-01	40.6	na	---
A2MW09-02	40.7	na	---
MW10-01I	39.3	34.678	---
MW10-01D	39.2	32.561	6.6
MW10-02I	39.0	na	---
MW10-02D	39.5	33.119	6.4
MW10-03I	40.4	34.251	6.2
MW10-03D	40.2	34.968	5.2
MW11-2S	42.7	41.420	1.3
MW11-2I	42.3	40.750	1.6
MW11-2D	42.3	40.710	1.6
MW11-4S	37.4	36.000	1.4
MW11-6S	38.8	37.905	0.9
MW11-6I	38.2	na	---
MW11-6D	38.2	28.490	9.7
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	27.950	9.9
MW11-9S	37.7	na	---
MW11-9I	37.7	28.090	9.6
MW11-10S	39.5	na	---
MW11-10I	39.5	29.970	9.6
MW11-11S	42.9	41.530	1.3
MW11-11I	42.6	38.540	4.1
MW11-12S	42.8	41.340	1.4
MW11-12I	41.5	33.310	8.2
UEIB-1	40.1	33.850	6.2
UEIB-12	38.6	31.380	7.2
UEIB-13	39.7	33.260	6.4
UEIB-20	41.5	40.280	1.3
UEIB-21	41.6	39.600	2.0
Average Observed Drawdown (m)[2]			5.4
Lower Bench			
PW03-1A	36.6	na	---
PW03-1B	37.0	na	---
PW03-3	37.8	na	---
PW03-06	37.2	na	---
U8	36.8	na	---
U9	36.7	na	---
MW02-02	38.6	na	---
MW02-03	38.2	na	---
MW03-02	38.9	33.326	5.6
A2MW09-05I	36.2	30.920	5.3
A2MW09-10	36.4	na	---
A2MW09-11	38.3	na	---
A2MW09-12	38.1	na	---
A2MW09-14	39.1	na	---
A2MW09-15	39.2	39.158	0.1
Average Observed Drawdown (m)[2]			3.6

Well ID	January 23, 2012 Groundwater Elev. (masl.)[1]	November 7-14, 2016 Groundwater Elev. (masl.)[1]	November 7-14, 2016 Observed Drawdown (m)[2]
Upper Bench			
A2-13D	39.4	32.678	6.7
G2-1A	42.2	41.087	1.2
G2-1B	41.8	31.523	10.3
G2-1C	41.6	26.060	15.5
G2-2A	40.2	37.249	3.0
G2-2B	39.6	33.690	5.9
G2-2WT	40.0	39.529	0.4
MW03-01	40.6	38.233	2.4
A2MW09-02	40.7	39.152	1.5
MW10-01I	39.3	35.628	3.7
MW10-01D	39.2	34.631	4.5
MW10-02I	39.0	na	---
MW10-02D	39.5	30.709	8.8
MW10-03I	40.4	34.671	5.8
MW10-03D	40.2	34.478	5.7
MW11-2S	42.7	41.760	0.9
MW11-2I	42.3	33.230	9.1
MW11-2D	42.3	30.870	11.4
MW11-4S	37.4	37.730	-0.4
MW11-6S	38.8	38.610	0.2
MW11-6I	38.2	na	---
MW11-6D	38.2	28.780	9.4
MW11-7S	nd	na	---
MW11-7I	37.8	na	---
MW11-7D	37.9	30.760	7.1
MW11-9S	37.7	na	---
MW11-9I	37.7	28.620	9.1
MW11-10S	39.5	na	---
MW11-10I	39.5	30.480	9.1
MW11-11S	42.9	41.090	1.8
MW11-11I	42.6	35.500	7.1
MW11-12S	42.8	41.210	1.5
MW11-12I	41.5	32.540	9.0
UEIB-1	40.1	38.090	2.0
UEIB-12	38.6	33.030	5.6
UEIB-13	39.7	35.030	4.6
UEIB-20	41.5	41.090	0.4
UEIB-21	41.6	26.700	14.9
Average Observed Drawdown (m)[2]			5.6
Lower Bench			
PW03-1A	36.6	35.969	0.6
PW03-1B	37.0	36.739	0.2
PW03-3	37.8	na	---
PW03-06	37.2	36.871	0.3
U8	36.8	35.015	1.8
U9	36.7	35.144	1.6
MW02-02	38.6	38.078	0.6
MW02-03	38.2	37.077	1.1
MW03-02	38.9	35.956	3.0
A2MW09-05I	36.2	34.630	1.6
A2MW09-10	36.4	34.875	1.5
A2MW09-11	38.3	37.362	0.9
A2MW09-12	38.1	37.991	0.2
A2MW09-14	39.1	38.734	0.3
A2MW09-15	39.2	37.228	2.0
Average Observed Drawdown (m)[2]			1.1

1. Elevations are in Chevron Datum = Geodetic Datum + 91.52 feet.
2. Drawdown is expressed as a positive value as the groundwater elevation decreased.

