Appendiks

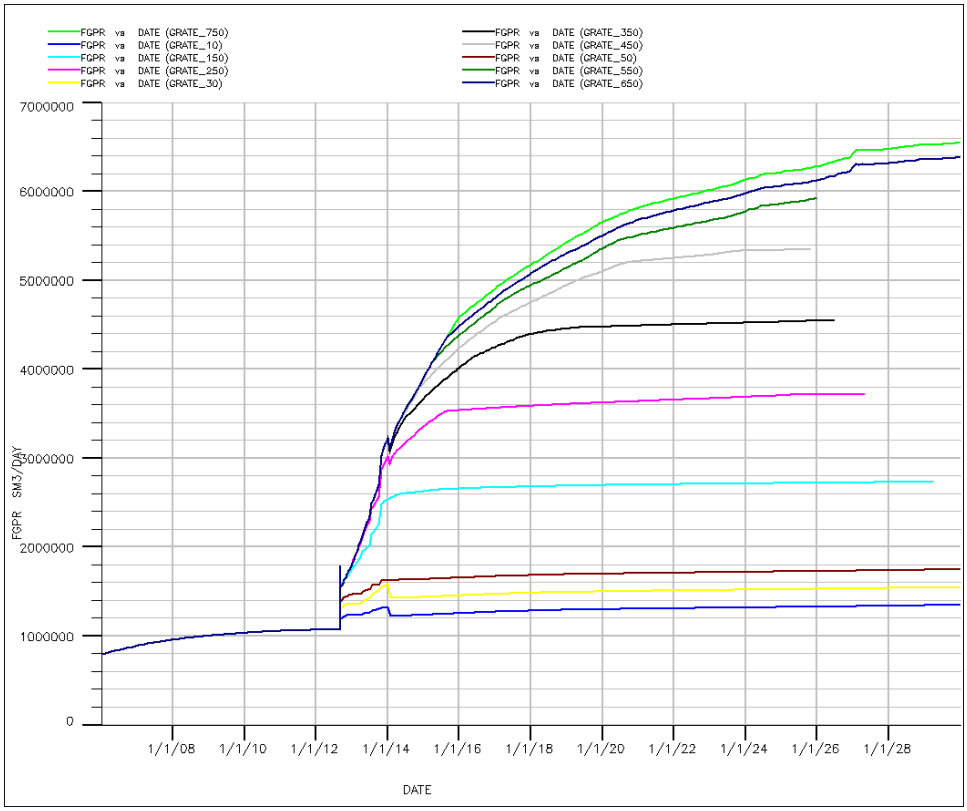
APPENDIKS A – Sensitivitetsanalyse, gassproduksjonsrate

APPENDIKS B – Sensitivitetsanalyse, injeksjonstrykk

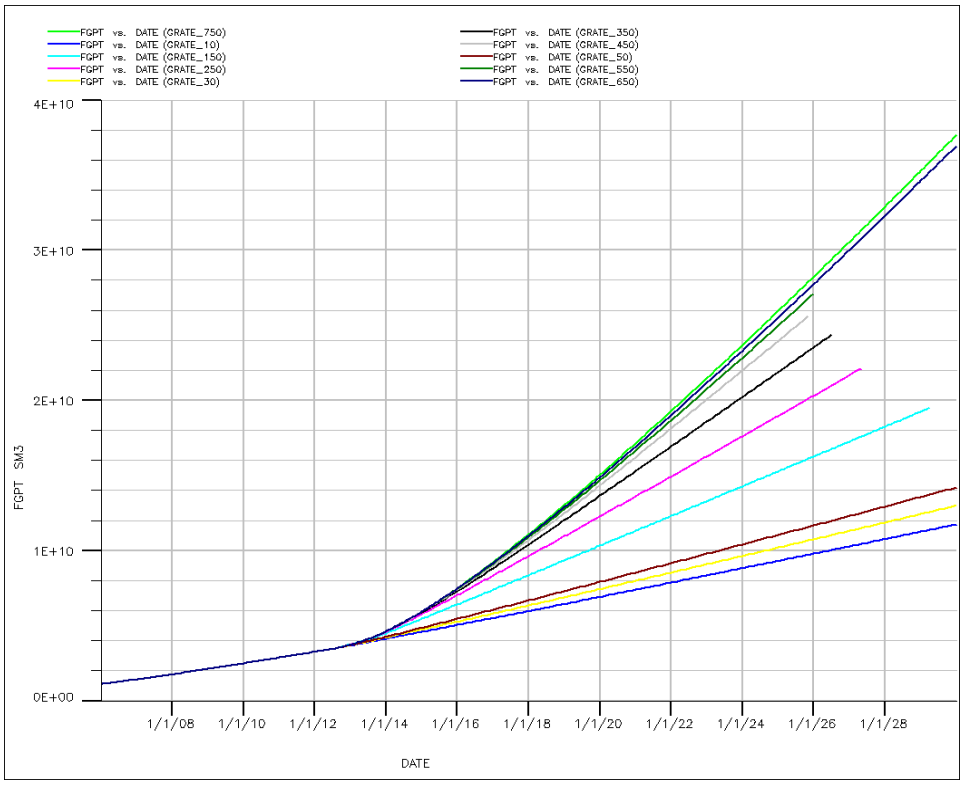
APPENDIKS E - Brønnplasseringer og lengder