APPENDIX D

MINISTRY OF ENVIRONMENT LETTER REGARDING AREA 2 DRINKING WATER

BRITISH
COLUMBIA

File: 26250-20/6726
Site: 6726

May 15, 2017

Mr. Chris Boys
Chevron Canada Limited
355 Willingdon Avenue
Burnaby, BC V5C 1X4

Dear Mr Boys:

Re: Drinking Water Exemption Request, Area 2, Chevron Burnaby Refinery, 5201 Penzance Drive, Burnaby, BC

The Ministry of Environment (Ministry) has reviewed the following technical report prepared by SLR Consulting (Canada) and additional correspondence from AECOM Canada Consulting submitted in support of your application for a determination of no drinking water use at Area 2 Chevron Refinery in Burnaby, British Columbia (the Site):

- *Drinking Water Standards Exemption Request, Chevron Burnaby Refinery, Area 2, 5201 Penzance Drive, Burnaby BC dated November 20, 2012 prepared by SLR Consulting (Canada)*
- *Additional information contained in an email from AECOM Canada dated Sept 1, 2016*
- *Additional information contained in a letter to the ministry from AECOM Canada dated March 17, 2017*

The legal description of the Site to which this water use determination applies is:

- Block F, Plan 13496, District Lot 188/189, Group 1 Land District, Except Plan RP13504 (PCL 3) & RP13238 (PCL 1) & B/L A37751 & 49497, 6238-0691, 5804-0588, 9999-5286, 0250-5620)

The Site is depicted in attached Figure 1 for reference.

Section 12(5) of the Contaminated Sites Regulation (CSR) specifies the water uses that may apply at sites in BC, including aquatic life, drinking, irrigation and livestock watering water uses, as well as the factors a Director must consider in determining current and reasonable potential future water uses at a site. Protocol 21 provides criteria for determining current and reasonable potential future water uses at specific sites.

Where drinking water use has been determined to apply at a site under Protocol 21 and site circumstances indicate that it is unlikely or unreasonable to anticipate that water would be used for drinking, a site-specific water use determination may be sought from the Director. Protocol 21, Appendix 1 "Director's Decision Framework for Site-Specific Determinations of Water Use" outlines a multiple-lines-of-evidence approach for seeking a Director's determination of no drinking water use at a specific site.

The letter request and additional documentation provided by SLR and AECOM for a Water Use Determination provides the following rationale to support that drinking water use should not apply to the groundwater at the Site:

- *The geometric mean hydraulic conductivity for the native till based on the pumping tests is 3×10^{-7} m/s within this unit.*
- *The geometric mean hydraulic conductivity for the native till based on slug tests is: 9×10^{-7} m/s.*
- *Based on the nearest* [~700 m to 1 km away; Area 1 of the Chevron Refinery] *available bedrock hydrogeological data ... has bulk hydraulic conductivity less than 1×10^{-6} m/s, and a yield less than 1.3 L/min* [yield calculations ranged from 0.1 L/min to 0.8 L/min]*...the bedrock below Area 2 of the Refinery is not a viable aquifer.*
- There are no mapped aquifers at the Site, according to the Water Resources Atlas.
- *The site and down gradient Canadian Pacific Railway (CPR) property have been subject to heavy industrial usage since the mid 1900s and will continue to be so into the foreseeable future. Chevron has operated a refinery on the site since approximately 1954;*
- *The Burrard Inlet shoreline is approximately 30 m northwest (downgradient) of the site boundary and forms the northern boundary of the CPR lands;*
- *Because of the close proximity of marine waters to the site and the long past and continued use of the site for heavy industrial purposes into the future, it is unlikely that groundwater beneath the site or the CPR lands containing their main rail line into Vancouver would be used for drinking water;*
- *The land use for those lands abutting the site to the east, south, and west are park or green space, residential areas, or roadway rights-of-way;*
- *All residential areas are south of the site and are significantly higher in elevation (upgradient);*
- *The residential areas are serviced by Municipal water supply and the aquifer below these areas is not classified as a drinking water aquifer;*

- *There are no current drinking water wells, points of diversion, or mapped aquifers within 500 m of the site;*
- *There is no indication of contaminant migration to the south from contaminated areas at the site; and*
- This exemption would be similar to *the DW exemptions granted by the MoE for Site 8071 in New Westminster and Site 8467 in Port Alberni.*

On the basis of the arguments and supporting information provided by SLR and AECOM, I concur with the conclusion that potential future use of the groundwater underlying the Site for drinking water is unlikely for the following reasons:

- Hydraulic response and pumping tests indicate that the bulk hydraulic conductivity of the alluvium, glacial till formation is less than 1×10^{-6} m/s.
- Hydraulic response tests conducted in wells within 1 km of the site indicate that the bulk hydraulic conductivity of the native bedrock is less than 1×10^{-6} m/s and a maximum calculated yield of 0.8 L/min.
- There are no mapped aquifers below the Site according to the Water Resource Atlas.
- There are no current drinking water uses within 500 m of the Site and Site drinking water is serviced by a municipality that is not sourced from groundwater.
- The Site is located approximately 30 m from the marine foreshore and Site groundwater discharges to the marine environment.
- The Site has a long history of heavy industrial use. The Site will continue for heavy industrial purposes into the future.

Therefore, I hereby determine that drinking water use does not apply at the Site. I also confirm that aquatic life water use (marine) does apply.

This decision is based on the most recent information available to the ministry regarding the above referenced site. The ministry, however, makes no representation or warranty as to the accuracy or completeness of this information.

Please contact Lavinia Zanini at 604-582-5348 (lavinia.zanini@gov.bc.ca) if you require clarification regarding this letter.

Sincerely,

Amy Sloma, P. Eng.
For Director, *Environmental Management Act*

Attachment: Figure 1

cc: Mike Gill, AECOM Canada Consulting
Lucy Hewlett, Ministry of Environment, Victoria
Catherine Schachtel, CSAP Society

Figure 1. Chevron Burnaby Refinery, Area 2 (blue)

APPENDIX E
SITE-SPECIFIC SCREENING LEVELS FOR GROUNDWATER

APPENDIX E – SITE-SPECIFIC SCREENING LEVELS FOR GROUNDWATER

This appendix provides the proposed site-specific screening levels (SSSLs) protective of aquatic life for groundwater for the Perimeter Monitoring Program for Areas 1, 2 and 3. The SSSLs are based on the updated screening levels and risk-based management targets developed for application along the Foreshore down slope of Area 2 of the refinery. The sources of values used to derive the SSSLs are presented in Section 1 and the approach followed to obtain the SSSLs is described in Section 2. The selected SSSLs for groundwater are summarized in Section 3, Table 1.

1.0 Sources of SSSLs

The sources of SSSLs included:

- Updated Screening Levels (USLs) for Foreshore Monitoring (SLR 2013a and 2013b);
- Risk-Based Management Targets (RBMT) for the Seep Area along the Foreshore Downslope of East Impounding Basin (SLR 2014a and 2014b); and,
- The BC CSR, Stage 10 (Omnibus) Amendments, Schedule 3.2 – AW Standard for the Protection of marine Aquatic Life.

1.1 Updated Screening Levels

The updated screening levels (USLs) were used as part of the Foreshore Monitoring Plan to evaluate porewater and seawater samples collected in the Foreshore down slope of Area 2 of the Refinery. The USLs were presented to BC MoE in two memoranda prepared by SLR: *Updated Screening Levels for Foreshore Monitoring* and *Updated Screening Levels for Foreshore Monitoring - Addendum*, dated May 9, 2013 and June 6, 2013, respectively. The USLs were based on the BC Approved Water Quality Guidelines (AWQG) for the protection of marine aquatic life, the Burrard Inlet Water Quality Objectives (BIWQOs), the CCME Water Quality Guidelines for the Protection of Aquatic Life and the Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites (Meridian 2012). The rationale supporting each proposed USL was provided in the SLR memoranda (2013a and 2013b). Upon review, BC MoE confirmed that the selected screening levels were satisfactory to the Ministry (BC MoE 2013).
The USLs were used to evaluate potential contaminants of concern (PCOCs) in the porewater and seawater along the Foreshore in the vicinity of hydrocarbon seeps and at a reference location, to assess the performance of the Interim Remedial Action (IRA), and, to support the selection of PCOCs for the Human Health and Ecological Risk Assessments completed for the Foreshore down slope of Area 2 (SLR 2016).