APPENDIKS F – Historisk vannproduksjonsrate vs. simulert

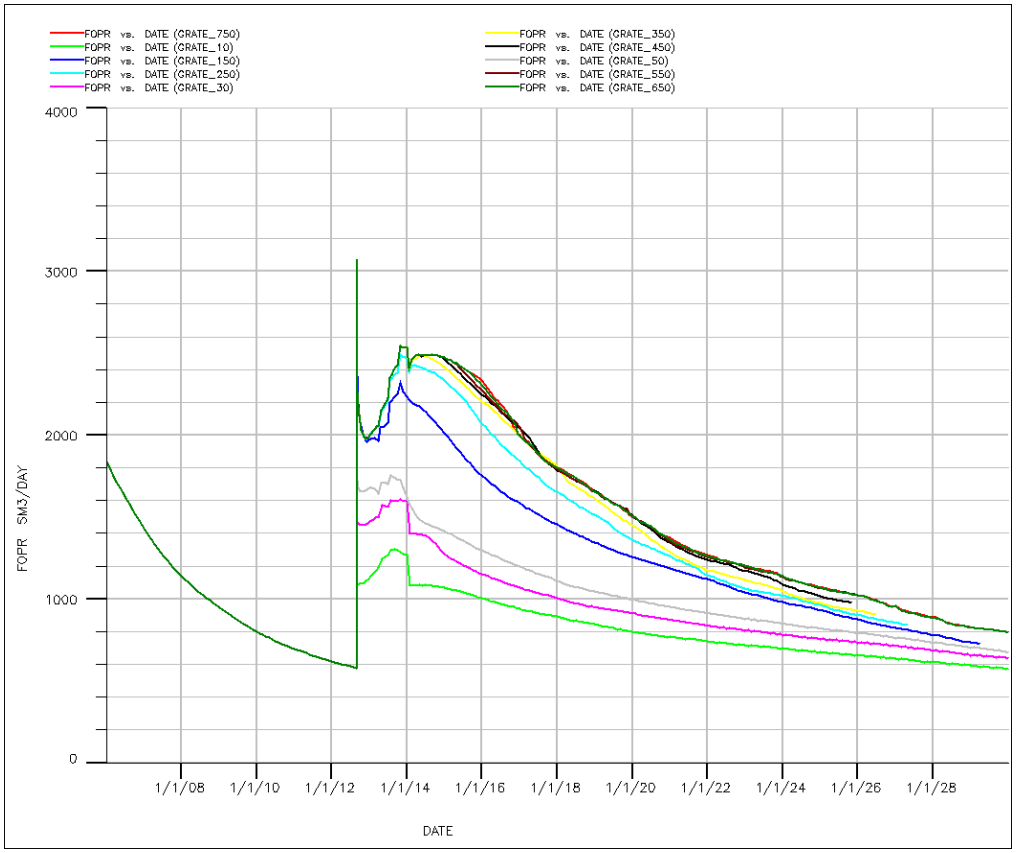
APPENDIKS A – RATESTYRT INJEKSJON



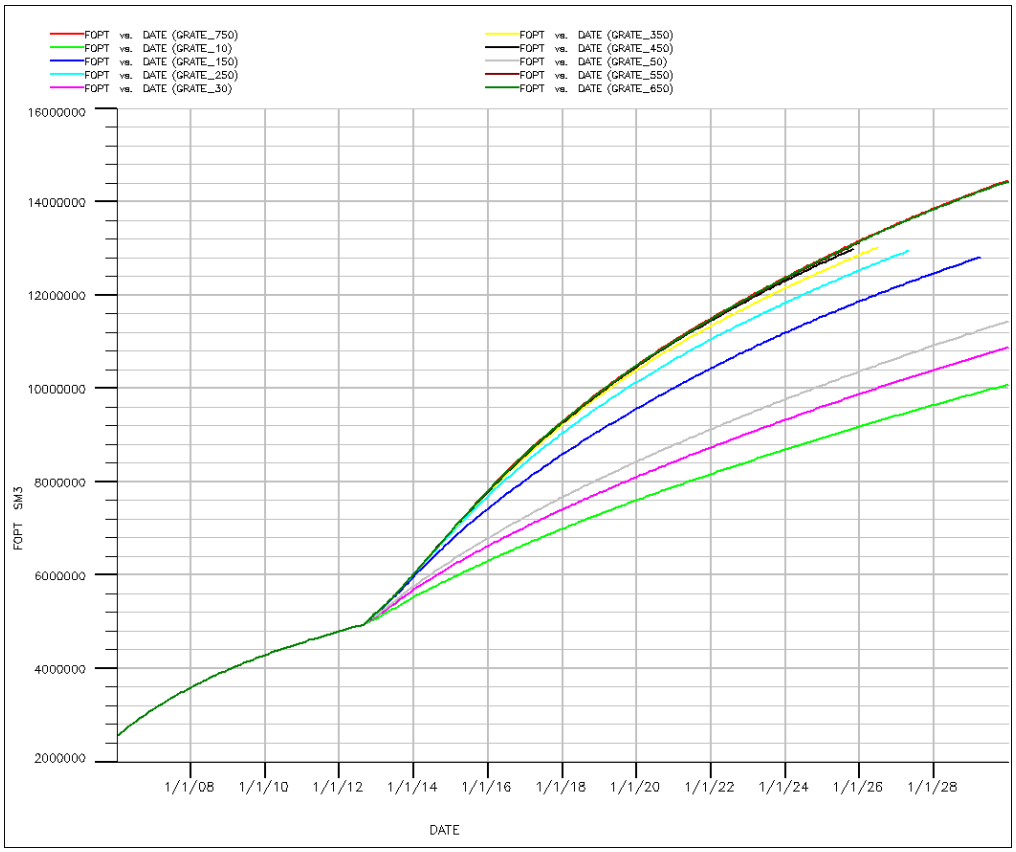
Figur1: Ratestyrt FGPR



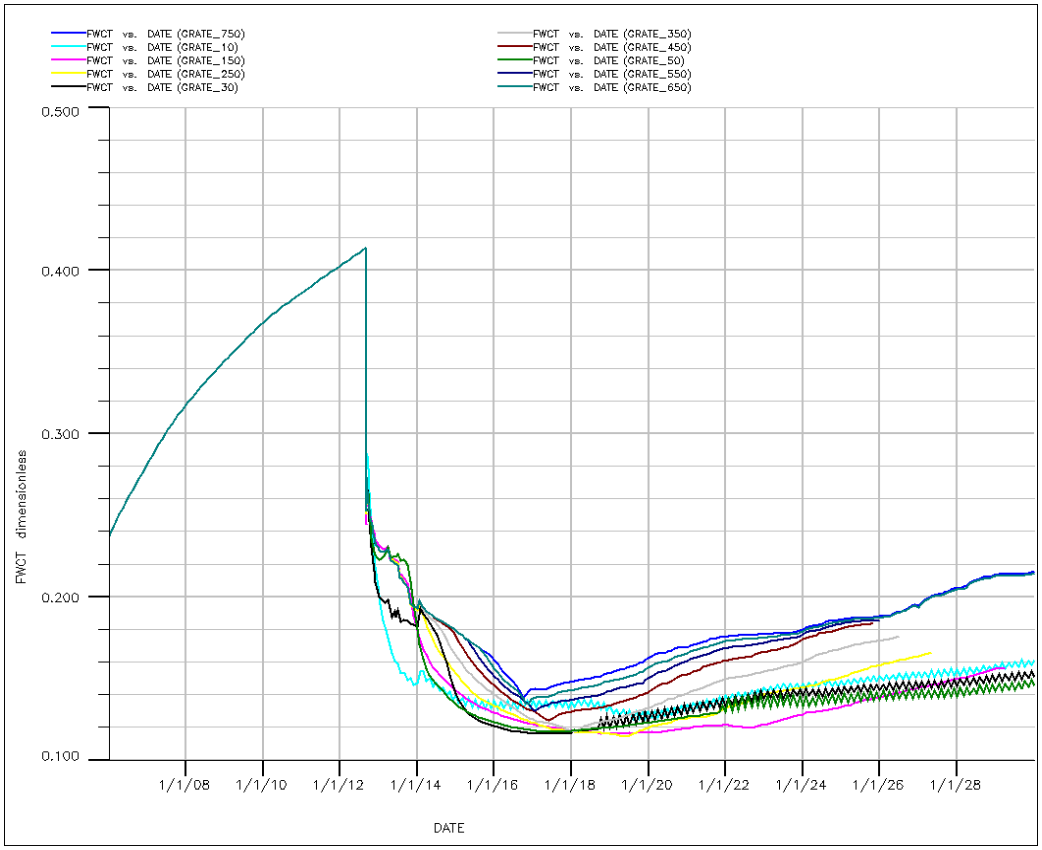
Figur2: Ratestyrt FGPT



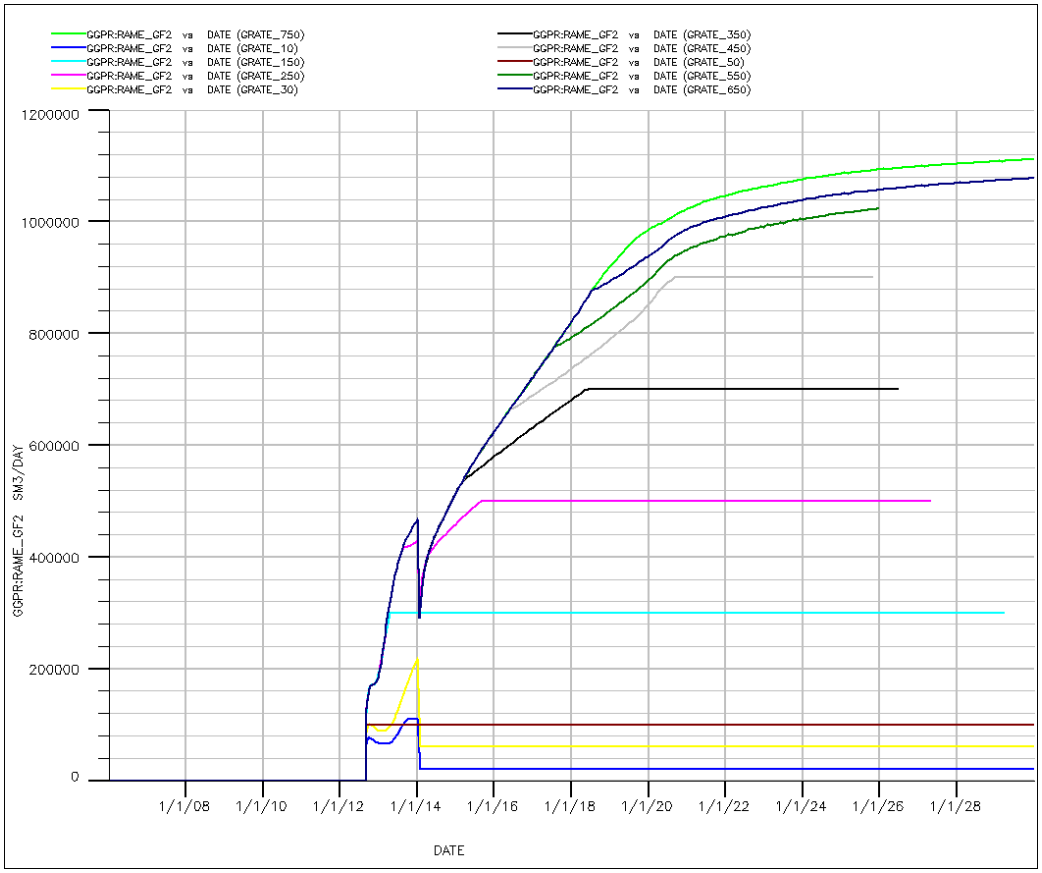
Figur3: Ratestyrt FOPR



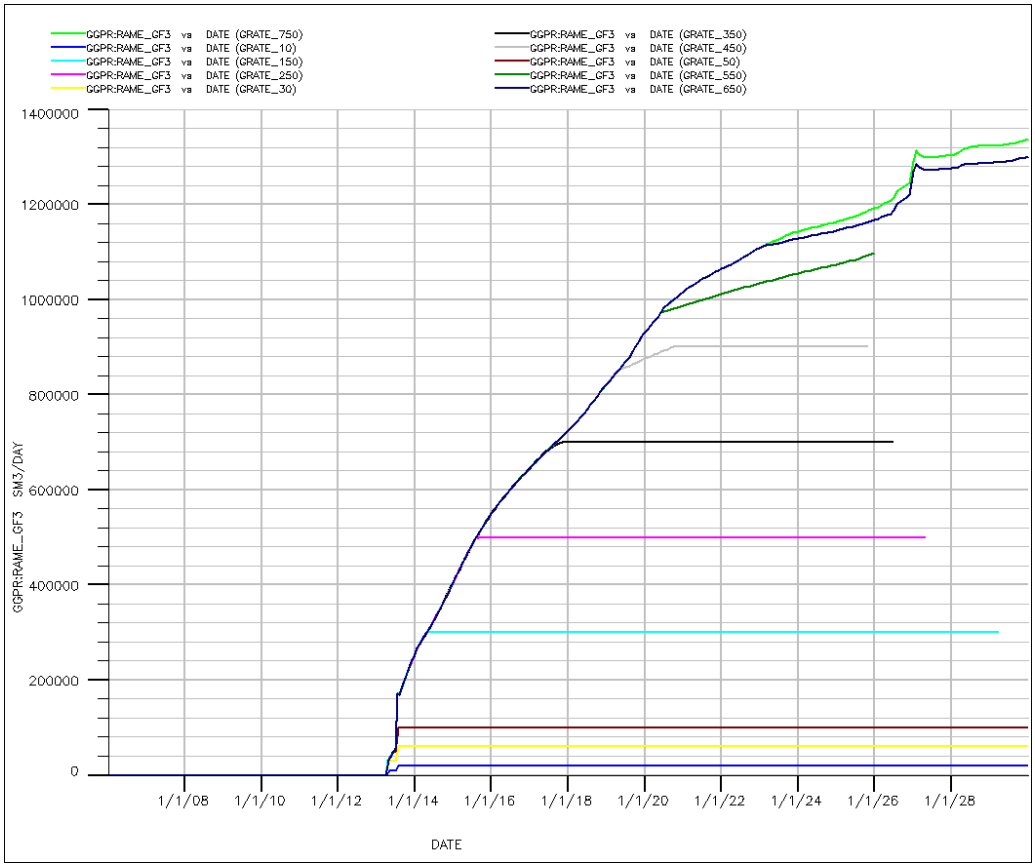
Figur 4: Ratestyrt FOPT



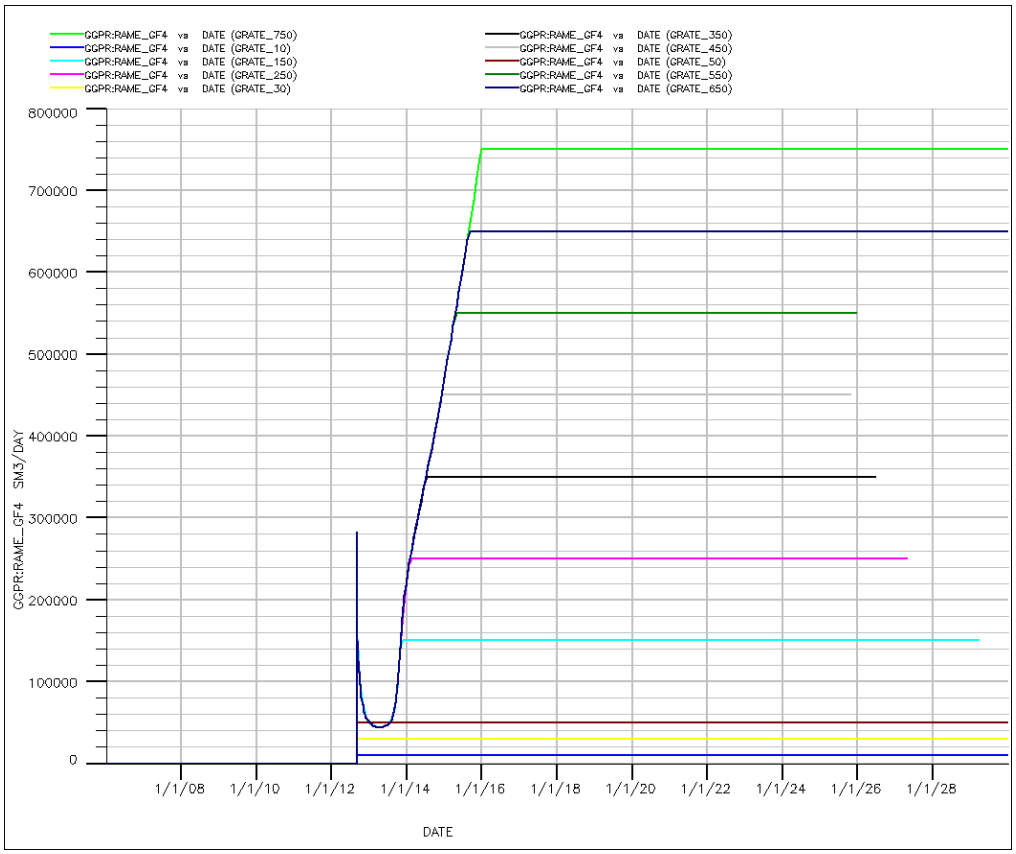
Figur 5: Ratestyrt FWCT



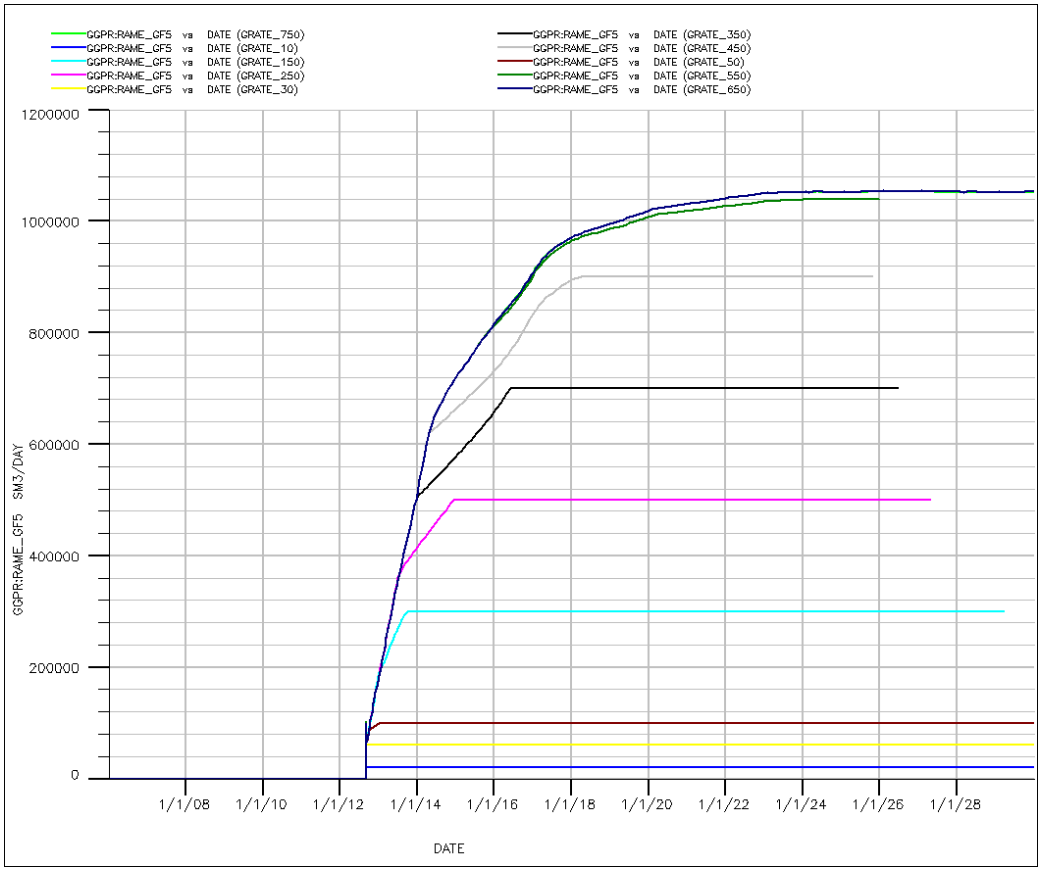
Figur 6: Ratestyrt GGPR GF2



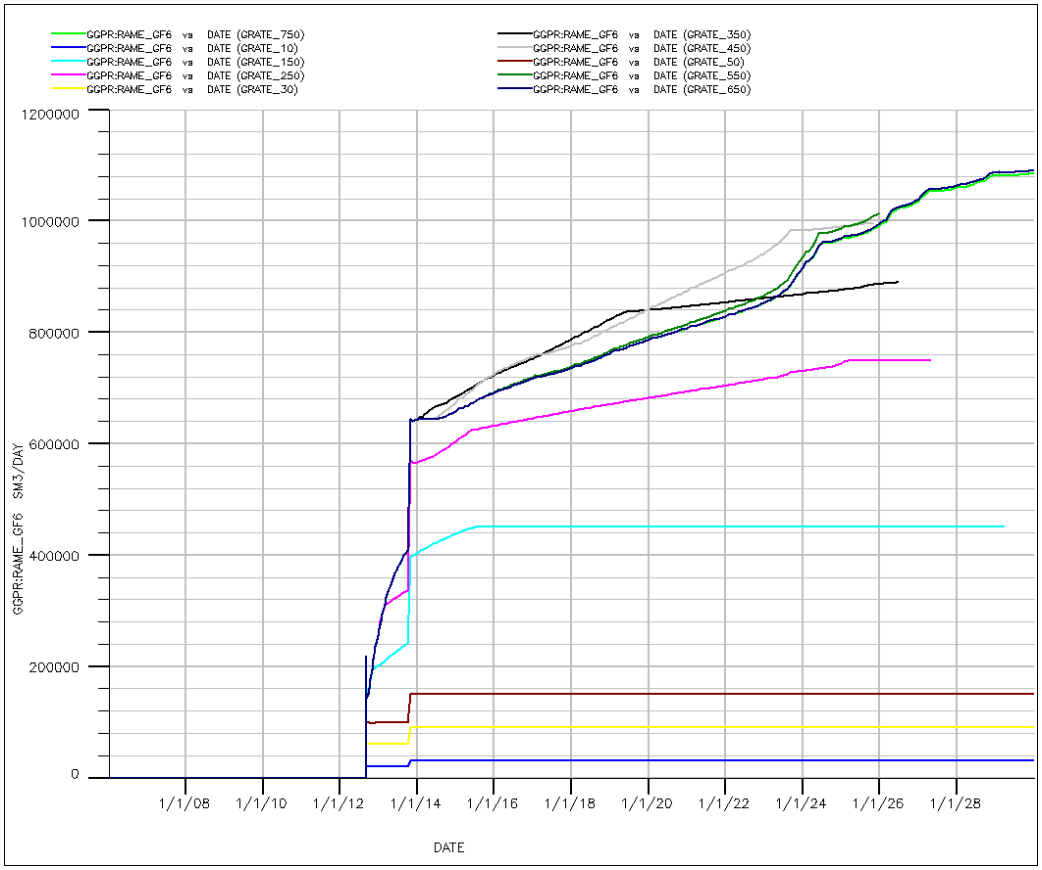
Figur 7: Ratestyrt GGPR GF3