1.2 Risk-Based Management Targets

Risk-Based Management Targets (RBMTs) were derived by SLR for PCOCs associated with the seeps observed in the Foreshore area down slope of the East Impounding Basin (EIB) in Area 2. The PCOCs for which RBMTS were derived were selected based on the final porewater and surface water PCOCs retained in the HHERA for the protection of marine aquatic life (SLR 2014a). PCOCs for which RBMTs were proposed included LEPHw, VPHw, BTEX, styrene, benzo(a)pyrene, naphthalene, copper and zinc. RBMTs were developed to be protective of aquatic plants and invertebrates at the community level and fish at the population level and were defined as the concentrations of PCOC in porewater below which the ecological function of aquatic plants and invertebrates and the viability of local fish population can be maintained. Literature sources reviewed in the derivation of the RBMTs for aquatic receptors included:

- Technical supporting documents published by BC MoE as part of the BC Approved Water Quality Guidelines (AWQG).
- Technical supporting documents published by CCME as part of the Canadian Environmental Quality Guidelines for the protection of aquatic life.
- Technical supporting document published by the US EPA to support the Ambient Water Quality Guidelines.
- Toxicity values developed by other jurisdictions such as the Atlantic Risk Based Corrective Action (RBCA) and the European Union.
- Scientific peer review articles such as McGrath and DiToro (2009).
- Grey literature including ecological risk assessment reports prepared by environmental consultants focusing on projects completed in British Columbia.

Preferences were given to chronic sublethal toxicity data (e.g., EC_{20}) for reproduction and growth, if available, when selecting the RBMTs. The rationale supporting the RBMTs is provided in SLR (2014a and 2014b).

The RBMTs were proposed in the context of the final remedy for the seeps, as a risk management tool, to determine whether porewater PCOCs can adversely impact aquatic life upon discharge in the Foreshore (i.e. downgradient of the remedial measure) and to assess the performance of the final remedy in the Foreshore cross gradient and downgradient of the seeps. The RBMTs were deemed adequate by BC MoE (2014).

1.2.1 Regulatory Context for the RBMTs

The Contaminated Sites Regulation (CSR) under the *Environmental Management Act* (EMA) is the principal regulatory document defining requirements for contaminated sites management in British Columbia. The CSR came into effect on April 1, 1997 and has been amended several times, most recently on July 19, 2016. The EMA and CSR have provisions for both numerical standards and risk-based standards approaches to managing site contamination.

CSR standards are not available for porewater/groundwater quality assessment for wells located within 10 m of the high water mark of the aquatic receiving environment. The CSR AW standards apply to porewater/groundwater at distances greater or equal to 10 m from the high water mark of receiving environment, based on the assumption that groundwater will be diluted at least 10-fold from its initial concentration in the remaining 10 metres before entering the aquatic receiving environment (BC MoE 2013). The BC WQGs apply to high water mark of the aquatic receiving environment.

As part of the Foreshore Monitoring Program implemented by URS (2012a, 2012b, 2012c) (now AECOM), porewater results for samples collected from wells installed within the intertidal area have been compared to USLs for the protection of marine aquatic life. As indicated in Section 1.1.1, these benchmarks were presented to BC MoE in two memoranda prepared by SLR (2013a and 2013b) and upon review, BC MoE confirmed that the selected screening levels were satisfactory to the Ministry.

If the CSR AW standards cannot be met at distances greater or equal to 10 m from the high water mark of the receiving environment and the BC WQGs (i.e., USLs for Foreshore monitoring in this case) cannot be met for wells located within 10 m of the high water mark of the aquatic receiving environment, BC MoE, the Technical Guidance 15 – *Concentration Limits for the Protection of Aquatic Receiving Environments* (BC MoE 2013) allows an alternative risk-based approach which shows that:

- the 10-fold dilution of substance concentrations in groundwater occurs before the water enters the aquatic receiving environment;
- groundwater quality meets a site-specific risk-based standard with a protection level appropriate for aquatic receiving environments (i.e., EC_{20}); or
- substance concentrations in groundwater do not represent an unacceptable risk to aquatic life as revealed by a detailed ecological risk assessment.

According to the above, the RBMTs were used to determine whether porewater PCOCs presented an unacceptable risk to aquatic life upon discharge to the foreshore.

2.0 Derivation of SSSLs for Perimeter Monitoring Program for Areas 1, 2 and 3.

The following approach was used to select the SSSLs for Perimeter Monitoring Program for Areas 1, 2 and 3:

- The RBMT values were multiplied by 10 to obtain SSSLs to screen groundwater monitoring wells located greater than 10 m from the Foreshore high water mark. This approach was followed for LEPHw, VPHw, BTEX, styrene, benzo(a)pyrene, naphthalene, copper and zinc.