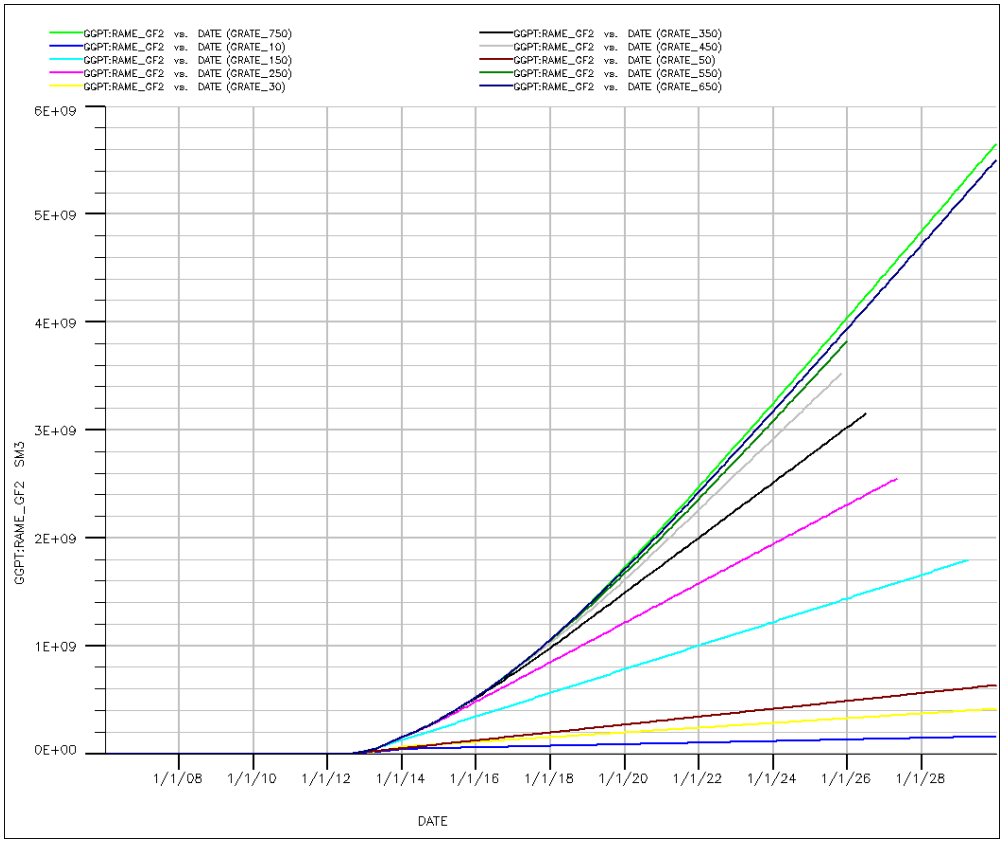
Figur 8: Ratestyrt GGPR GF4



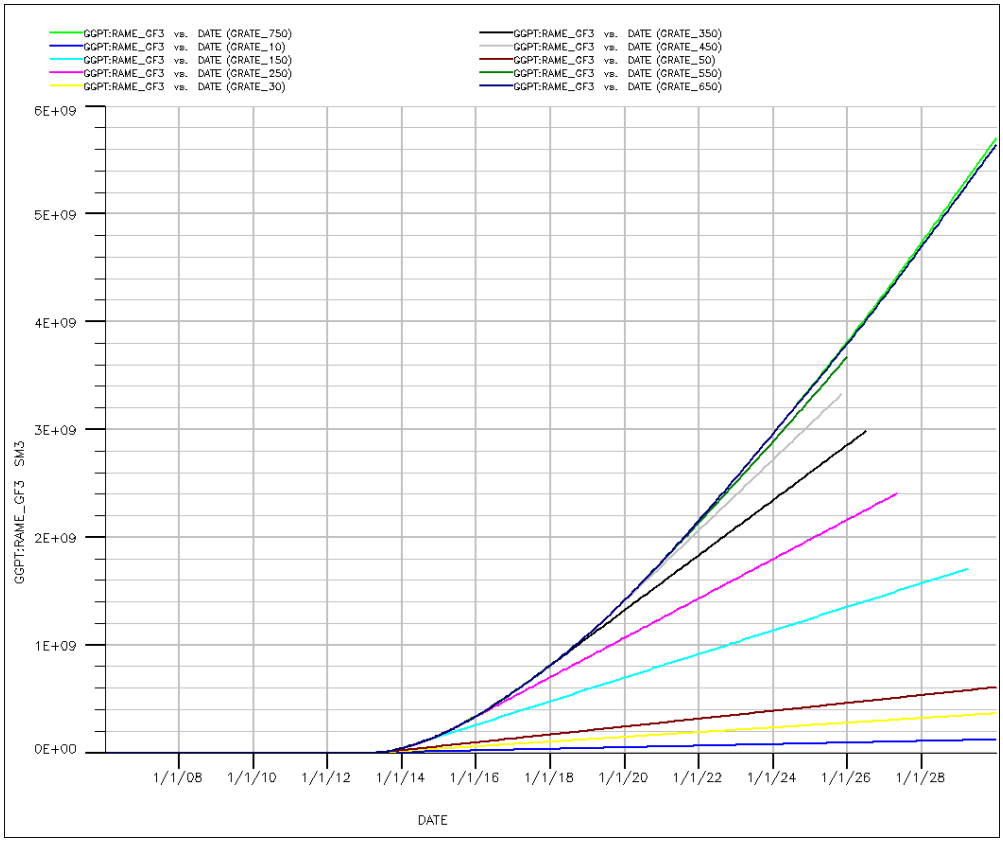
Figur 9: Ratestyrt GGPR GF5



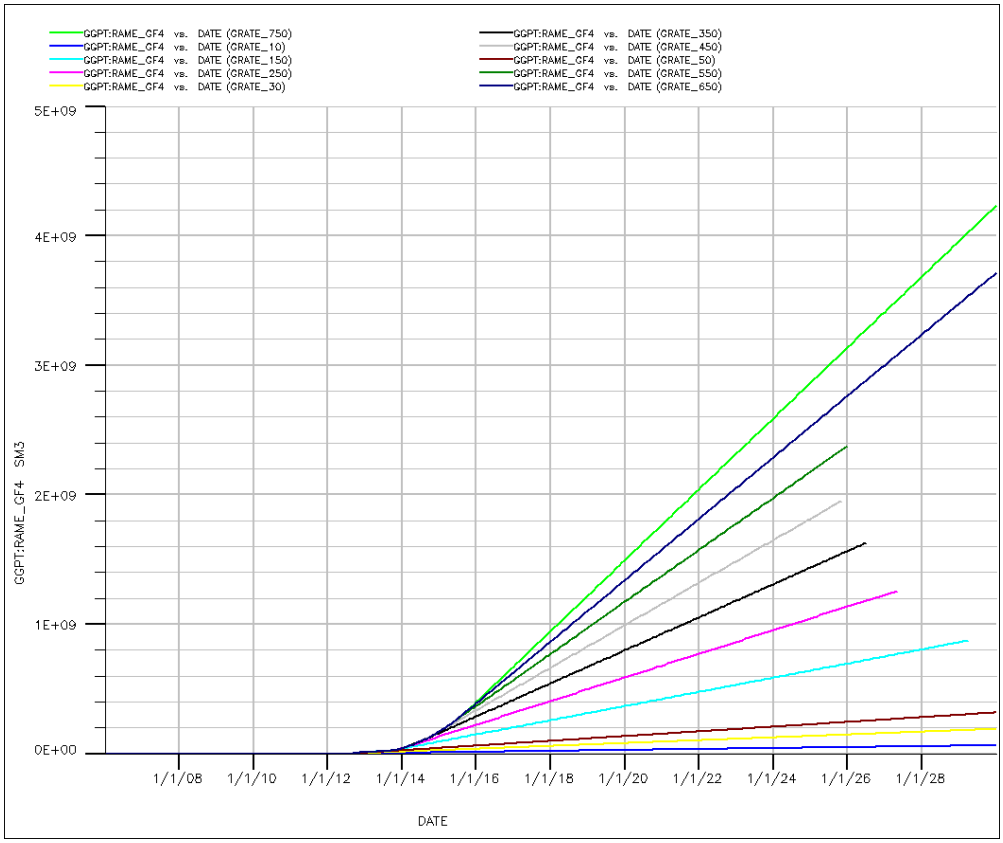
Figur 10: Ratestyrt GGPR GF6



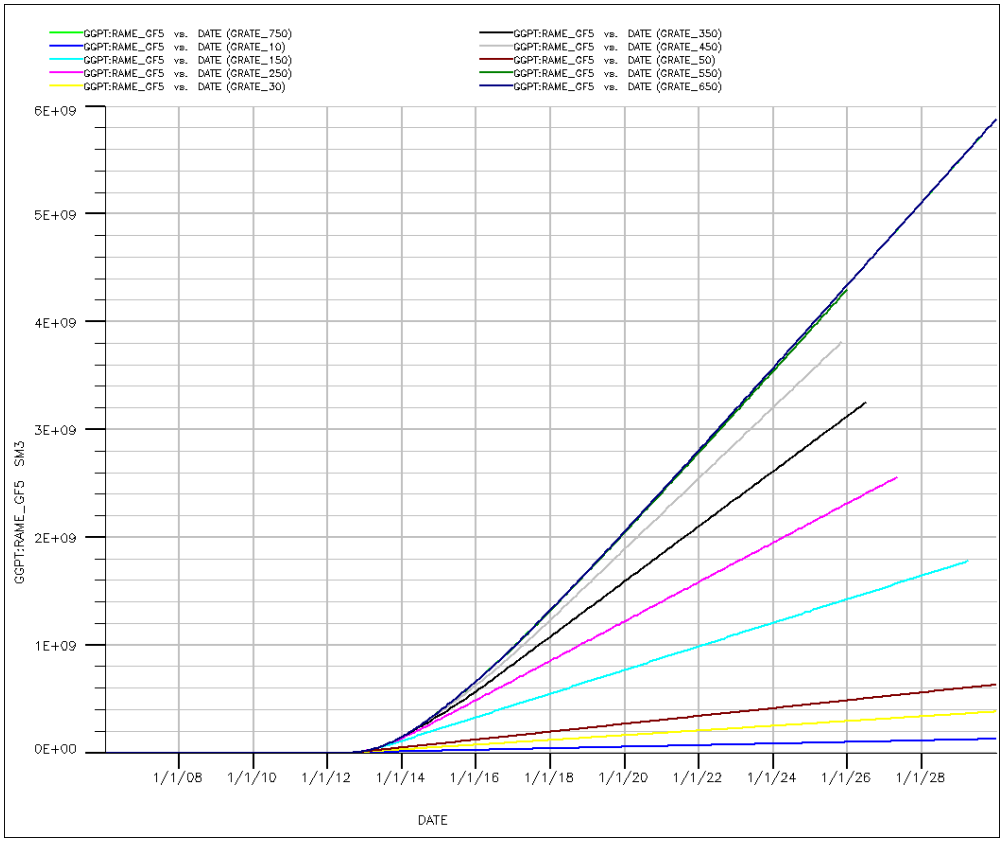
Figur 11: Ratestyrt GGPT GF2



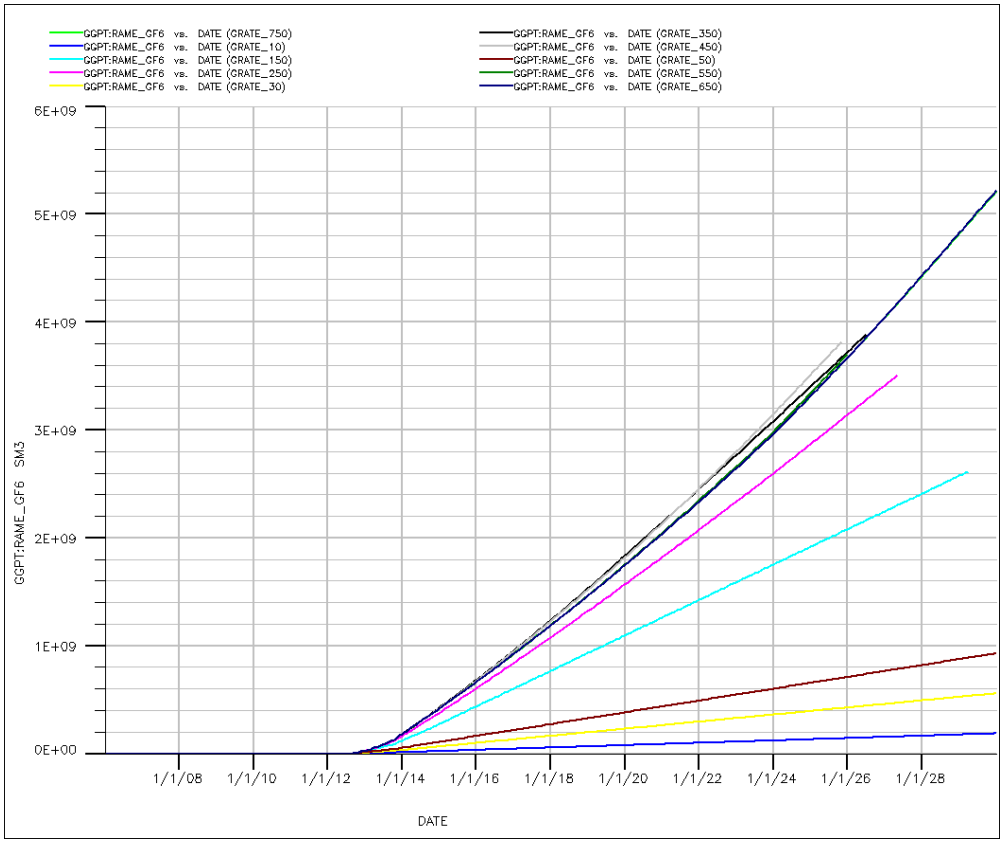
Figur 12: Ratestyrt GGPT GF3



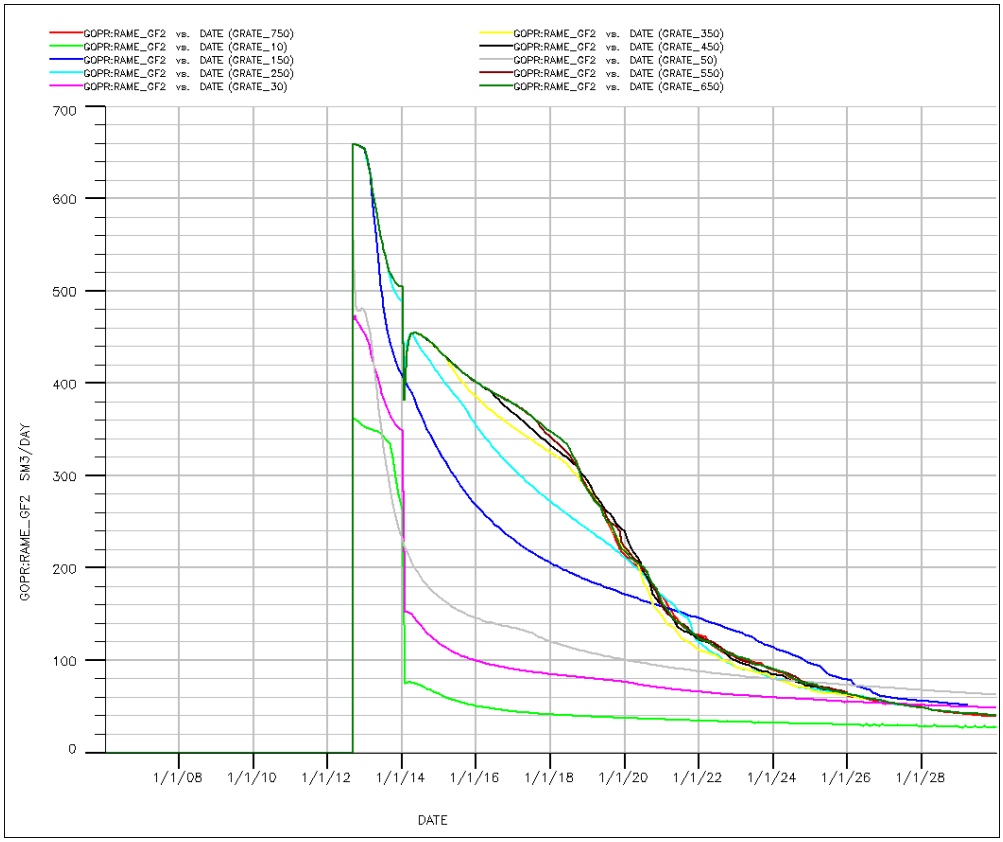
Figur 13: Ratestyrt GGPT GF4



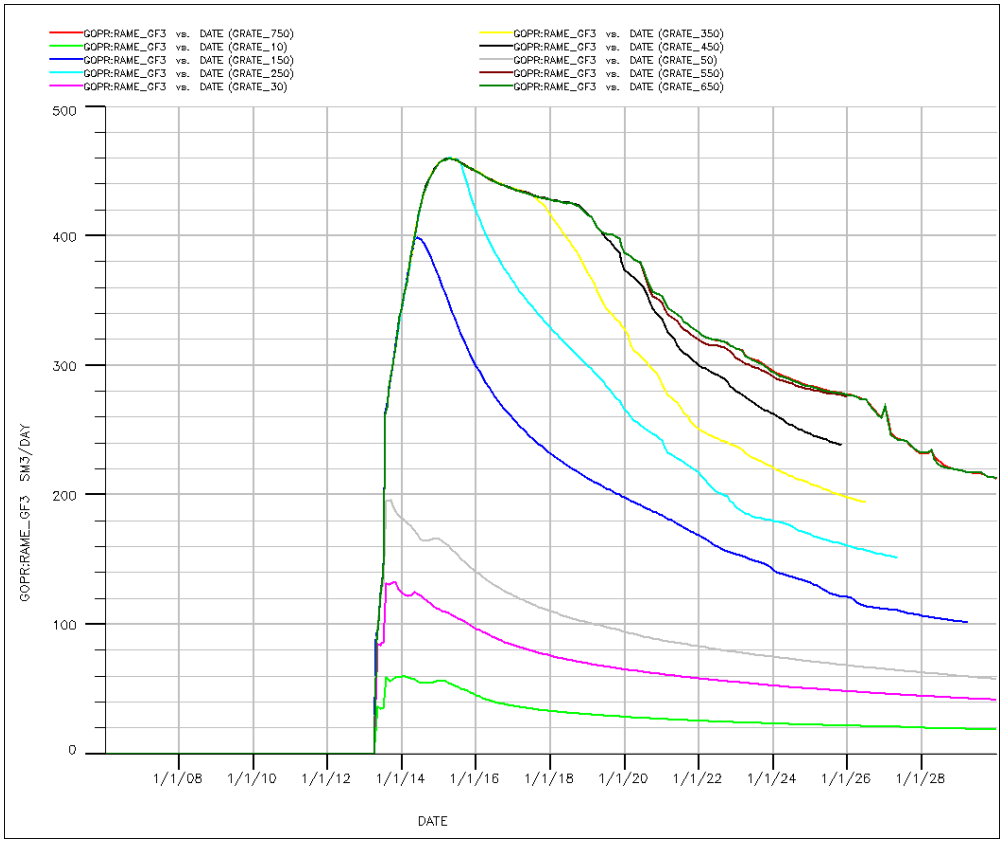
Figur 14: Ratestyrt GGPT GF5



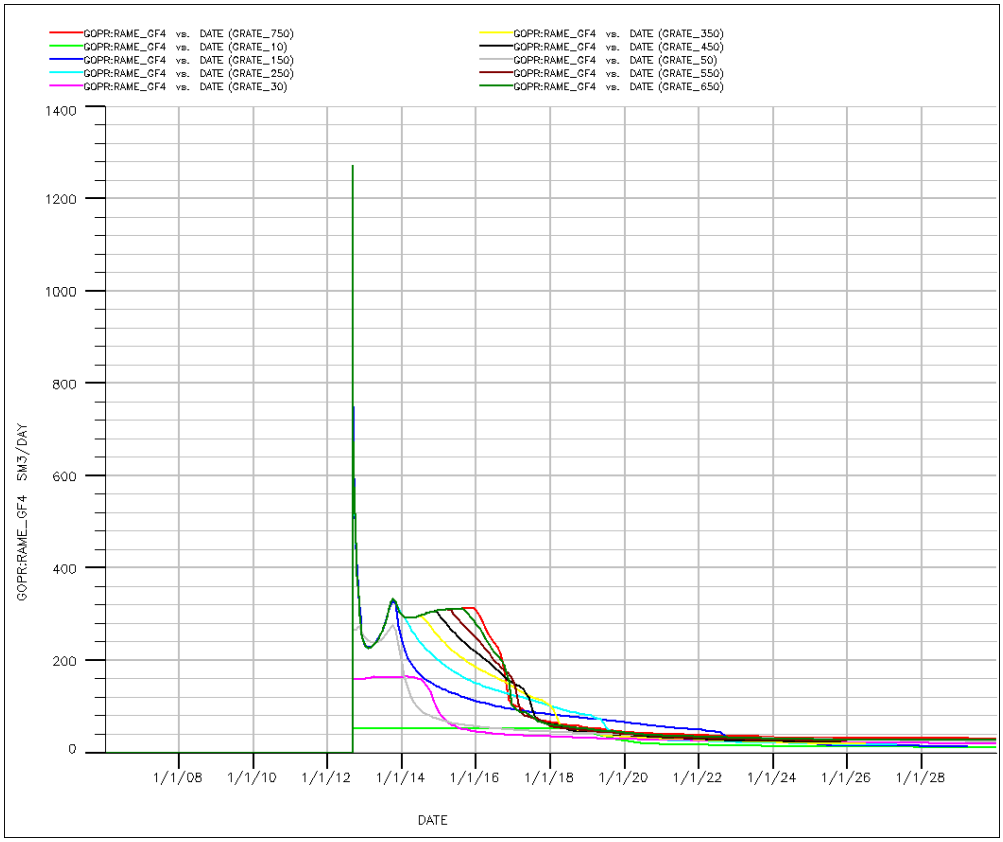
Figur 15: Ratestyrt GGPT GF6



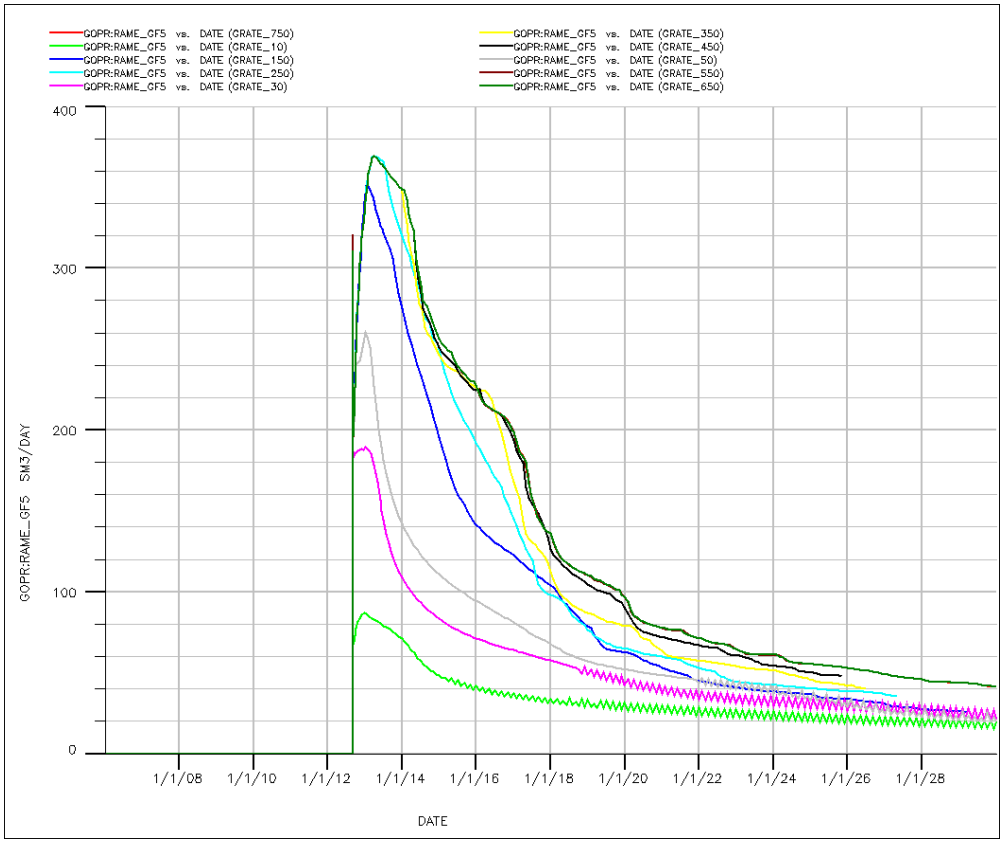
Figur 16: Ratestyrt GOPR GF2



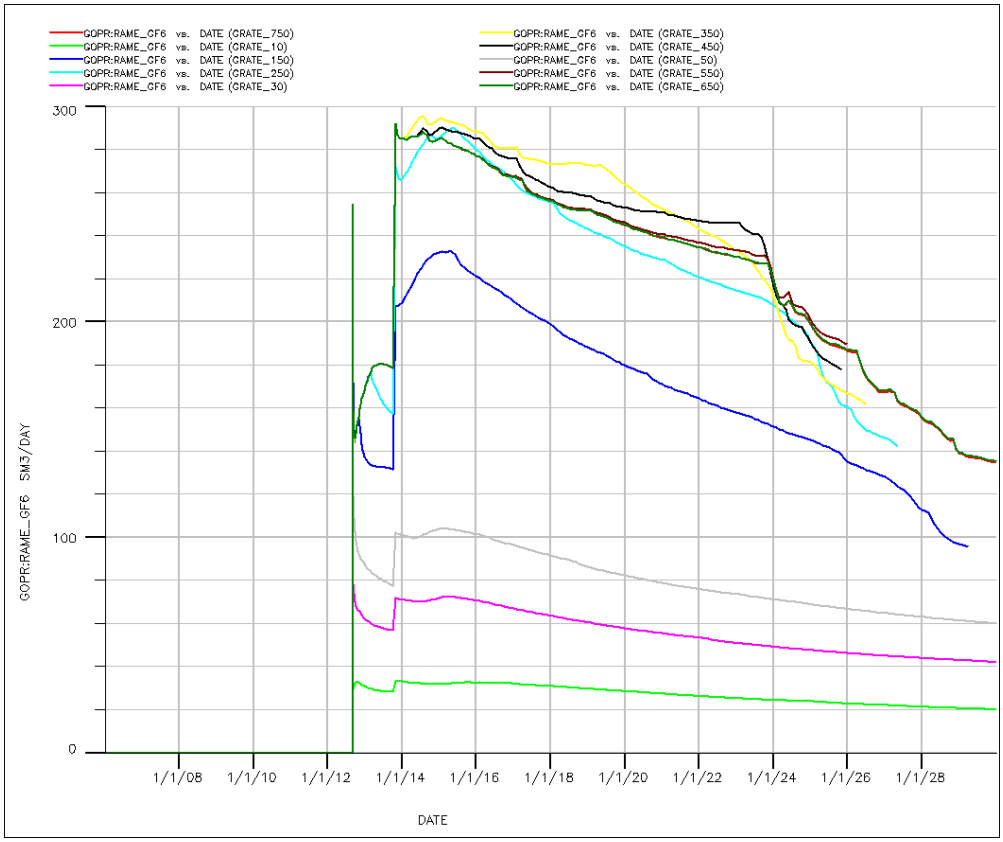
Figur 17: Ratestyrt GOPR GF3



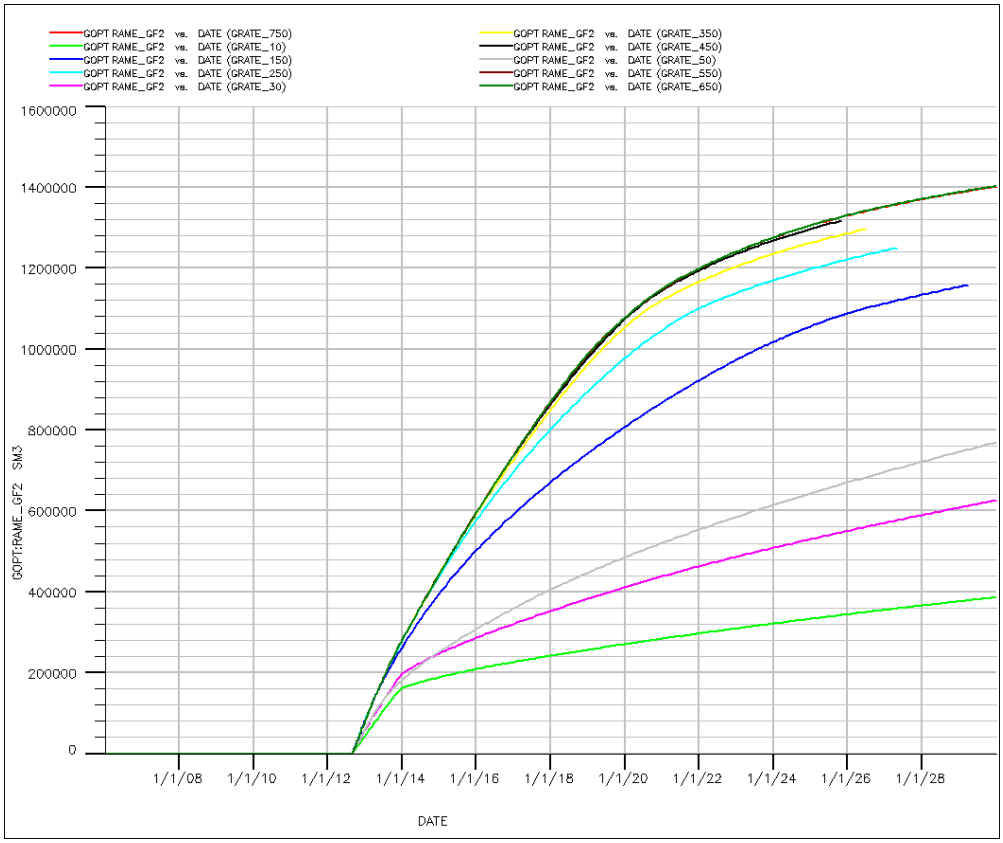
Figur 18: Ratestyrt GOPR GF4



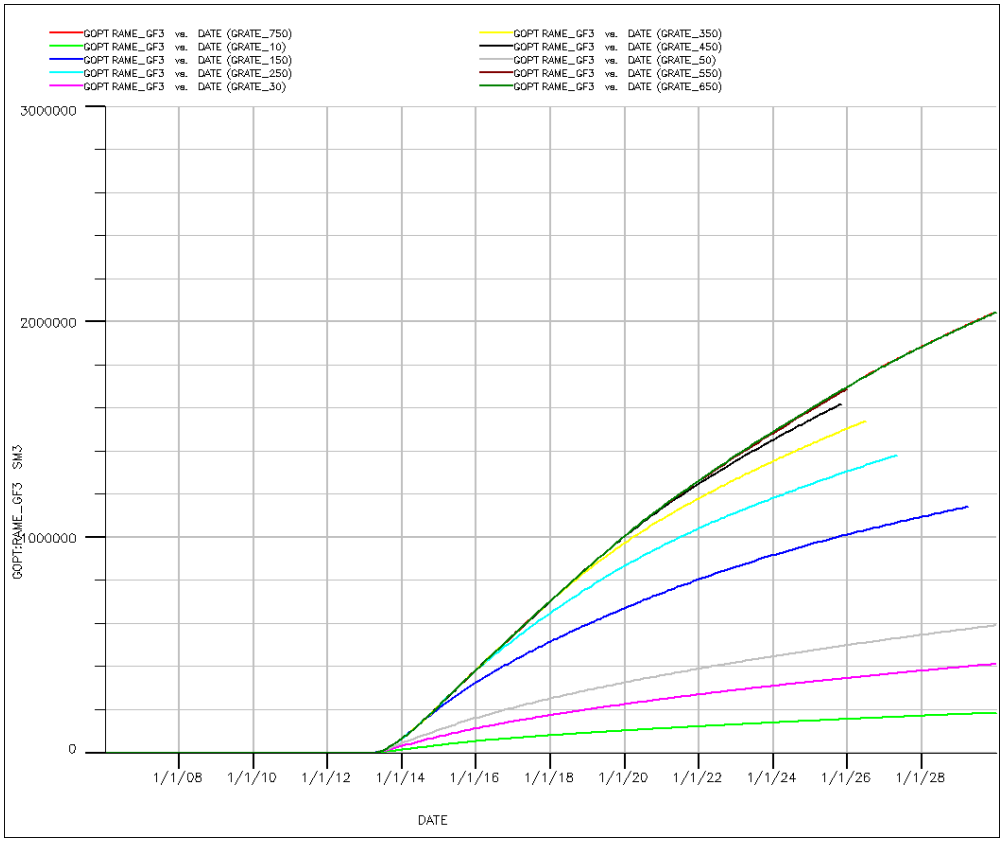
Figur 19: Ratestyrt GOPR GF5



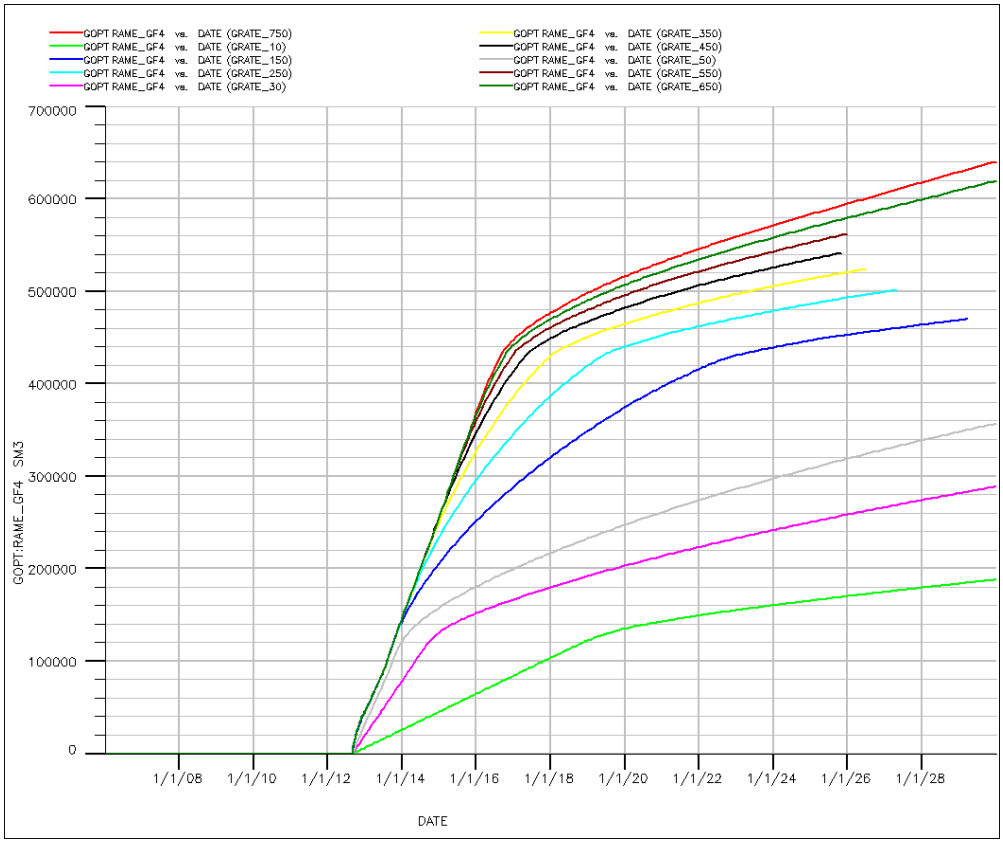
Figur 20: Ratestyrt GOPR GF6



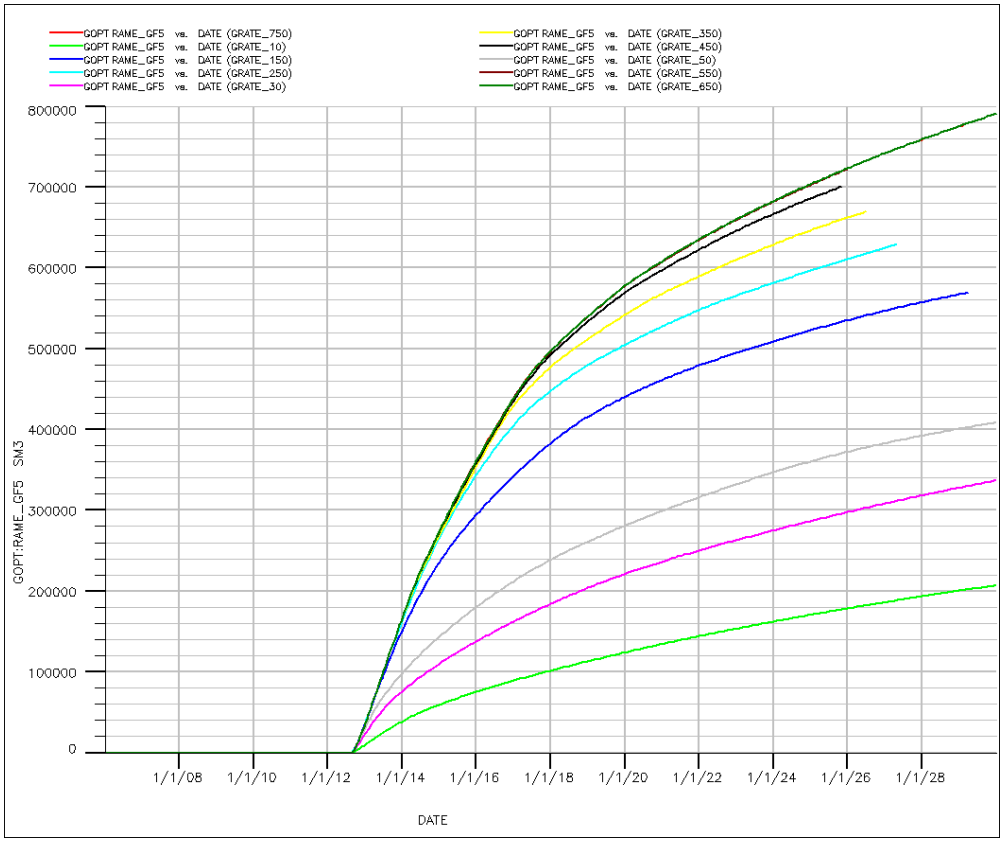
Figur 21: Ratestyrt GOPT GF2



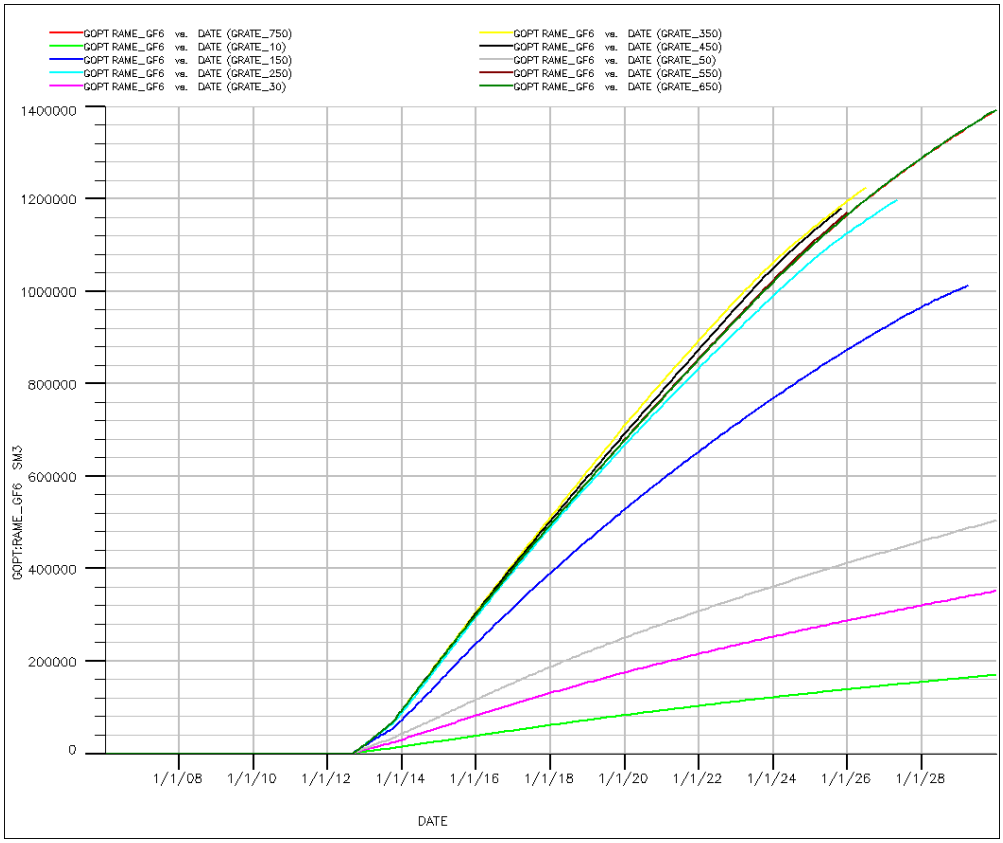
Figur 22: Ratestyrt GOPT GF3



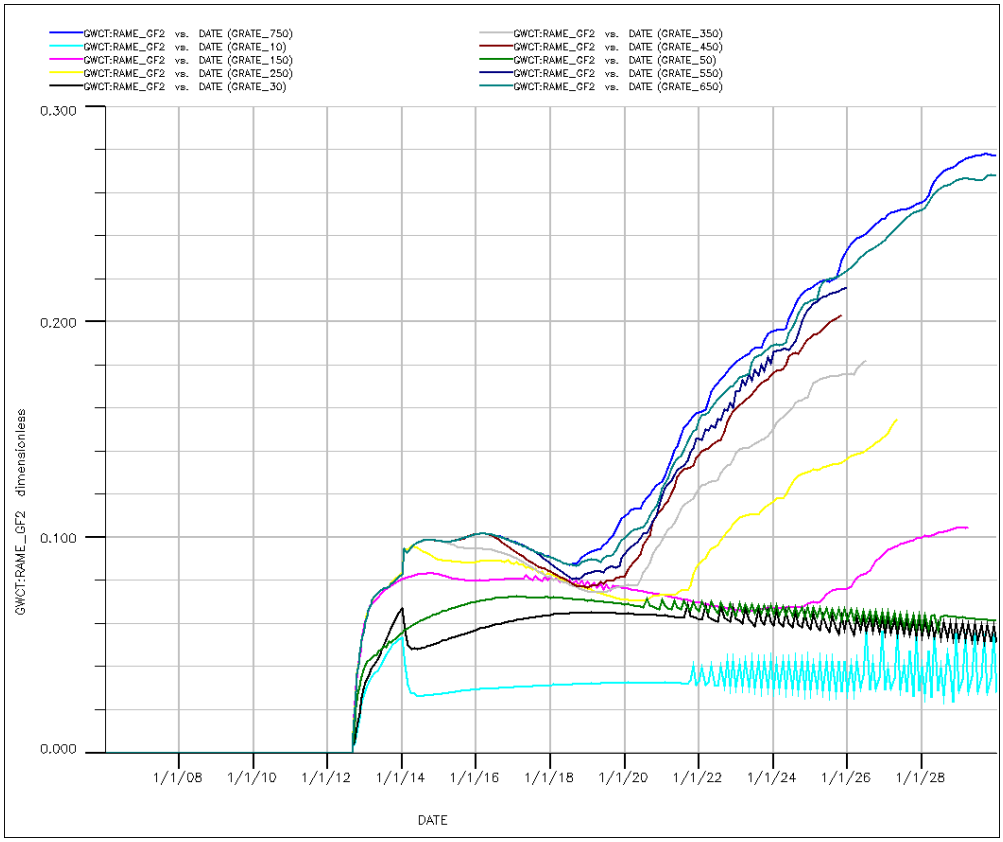
Figur 23: Ratestyrt GOPT GF4



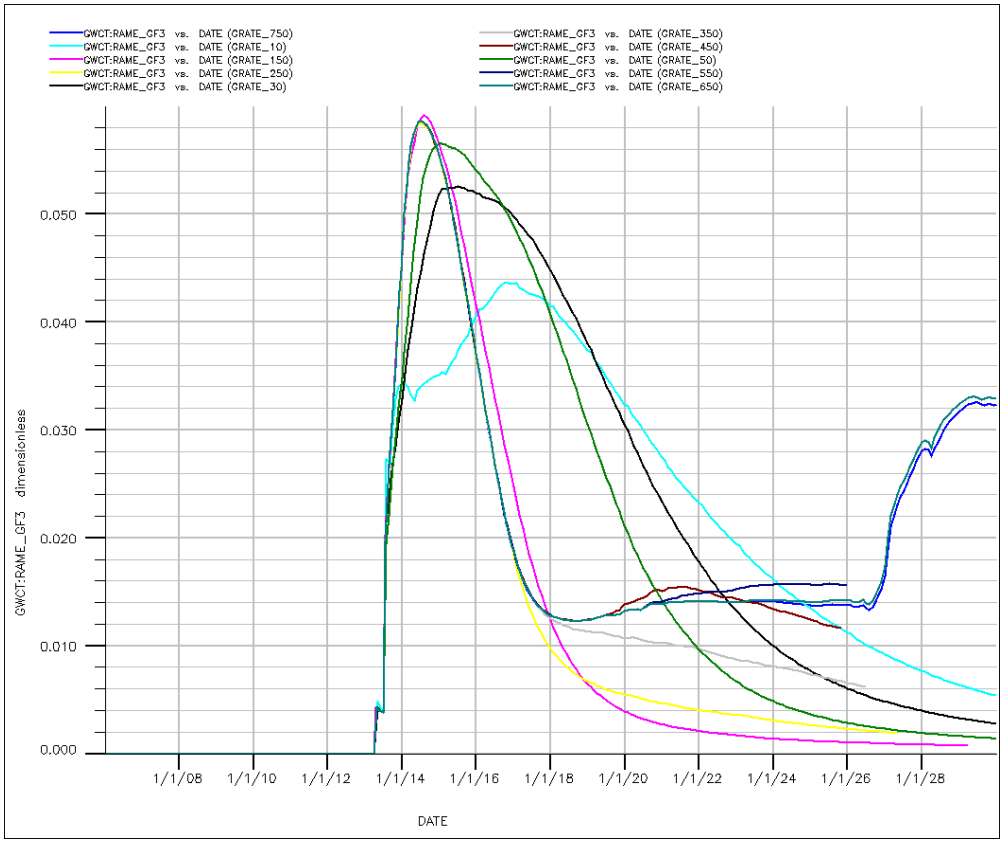