- In the absence of RBMTs, the USL values were multiplied by 10 to obtain SSSLs to screen groundwater monitoring wells located greater than 10 m from the foreshore high water mark. This approach was followed for acenaphthene, acridine, anthracene, benz(a)anthracene, fluoranthene, fluorene, phenanthrene, pyrene, quinoline, barium, beryllium, cadmium, chromium, cobalt, lead, molybdenum, nickel, selenium, thallium, titanium, and uranium. Note that several of the SSSLs derived based on this approach are equal to the BC CSR, Stage 10 (Omnibus) Amendments, Schedule 3.2 – Generic Numerical Water Standards for the Protection of Aquatic Life (AW). In these instances, the Stage 10, Schedule 3.2 AW Standards were adopted as the SSSLs. PCOCs for which the USL was multiplied by 10 and thus equal to the CSR AW standard included: VHw (C6-C10), acenaphthene, benz(a)anthracene, chrysene, fluorene, phenanthrene, quinoline, barium, beryllium, molybdenum, selenium, and thallium.

- The BC CSR, Stage 10 (Omnibus) Amendments, Schedule 3.2 – AW Standard was selected when it was higher than the RBMT x 10 and/or USL x 10. This approach was followed for antimony, arsenic, and boron.

2.1 Additional SSSLs Development Considerations

The USLs and RBMTs were originally derived for porewater and seawater in the Seep Area along the Foreshore down slope of EIB in Area 2. These USLs and RBMTs form the basis for SSSLs for Areas 1, 2 and 3 of the Refinery. The application of SSSLs based on values originally proposed for the Foreshore below Area 2, to Areas 1 and 3 is considered to be an appropriate and conservative approach based on the following observations:

- The USLs and RBMTs were derived for PHCs, PAHs, and metals. The same PCOCs were associated with Areas 1 and 3. In addition, the petroleum hydrocarbon sources are similar for the three areas.

- A sensitive site designation was attributed to the Foreshore down slope of Area 2 for the purpose of deriving the USLs and RBMTs. The receptors of concerns considered as part of the selection of USLs and RBMTs included aquatic plants, benthic invertebrates and fish (including federally or provincially listed fish). The sensitive site designation and aquatic receptors of concern selected for the Foreshore down slope of Area 2 are considered to be protective of the aquatic species residing in aquatic habitat down slope of Area 1 and Area 3. The Foreshore downgradient of Area 1 and Area 3 includes a wharf and the slope to Burrard Inlet is stabilized with rip-rap, which extends into the Foreshore and intertidal environments (URS 2007). Aquatic plants, benthic invertebrates and fish, considered receptors of concern in the area of the Foreshore down slope of Areas 1 and 3, were also considered receptors of concern for the Foreshore down slope of Area 2.

- It is understood that a “Typical” site designation is applicable to the industrial setting of Area 3.

3.0 Summary of proposed SSSLs for Perimeter Monitoring Program for Areas 1, 2 and 3.

The proposed groundwater SSSLs for the Perimeter Monitoring Program for Areas 1, 2 and 3 are summarized in Table 1.

Table 1
Groundwater Site-Specific Screening Levels (SSSLs)

PCOC Group	PCOC	SSSL (µg/L)	Source	Comment
PHCs	LEPHw	3000	RBMT x 10	
	VPHw	15000	RBMT x 10	
	$EPHw_{10-19}$	5000	BC CSR AW Standard	
	VHw (C6-C10)	15000	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Benzene	21000	RBMT x 10	
	Ethylbenzene	3200	RBMT x 10	
	Styrene	7200	RBMT x 10	
	Toluene	7700	RBMT x 10	
	Xylenes	3300	RBMT x 10	
PAHs	Acenaphthene	60	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Acridine	30	USL x 10	
	Anthracene	40	USL x 10	
	Benz[a]anthracene	1	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Benzo[a]pyrene	2.8	RBMT x 10	
	Chrysene	1	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Fluoranthene	40	USL x 10	
	Fluorene	120	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Naphthalene	440	RBMT x 10	
	Phenanthrene	3	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Pyrene	40	USL x 10	
	Quinoline	34	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
Metals	Antimony	2500	BC CSR AW Standard	
	Arsenic	125	BC CSR AW Standard	
	Barium	5000	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Beryllium	1000	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Boron	12000	BC CSR AW Standard	
	Cadmium	90	USL x 10	
	Chromium	500	USL x 10	
	Cobalt	1100	USL x 10	
	Copper	62	RBMT x 10	
	Lead	1400	USL x 10	
	Molybdenum	10000	USL x 10	BC CSR AW Standard adopted as same value as USL x 10

	Nickel	750	USL x 10	
	Selenium	20	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Thallium	3	USL x 10	BC CSR AW Standard adopted as same value as USL x 10
	Uranium	1000	USL x 10	
	Zinc	900	RBMT x 10	
BC CSR refers to The BC CSR, Stage 10 (Omnibus) Amendments, Schedule 3.2 – AW Standard for the Protection of Aquatic Life.				

4.0 References

BC Ministry of Environment. 2013. CSR Technical Guidance 15. Concentration Limits for the Protection of Aquatic Receiving Environment. Version 1.0. April 2013.

BC Ministry of Environment. 2013. Email from Lizzy Mos Re: Screening Levels, SITE 6727. Dated September 4, 2013.

BC Ministry of Environment. 2014. Letter from Lizzy Mos Re: Chevron Burnaby Refinery. (Review of RBMTs). Dated August 28, 2014.

MacGrath, J.A. and D.M. DiToro. 2009. Validation of the Target Lipid Model for Toxicity Assessment of Residual Petroleum Constituents: Monocyclic and Polycyclic Aromatic Hydrocarbons. Environmental Toxicity and Chemistry: 28(6): 1130-1148. 2009.

Meridian Environmental Inc. (Meridian). 2012. CCME Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites (FIGQG).

SLR Consulting Canada Ltd (SLR). 2013a. Updated Screening levels for foreshore monitoring. Memorandum prepared for Chevron Canada Limited. May 9, 2013.

SLR Consulting Canada Ltd (SLR). 2013b. Updated Screening levels for foreshore monitoring – Addendum. Memorandum prepared for Chevron Canada Limited. June 6, 2013.

SLR Consulting Canada Ltd (SLR). 2014a. Risk-Based Management Targets, Seep Area Foreshore Down Slop of the East Impounding Basin, Chevron Burnaby Refinery, Burnaby, BC. Report prepared for Chevron Canada Limited. February 28, 2014.

SLR Consulting Canada Ltd (SLR). 2014b. Response to BC MoE's Review of SLR Risk-Based Management Targets, Seep Area Foreshore Down Slop of the East Impounding Basin, Chevron Burnaby Refinery, Burnaby, BC. Letter prepared for Chevron Canada Limited. August 26, 2014.

SLR Consulting Canada Ltd (SLR). 2016. Human Health and Ecological Risk Assessment of Seep Area Foreshore Down Slope of the East Impounding Basin, Chevron Burnaby Refinery, Burnaby, BC. Final Report prepared for Chevron Canada Limited.

APPENDIX F

FIELD PROGRAM AND METHODOLOGIES

APPENDIX F - FIELD PROGRAM METHODOLOGIES

The majority of wells included in the Perimeter Monitoring Program (PMP) are completed in low permeability, fine-grained formation material (e.g., sandy silt) and thus, typically recharge slowly and are more likely to produce highly turbid groundwater samples than monitoring wells constructed in coarse-grained materials. Excess solids entrainment in a sample may result in false positive results for dissolved polycyclic aromatic hydrocarbons (PAHs), light and heavy extractable petroleum hydrocarbons (LEPHw/HEPHw) or extractable petroleum hydrocarbons ($EPHw_{C10-C19}$/$EPHw_{C19-C32}$). Therefore, choosing appropriate purging and sampling techniques has been critical in obtaining high-quality, reliable analytical results for groundwater samples. AECOM has developed site-specific field procedures and documentation requirements for the Chevron Canada Limited (CCL) Refinery PMP. The field methodologies are similar to the MoE Field Sampling Guide (2013) and are consistent with AECOM protocols carried out at United States based Chevron sites and are described in the following subsections.

MONITORING WELL PURGING METHODOLOGY

The monitoring wells were purged of standing water before sampling to ensure that samples are representative of formation geochemical conditions. Prior to purging, the time of day and tide condition (for Area 3), well headspace vapour concentration levels, depth to water, and total depth of the well were recorded at each well location. Field observations, field measurements, instrumentation used, and other details related to monitoring, well purging, and sampling were recorded by AECOM field staff and recorded in Tables A-1 and B-1.

Well headspace vapour concentration levels were measured using a flame ionization detector (Eagle RKI) operated in methane elimination mode immediately after removing the well cap from the well. Depth to water was measured using an oil/water interface meter, which was decontaminated with amended water[1] between monitoring wells to prevent cross contamination.

During well purging, water was pumped from each monitoring well at a low flow rate (i.e., up to 0.5 litres per minute [L/min]) using a peristaltic pump connected to a well-dedicated length of ¼-inch high/low-density polyethylene drop tubing. Care was taken to position the intake of the tubing just above the middle of the screened section of each monitoring well to ensure representative samples were obtained and to minimize the disturbance and subsequent entrainment of silt located at the bottom of the well. During purging, field parameters including pH, temperature, conductivity, oxidation redox potential, and dissolved oxygen were monitored. Purging continued until field parameters stabilized and at least one well volume had been removed[2], or until the well was pumped dry.