Figur 24: Ratestyrt GOPT GF5



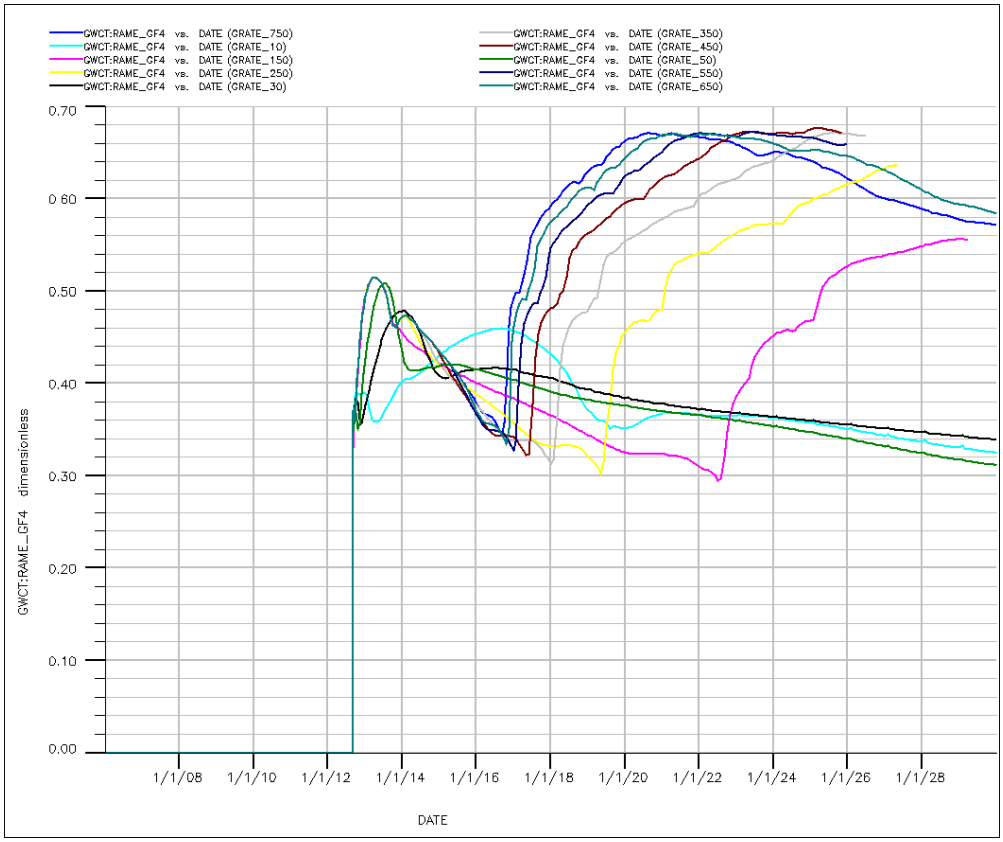
Figur 25: Ratestyrt GOPT GF6



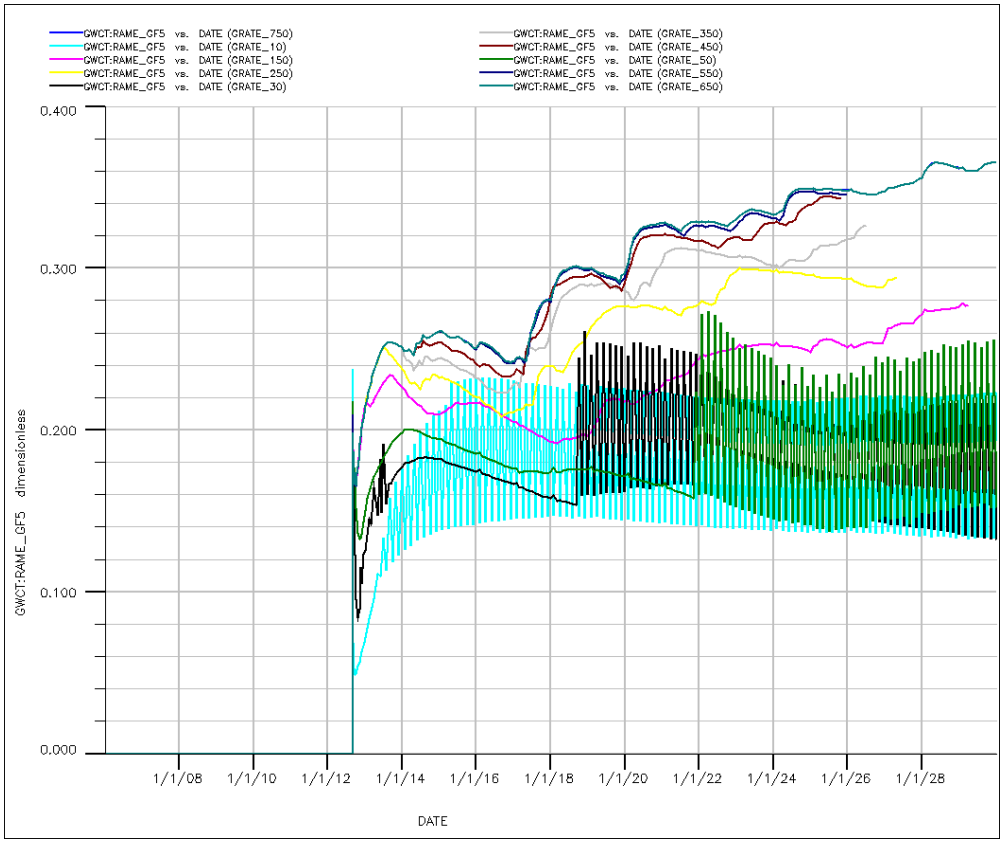
Figur 26: Ratestyrt GWCT GF2



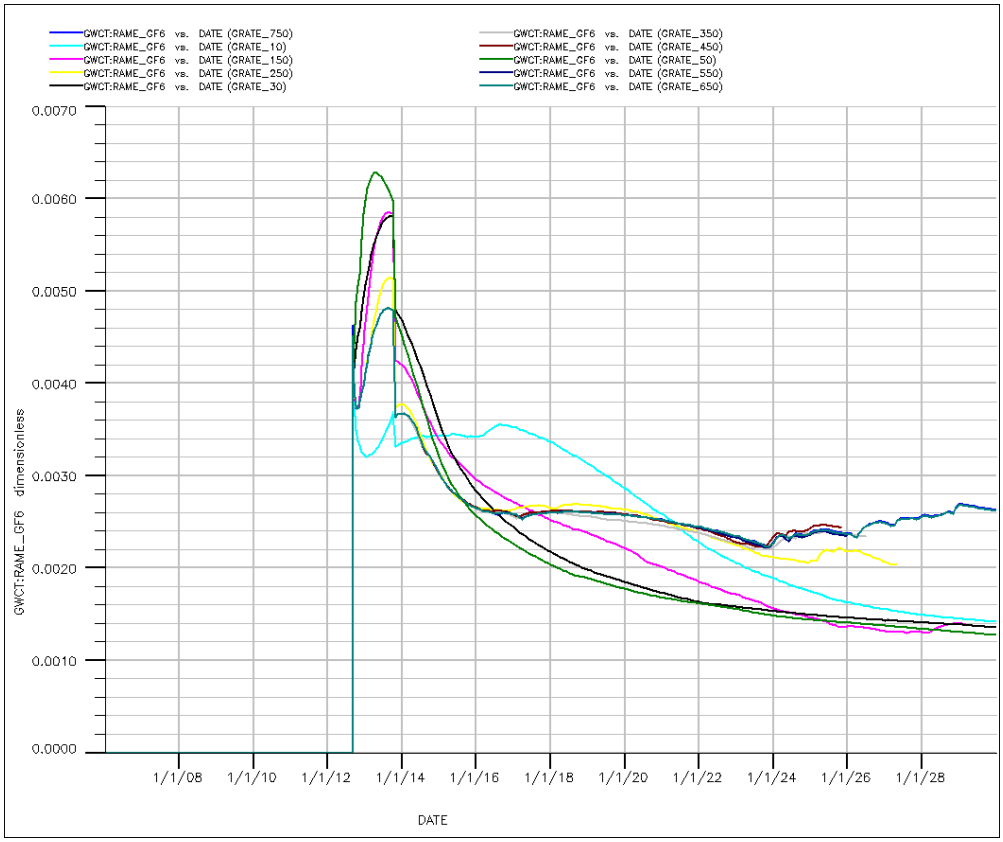
Figur 27: Ratestyrt GWCT GF3



Figur 28: Ratestyrt GWCT GF4

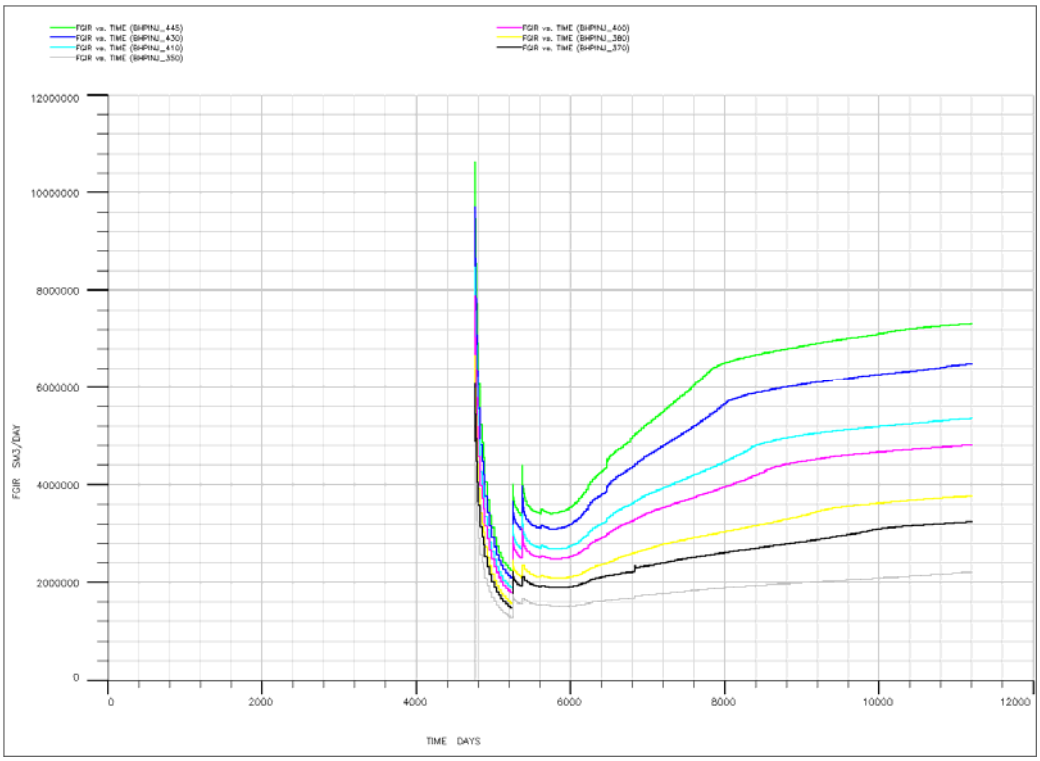


Figur 29: Ratestyrt GWCT GF5

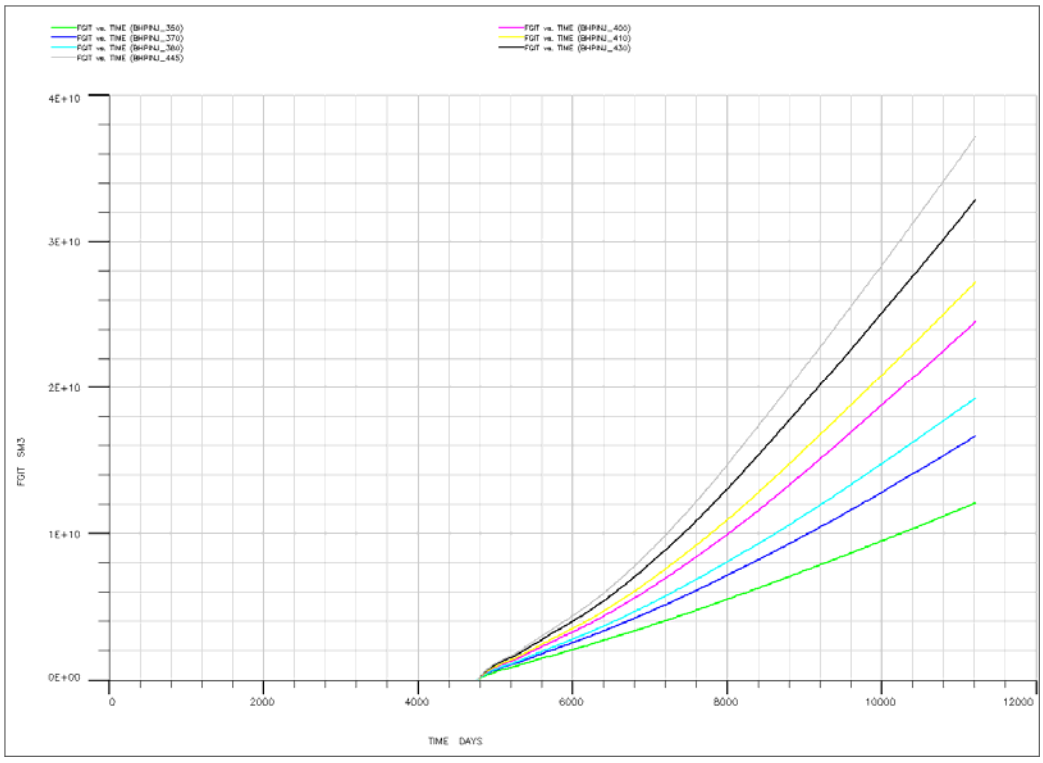


Figur 30: Ratestyrt GWCT GF6

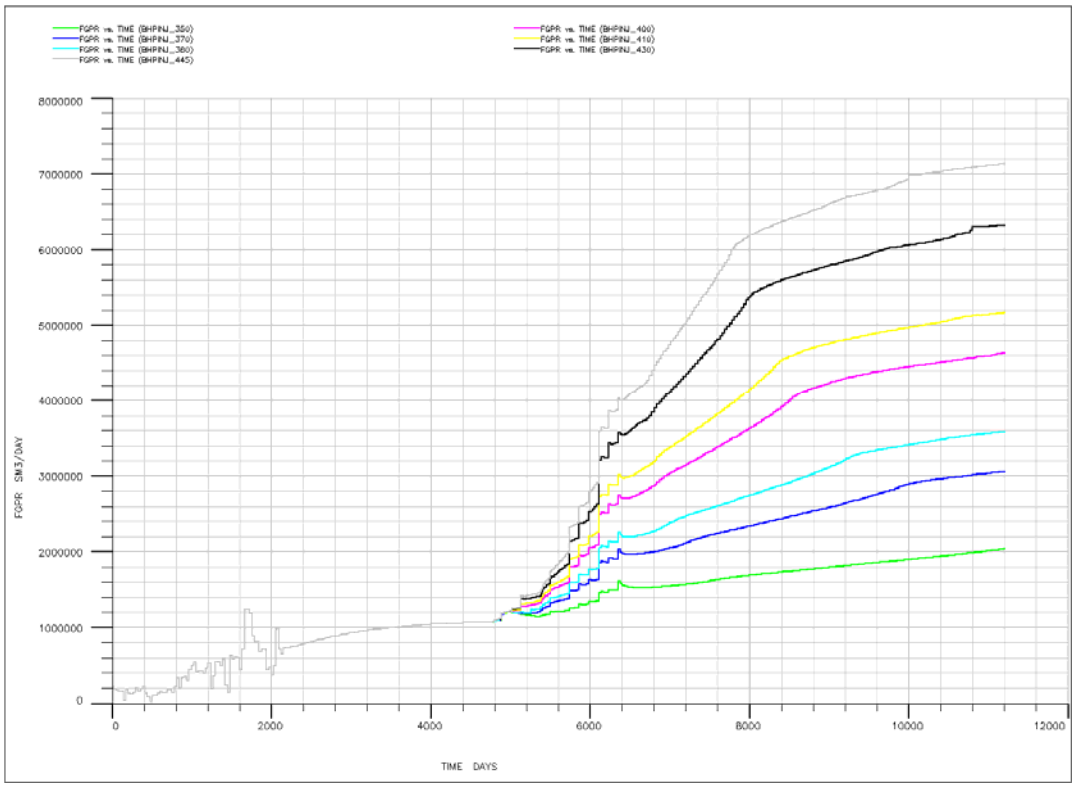
APPENDIKS B – BUNNHULLSTRYKK STYRT INJEKSJON



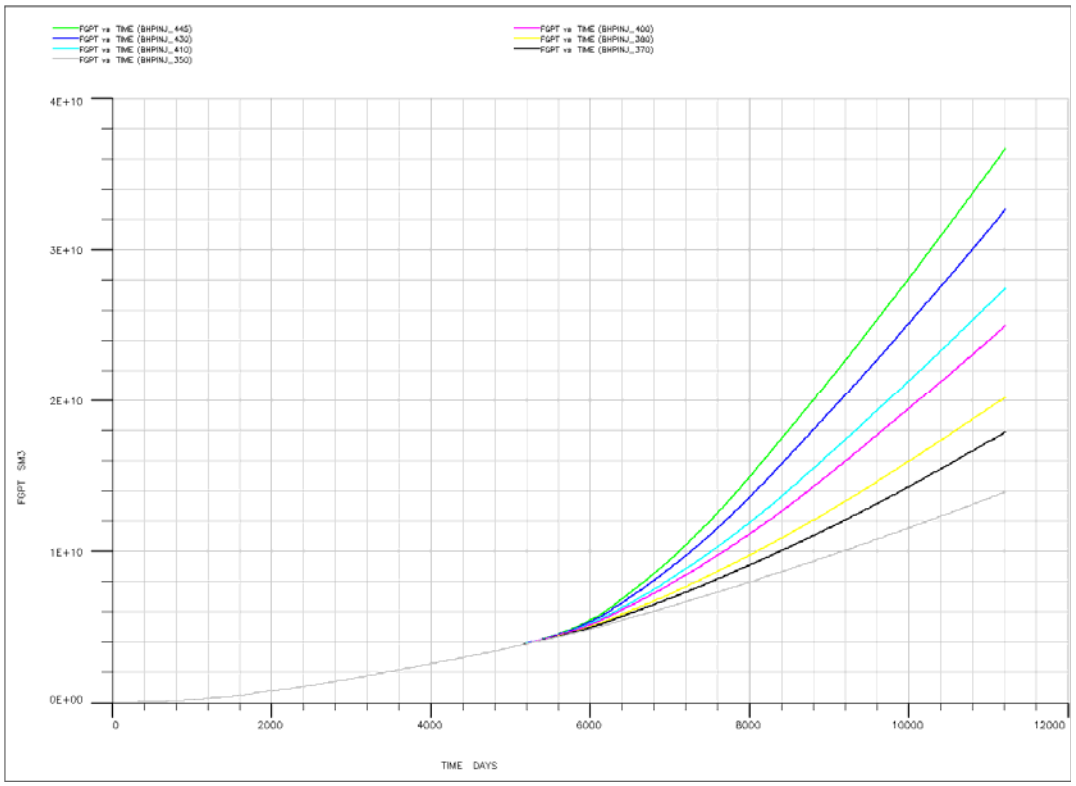
Figur 31: Bunnhullstrykk styrt FGIR