1 Amended water is a 0.5% solution of Liquinox and purified water.

2 Studies have demonstrated that when purging at low flow rates, formation water is accessed in less than three (3) well volumes, and frequently between one to two (1 to 2) well volumes (Puls, R.W. and Michael J. Barcelona 1996. Ground Water Issue: Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures, USEPA, Washington, DC).

If the water level in the well was greater than approximately 12 metres below grade, purging was conducted using a dedicated bailer, hydrolift, or Waterra™ tubing equipped with a foot valve rather than a peristaltic pump, since such depths are near the maximum lift capacity of the peristaltic pump. During purging with a bailer/Waterra™, care was taken to remove water from near the top of the water column to minimize any disturbance and subsequent entrainment of solids near the base of the well. Again, purging was continued until field parameters stabilized and at least three well volumes had been removed, or until the well was dry.

Regardless of the purging method, if the well was purged dry, it was left to recharge overnight and sampled directly thereafter without additional purging.

AECOM ensured that all purge water was disposed of as prescribed by current environmental regulations and CCL Refinery protocols.

MONITORING WELL SAMPLING METHODOLOGY

When sufficient recharge was present to purge and sample using a peristaltic pump, a lower flow rate (i.e., up to 0.5 L/min) was used to ensure minimal entrainment of silt in the sample as well as minimal losses of volatile constituents. When using a bailer, Waterra™ tubing, or when the well was purged/sampled dry, groundwater levels were allowed to recover enough to collect the remaining sample set.

The following describes the sample containers and preservatives used for each chemical constituent to be analyzed:

- $EPHw_{C10-C19}$/$EPHw_{C19-C32}$, LEPHw/HEPHw, and/or PAHs: two 500 millilitre (mL) amber glass bottles, no filtering, sodium bisulphate [$NaH(SO_4)$] preservative;
- BTEX, VPHw, and/or MTBE: two 40 mL clear glass purge and trap vials, no filtering, and $NaH(SO_4)$ preservative; and
- Dissolved metals: one 250 mL plastic container, field filtering, and nitric acid (HNO_3) preservative.

Care was taken to completely fill all sample vessels to minimize the headspace within the sample bottles. Extra diligence was exercised when collecting the samples for volatile petroleum hydrocarbons to ensure that no headspace was present within the purge and trap vials. All bottles were placed immediately in ice-packed coolers and transported at the end of the day under Chain of Custody (COC) to ALS Environmental (ALS) of Burnaby, BC. All samples were submitted, extracted, and analysed within the required holding time for each parameter. Groundwater samples from Areas 1 and 3 wells and Area 2 wells were submitted under separate COC forms.

POTENTIAL TIDAL EFFECTS

To minimize potential biases in groundwater data quality due to tidal effects, AECOM sampled the Area 3 monitoring wells over the period of an out-going or ebb tide cycle. Based on the locations of the remaining perimeter monitoring wells and site hydrogeology, the tidal effect on the remaining wells is understood to be negligible. Thus, tide conditions were not considered when monitoring and sampling wells outside Area 3.

ANALYTICAL TESTING PROGRAM

Based on reviews of historical analytical data for each of the perimeter monitoring wells included in the program, and as proposed in CCL's October 31, 2003 *Chevron Refinery Well Monitoring Program* letter to the MoE, AECOM devised an analytical testing program aimed at obtaining groundwater quality data necessary for the assessment of key contaminants of concern, while minimizing unnecessary data collection and budget expenditure. As such, it was proposed that perimeter monitoring wells with reported historical concentrations of LEPHw/HEPHw less than the Contaminated Sites Regulation (CSR) Aquatic Life (AW) standards for the protection of marine life be tested for EPHw range hydrocarbons only. More detailed LEPHw/HEPHw analysis was performed where the potential contaminants of concern included PAHs or where historical EPHw concentrations approached or exceeded the CSR AW standards.

QUALITY ASSURANCE

To evaluate the accuracy and reproducibility of the groundwater sampling results, AECOM collected approximately one field duplicate per every ten samples. Each data set included at least one duplicate for every constituent analyzed, or where one constituent is analysed repeatedly, a number equal to approximately 10% of the total number of analyses.

APPENDIX G

LABORATORY ANALYTICAL DATA

(on USB located on back cover of report)

APPENDIX H

QUALITY ASSURANCE AND QUALITY CONTROL PROTOCOLS

APPENDIX H - QUALITY ASSURANCE AND QUALITY CONTROL PROTOCOLS

Data Quality Assurance/Quality Control (QA/QC)

In order to assure the integrity and defensibility of the data collected, rigorous QA/QC protocols were observed. These protocols ensured that all samples were properly collected, identified, stored, shipped, and documented. Standard operating procedures (SOPs) for sample collection and storage, equipment decontamination, and sample chain of custody protocols were followed. Soil and groundwater samples were collected using sampling techniques discussed above. The use of these methods ensured the quality, soundness, and defensibility of the data obtained. The laboratory analytical data, once generated, was also proofed for inconsistencies and anomalies. Field duplicates, trip blanks, and equipment blanks were collected for QA/QC purposes.