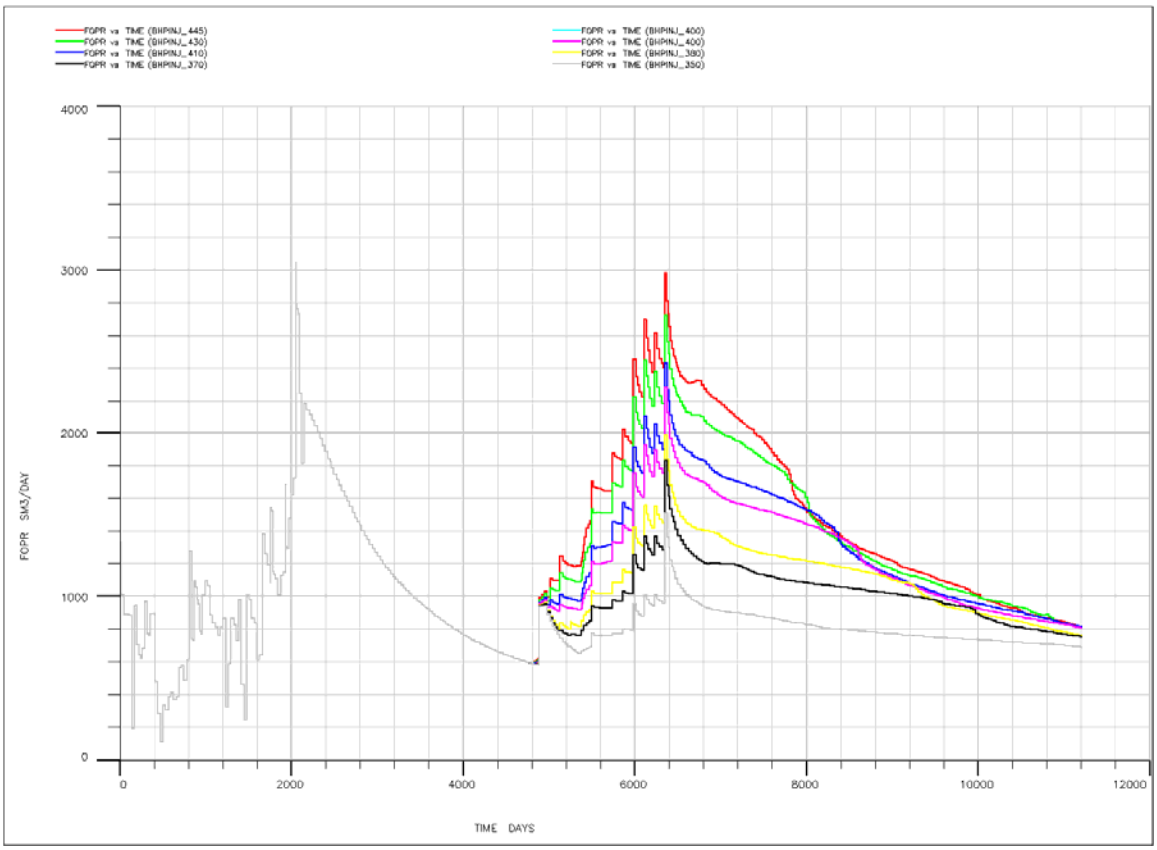
Figur 32: Bunnhullstrykk styrt FGIT



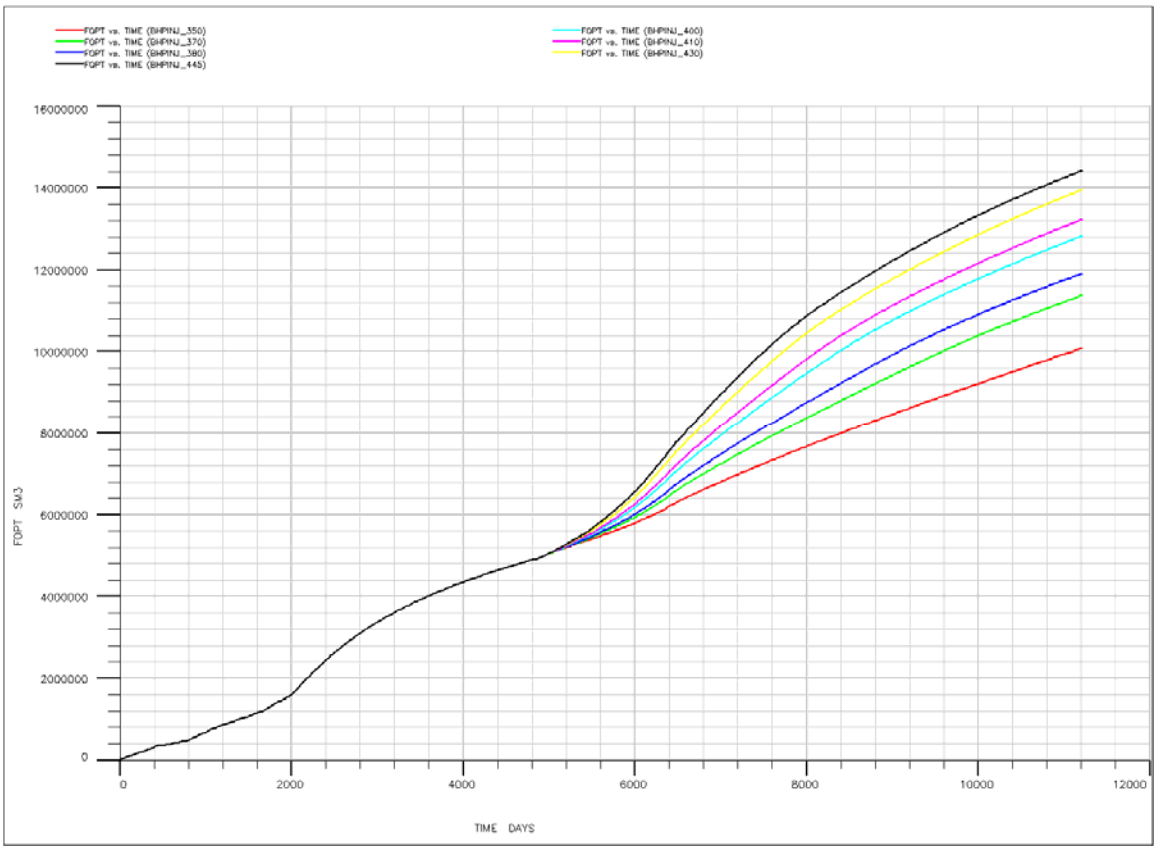
Figur 33: Bunnhullstrykk styrt FGPR



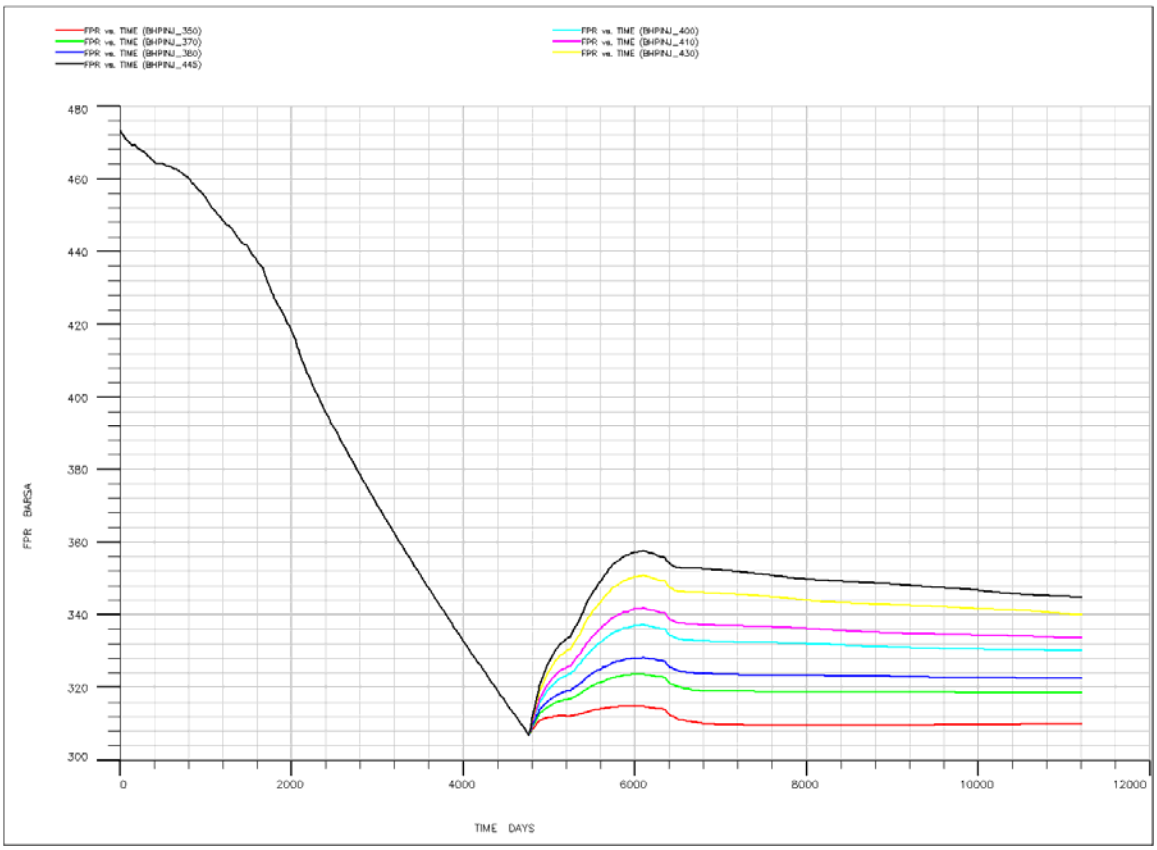
Figur 34: Bunnhullstrykk styrt FGPT



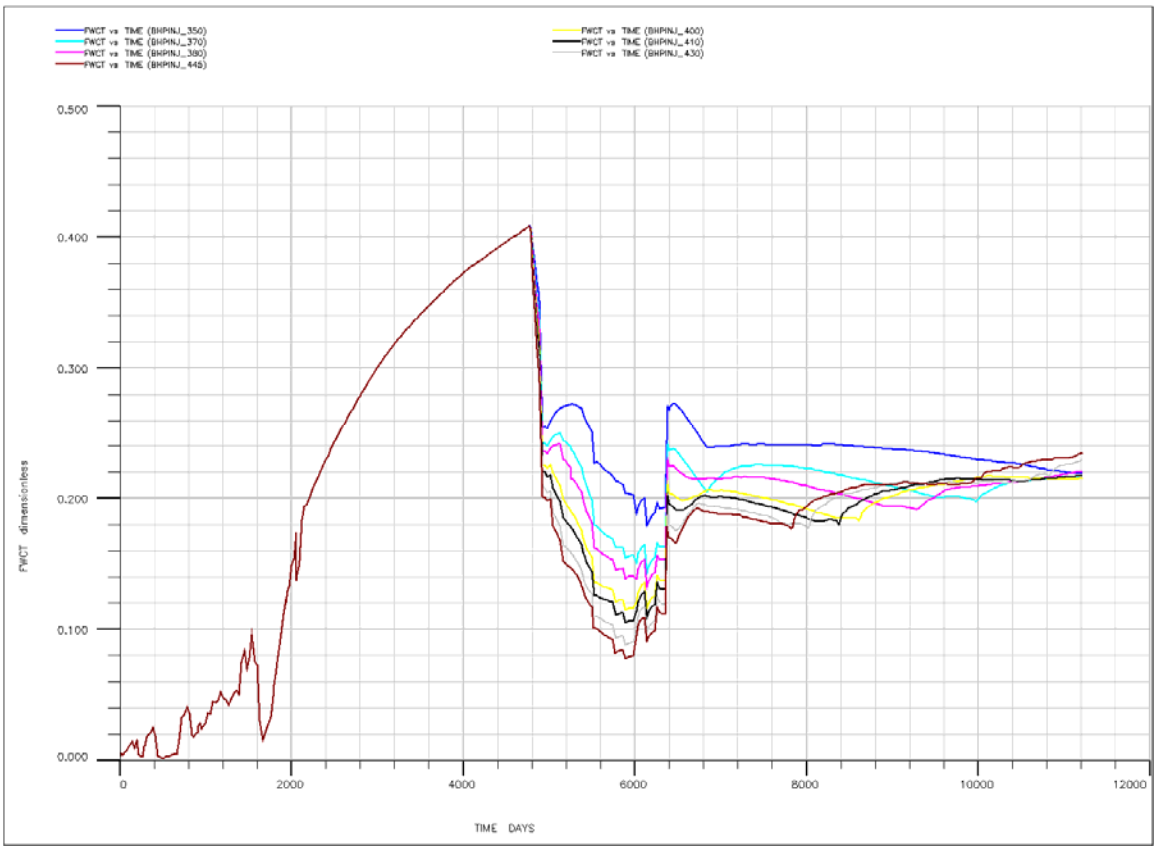
Figur 35: Bunnhullstrykk styrt FOPR



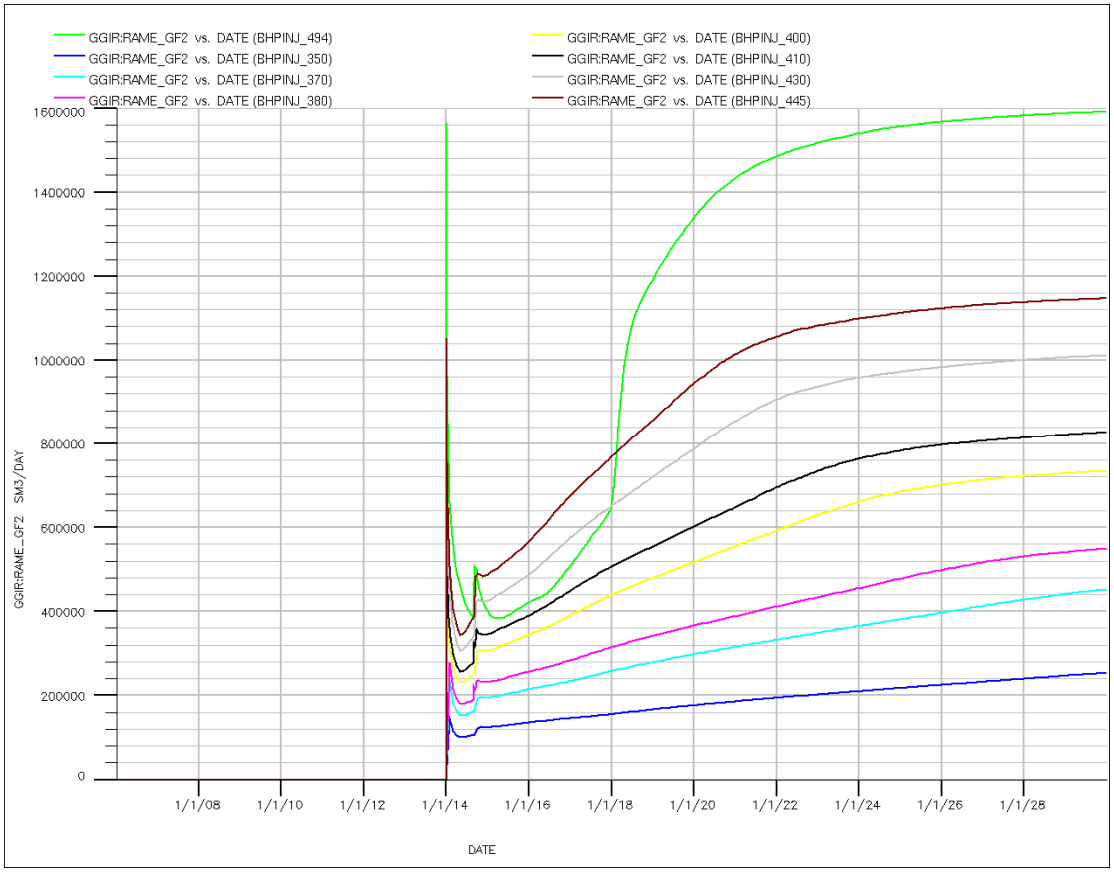
Figur 36: Bunnhullstrykk styrt FOPT



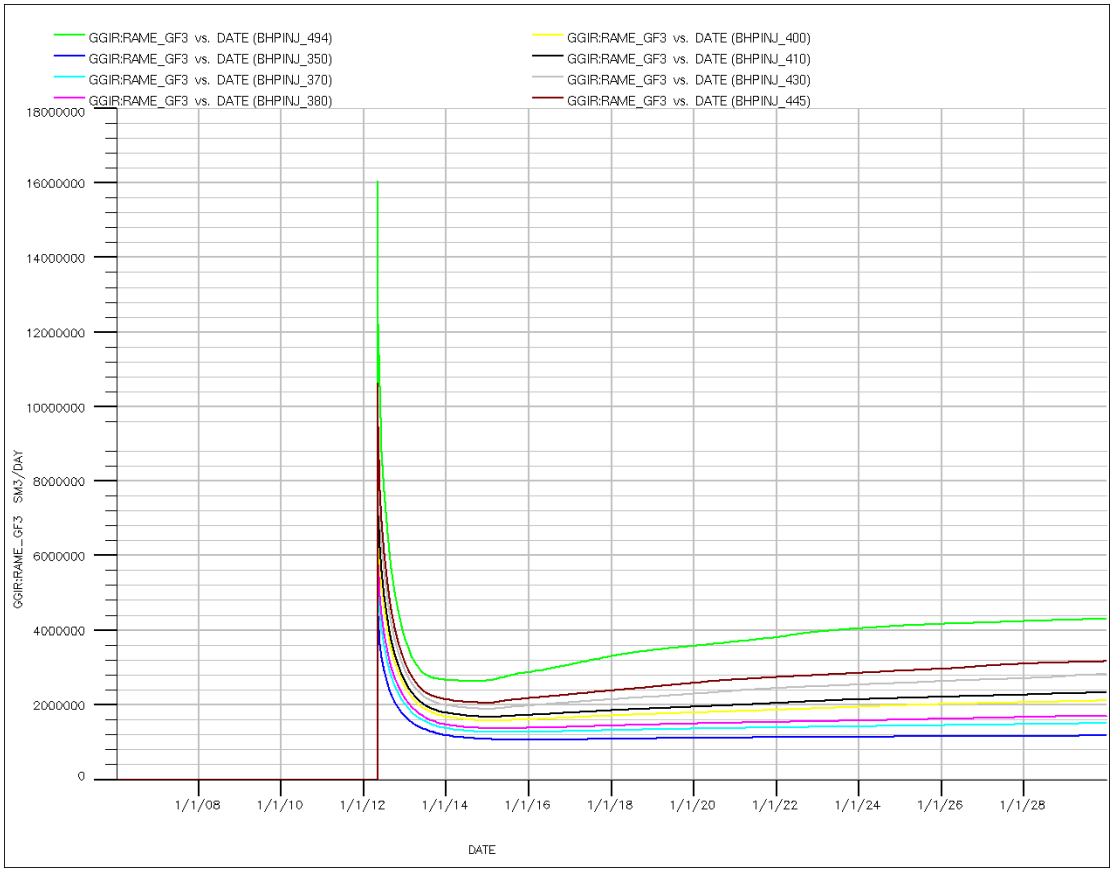
Figur 37: Bunnhullstrykk styrt FPR



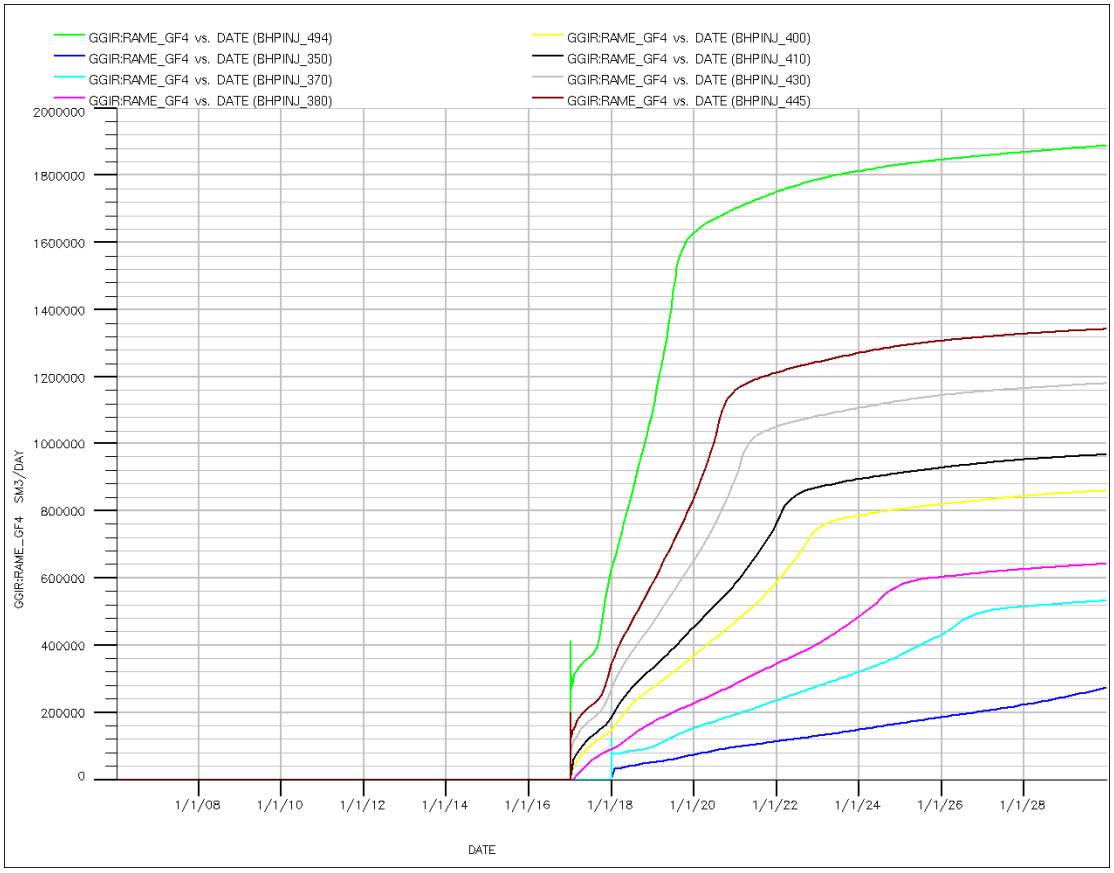
Figur 38: Bunnhullstrykk styrt FWCT



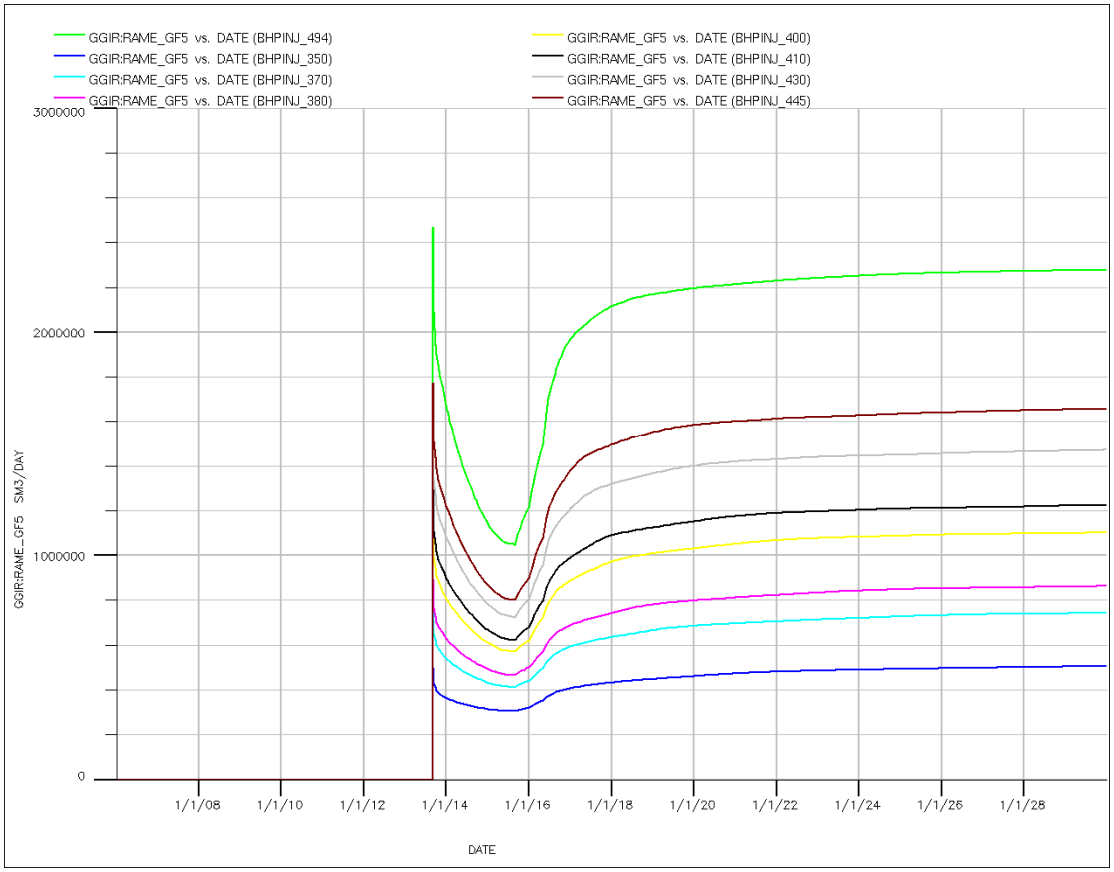
Figur 39: Bunnhullstrykk styrt GGIR GF2



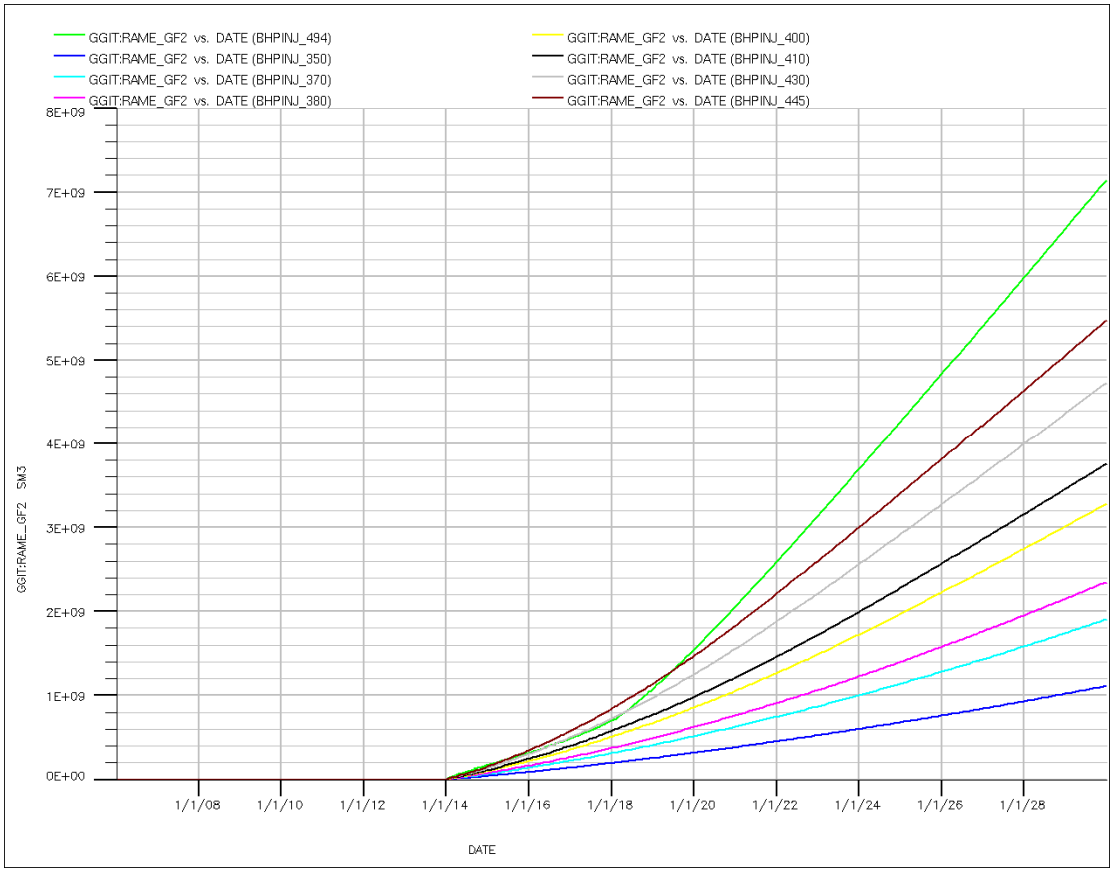
Figur 40: Bunnhullstrykk styrt GGIR GF3



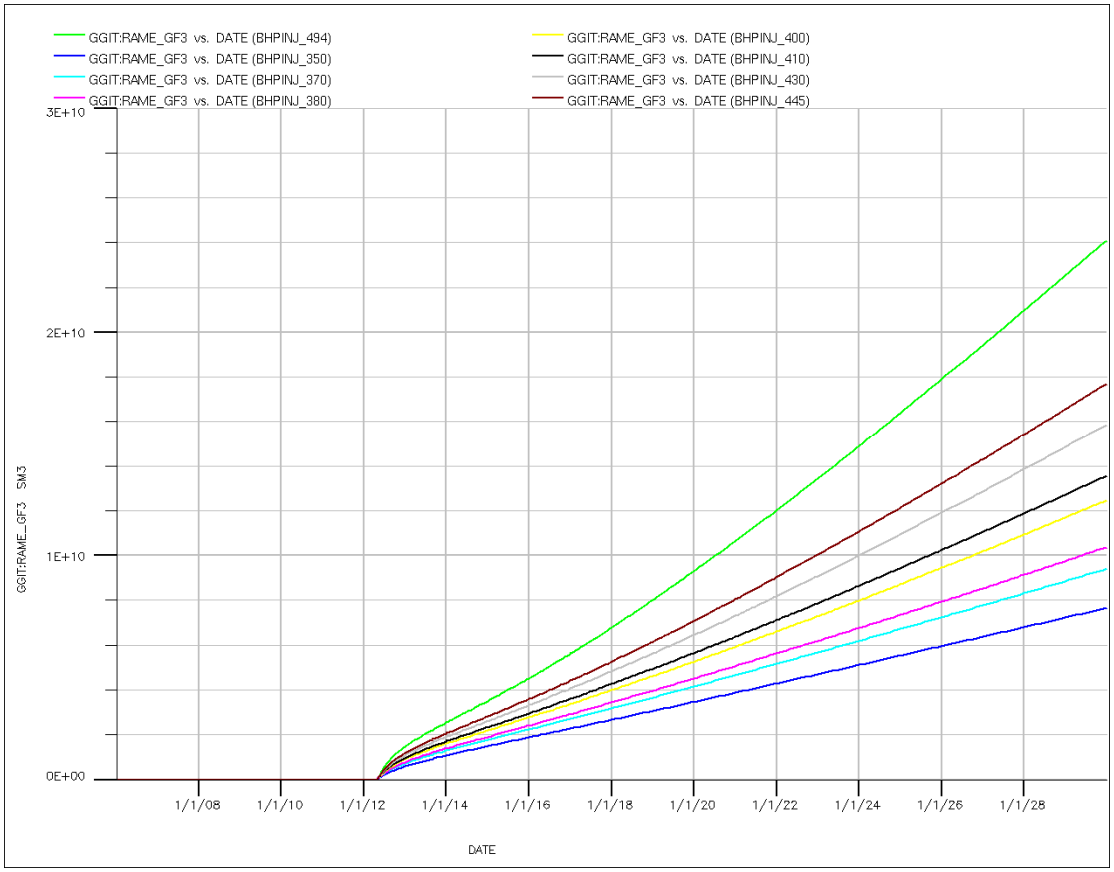
Figur 41: Bunnhullstrykk styrt GGIR GF4



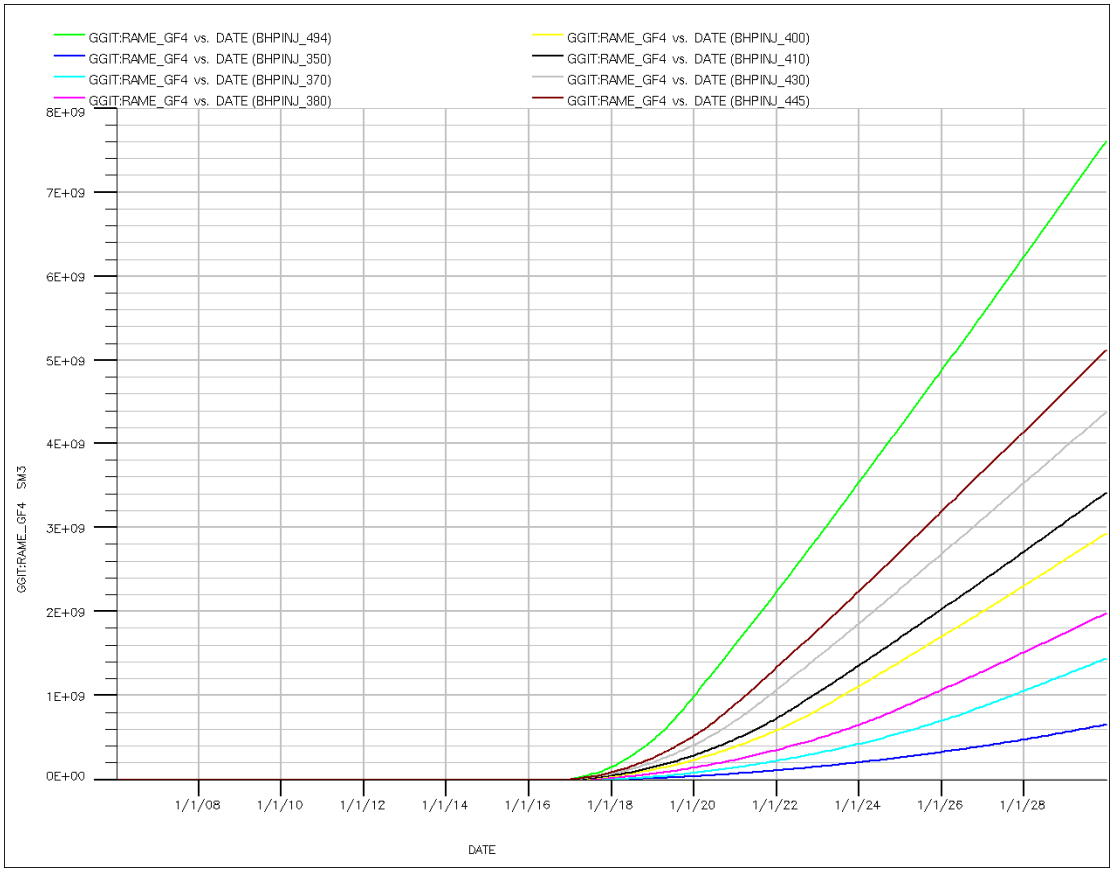
Figur 42: Bunnhullstrykk styrt GGIR GF5



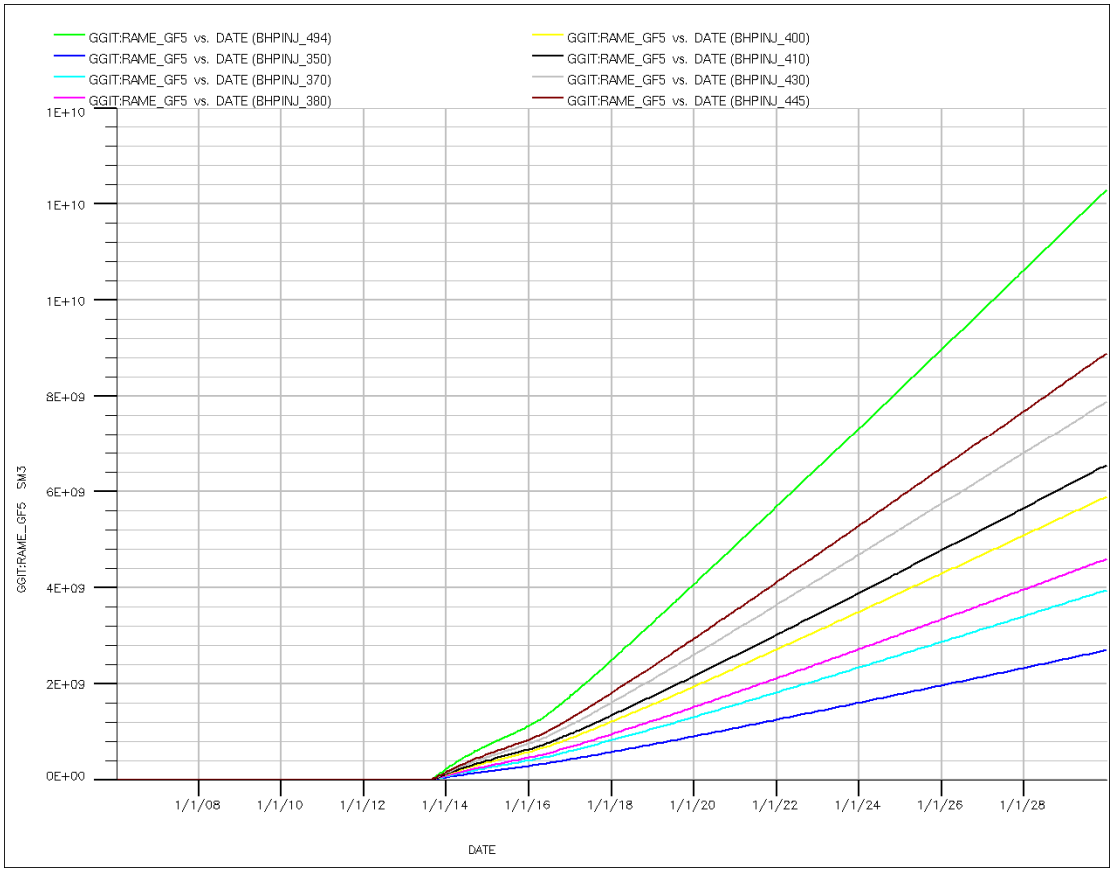
Figur 43: Bunnhullstrykk styrt GGIT GF2



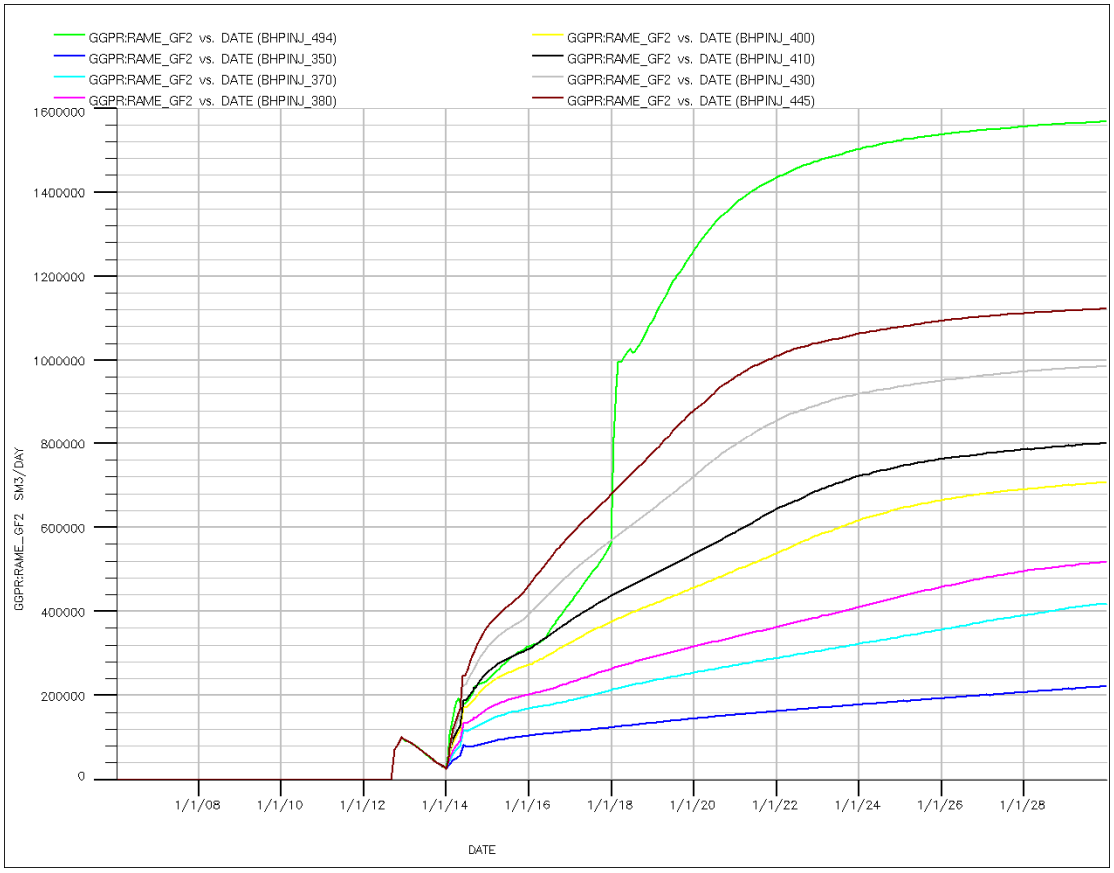
Figur 44: Bunnhullstrykk styrt GGIT GF3



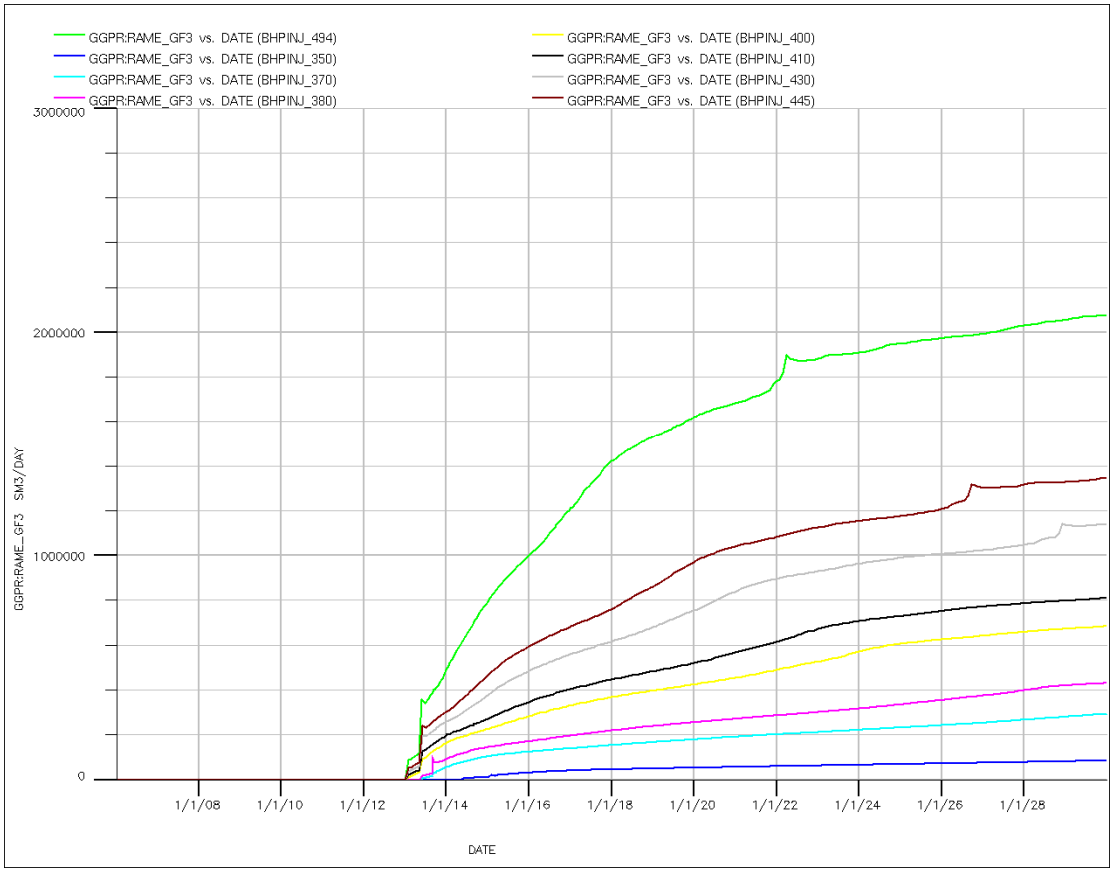
Figur 45: Bunnhullstrykk styrt GGIT GF4



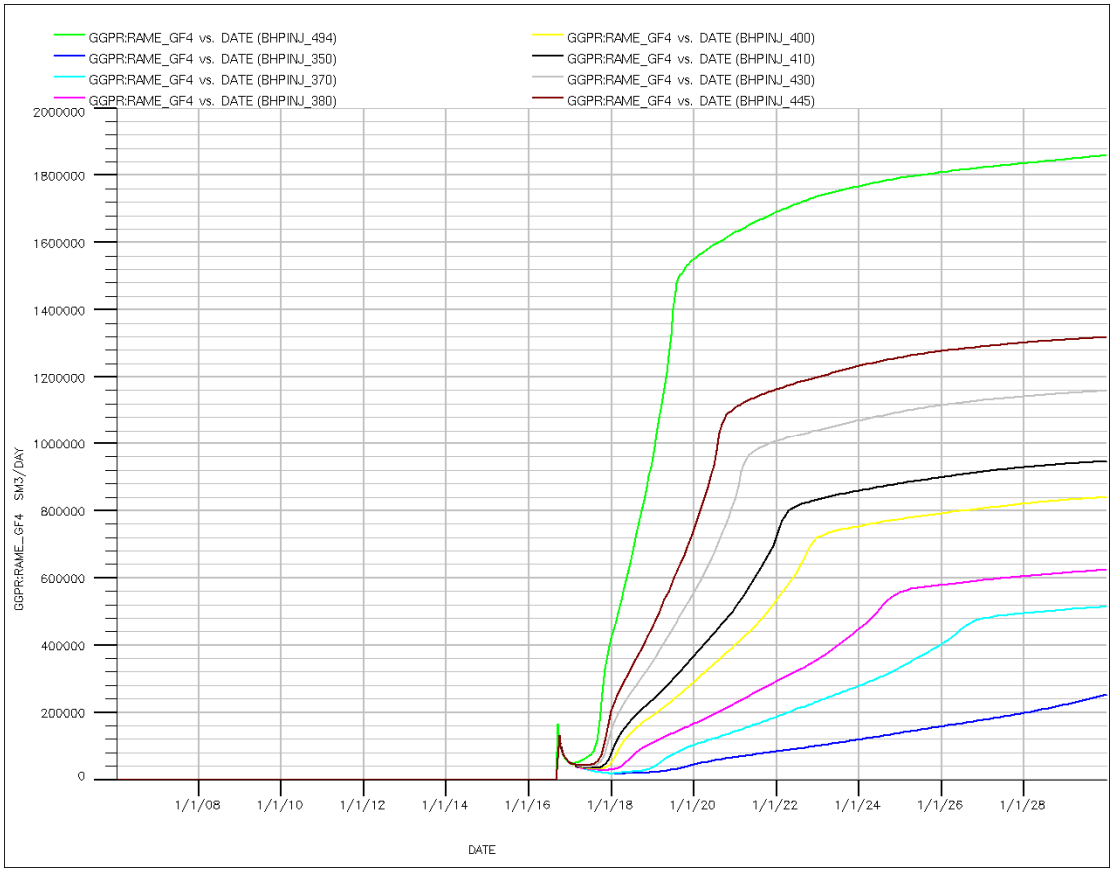
Figur 46: Bunnhullstrykk styrt GGIT GF5