Field Duplicate Samples

Field duplicate samples are two identical samples that are submitted to the laboratory with no indication that they are the same. The analysis of field duplicate samples provides an indication of the total precision of the sampling and analysis process. Field duplicate samples were collected and analyzed at a rate of approximately 10% of samples for a given analytical suite.

Trip Blanks

Trip blanks are samples of clean deionized, distilled (Reagent Grade Type II) water that are prepared in the laboratory, taken to the field, retained on site throughout sample collection, returned to the laboratory, and analyzed with the environmental samples. The QA/QC review identifies trip blanks with detections of target analytes and evaluates the effect of the detections on associated sample results for possible cross-contamination during transport.

Equipment Blanks

Equipment blanks are samples of deionized, distilled (Reagent Grade Type II) water that are prepared in the field by pumping the water through the decontaminated pumps and tubing into sample containers. The QA/QC review identifies equipment blanks detections of target analytes and evaluates the effect of the detections on associated sample results for possible cross-contamination during sample collection.

Analytical Data Interpretation

To confirm the quality of the laboratory analytical data, precision, accuracy, and completeness were considered.

Precision

Precision measures the reproducibility of repetitive measurements and is usually expressed in terms of imprecision. It is strictly defined as the degree of mutual agreement among multiple independent measurements as the result of repeated application of the same process under similar conditions.

Analytical precision is a measurement of the variability associated with the duplicate (*i.e.*, two) or replicate (*i.e.*, more than two) analyses of the same sample in the laboratory, and is determined by the analysis of matrix spike duplicate or laboratory duplicate samples.

Total precision is a measurement of the variability associated with the entire sampling and analysis process. It is determined by the analysis of duplicate or replicate field samples and incorporates any variability introduced by the analytical procedure, sample collection and handling procedures, and matrix factors. Precision data must be interpreted by taking into consideration these possible sources of variability.

Duplicate field samples were collected, and duplicate spiked or unspiked samples were analyzed to assess analytical precision. The results were assessed using the relative percent difference (RPD) between duplicate measurements. The equation used to calculate RPD for duplicate samples is:

$$RPD = \frac{(A-B)}{((A+B)/2)} \times 100$$

where:

A	=	analytical result
B	=	duplicate result.

Note that for RPDs the result can be a positive or a negative value. RPDs are often presented as *absolute* RPDs, in which case the absolute value of the RPD is reported, always resulting in a positive number. Reporting the absolute RPD results in a reduction in information, since, for instance, if a duplicate sample consistently returned higher results than the original sample, all RPD values would be negative and it may be an indication of a precision problem. In this case, if absolute RPD was reported, no indication would be forthcoming.

Total precision was determined by collecting field duplicate samples. These samples were collected and analyzed at a rate of approximately 10% of total samples for each analytical suite.

Analytical precision will be determined in the laboratory by running matrix spike/matrix spike duplicate (MS/MSD) pairs, or by running laboratory duplicate analyses. These samples will be analyzed at a rate of approximately 5% for each analytical suite.

Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (*e.g.,* variability due to imprecision) and systematic error (*e.g.,* bias). Therefore, accuracy reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ beyond acceptable limits from the true value or known concentration of the spike or standard. Acceptance criteria are indicated in the individual standardized analytical methods.

Analytical accuracy is typically measured by determining the percent recovery of known target analytes that are spiked into a field sample (*i.e.*, a surrogate or matrix spike), or reagent water (*i.e.*, laboratory control sample [LCS] or blank spike) before extraction at known concentrations. Percent recovery is calculated as:

$$\%REC = \frac{A}{B} \times 100$$

where:

A	=	obtained value
B	=	true value.

Analytical accuracy was determined in the laboratory by the running of MS samples or laboratory control samples. These samples were analyzed at a minimum rate of 5% for each analytical suite.

Completeness

Completeness for this investigation was defined as the percentage of valid analytical results. Results made uncertain due to missed hold times, improper calibration, blank contamination, or poor calibration verification results would be deemed invalid. Results that may be flagged due to matrix effects are not considered invalid. Completeness for projects should exceed 90%. Completeness is calculated by:

$$completeness = \frac{A}{B} \times 100$$

where:

A	=	number of valid analytical results
B	=	total number of analytical results.