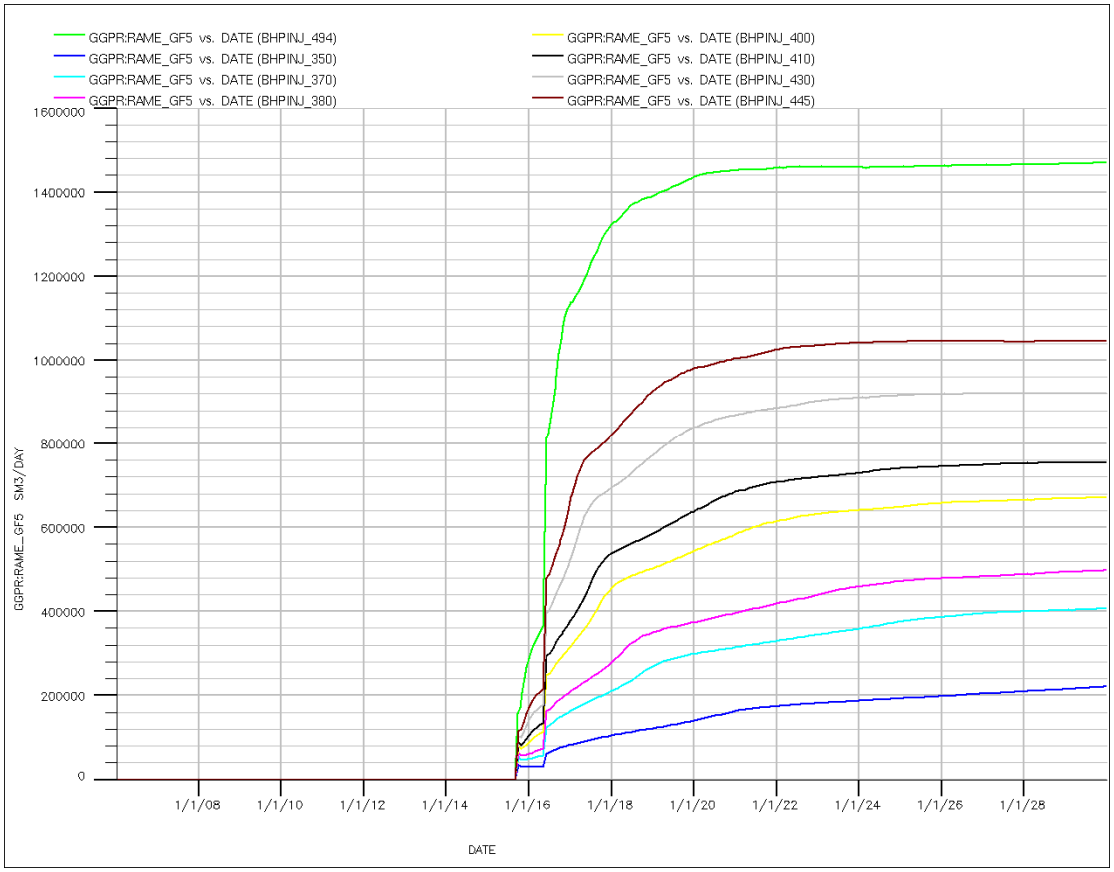
Figur 47: Bunnhullstrykk styrt GGPR GF2



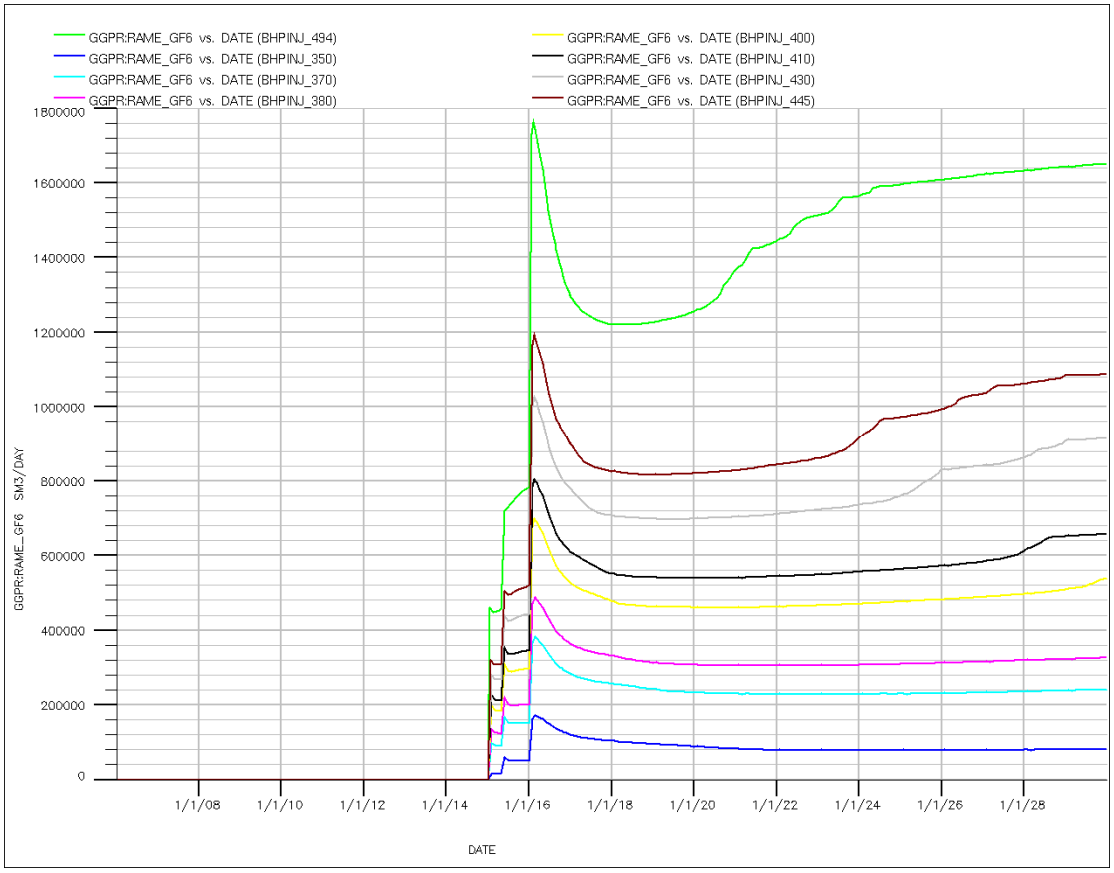
Figur 48: Bunnhullstrykk styrt GGPR GF3



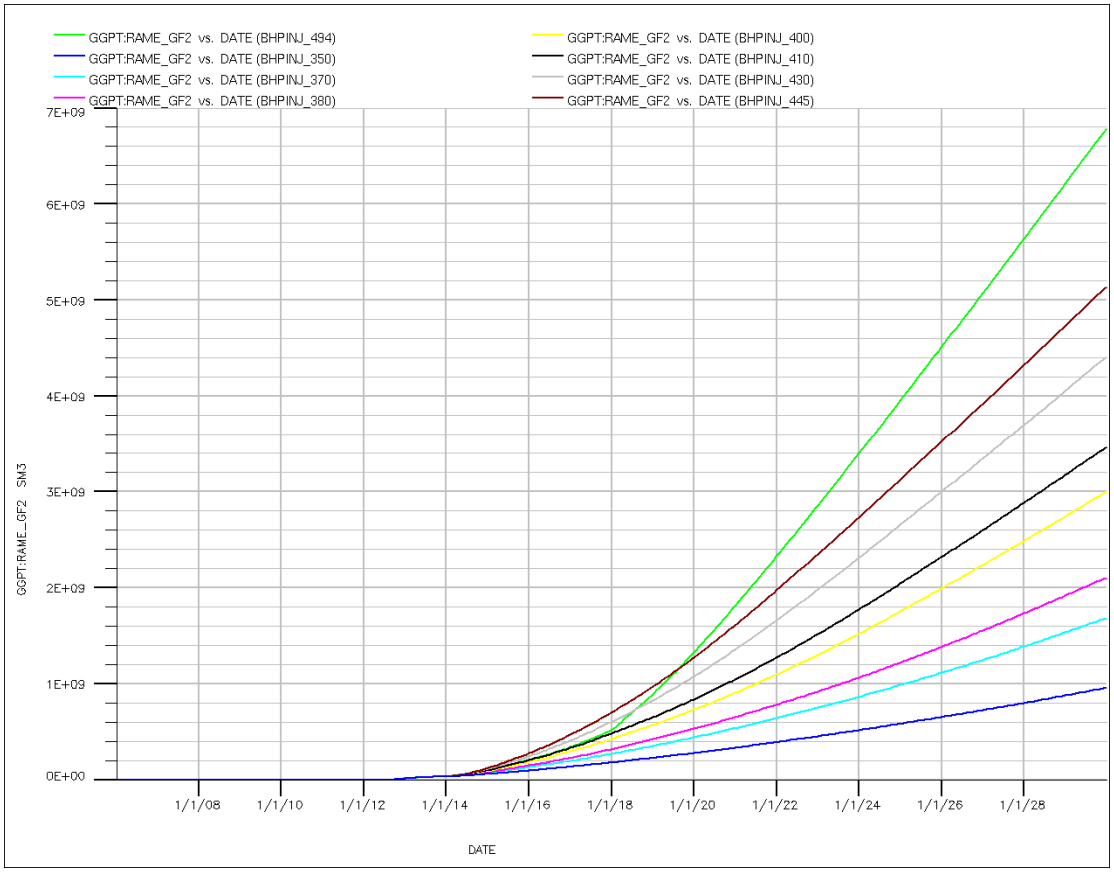
Figur 49: Bunnhullstrykk styrt GGPR GF4



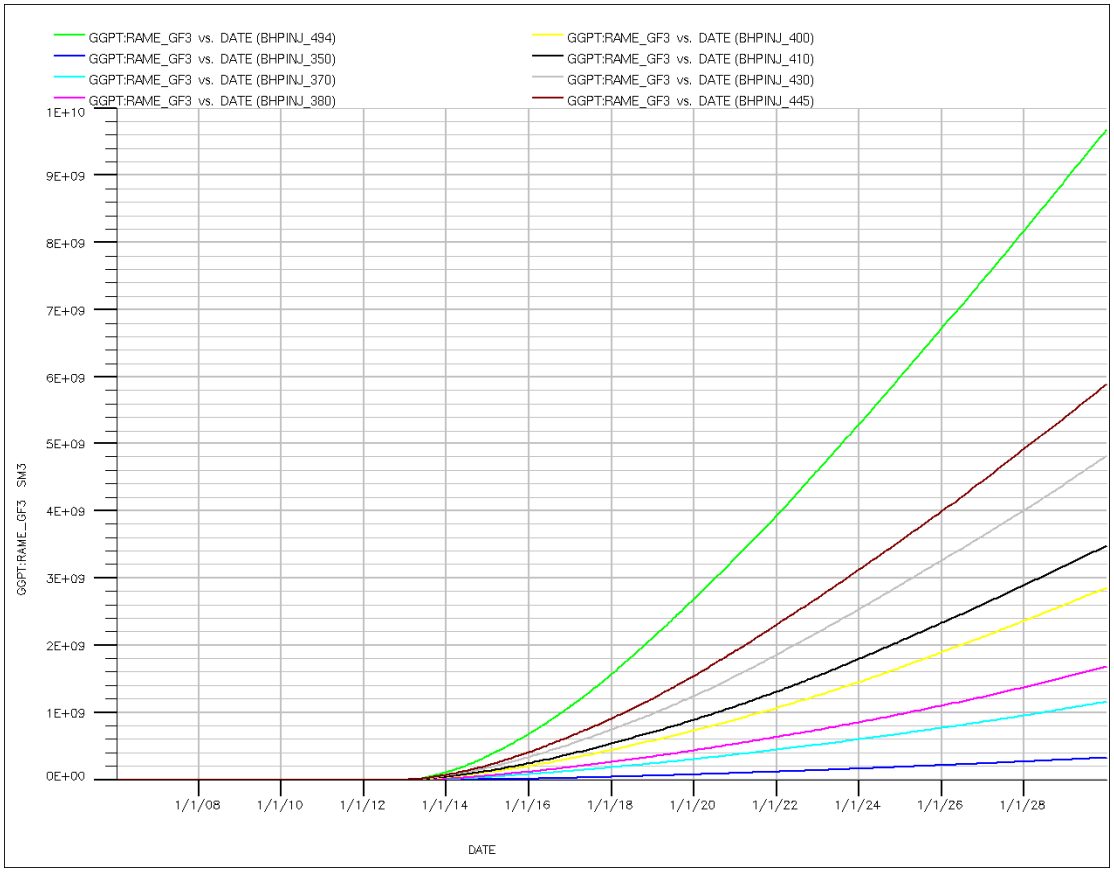
Figur 50: Bunnhullstrykk styrt GGPR GF5



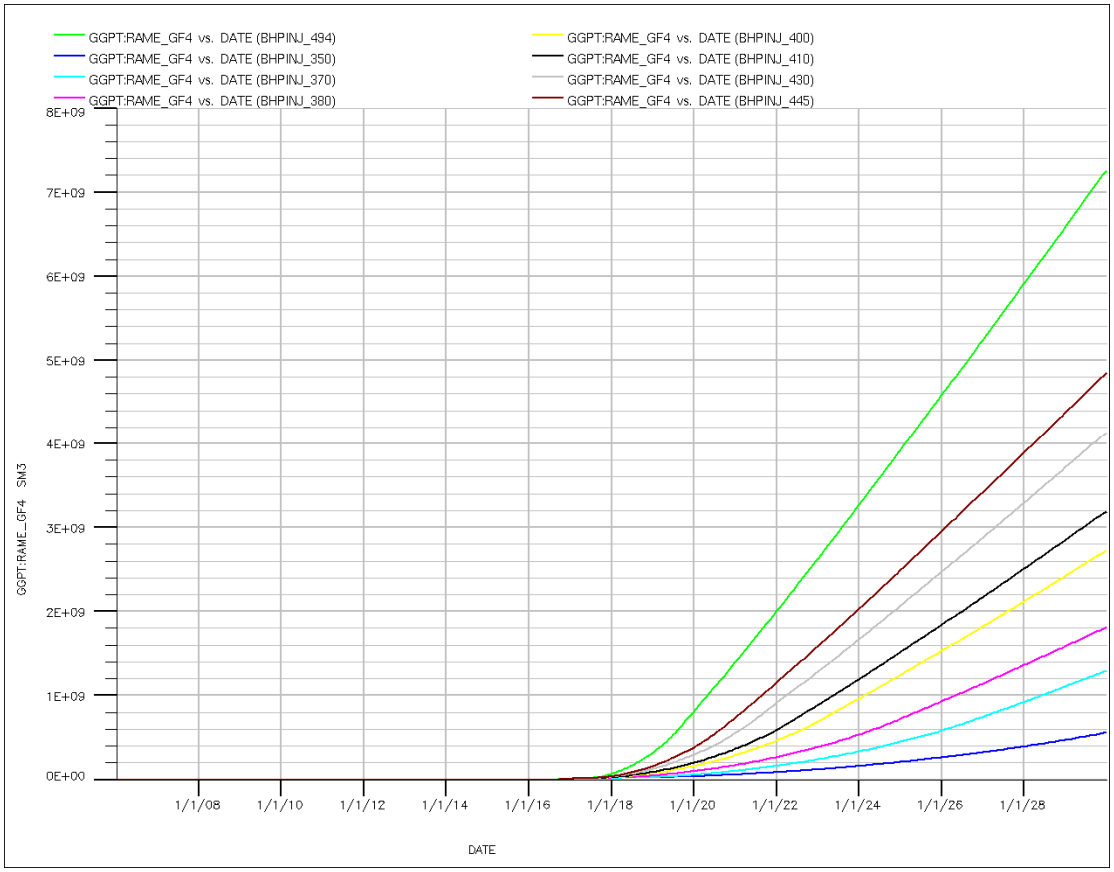
Figur 51: Bunnhullstrykk styrt GGPR GF6



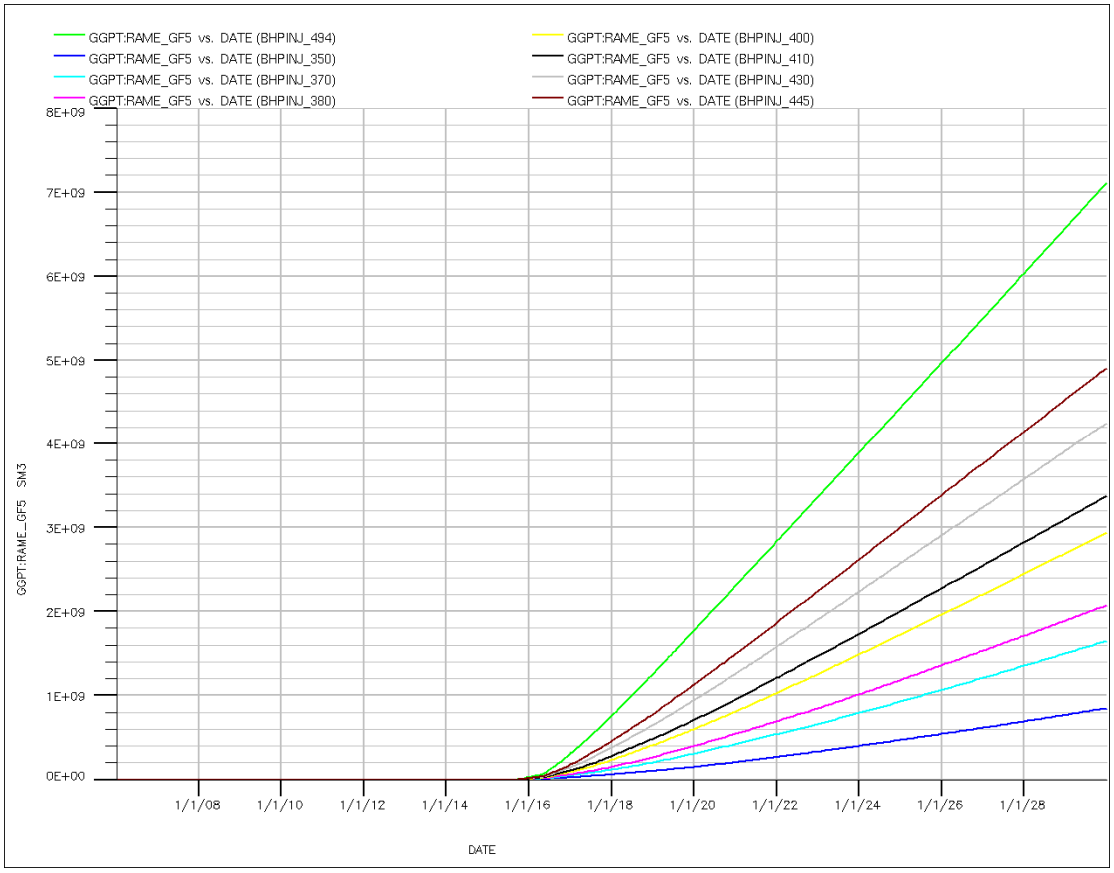
Figur 52: Bunnhullstrykk styrt GGPT GF2



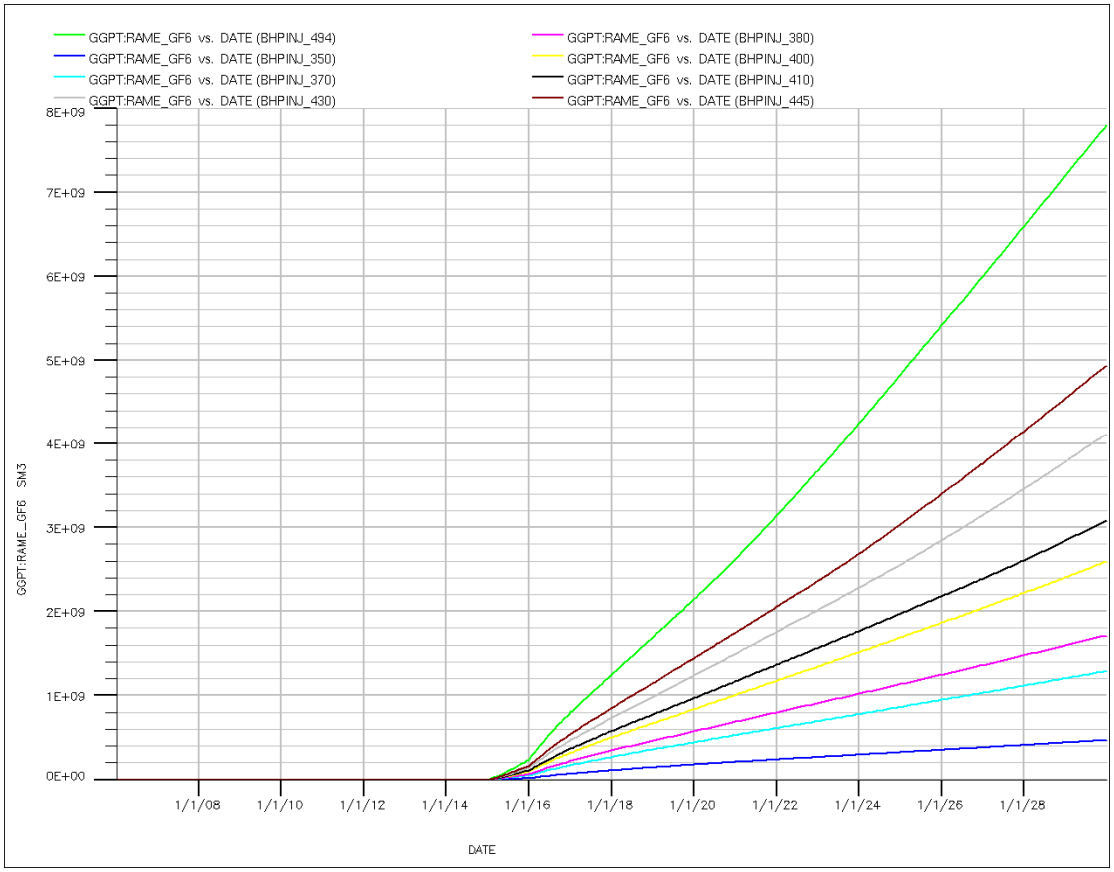
Figur 53: Bunnhullstrykk styrt GGPT GF3



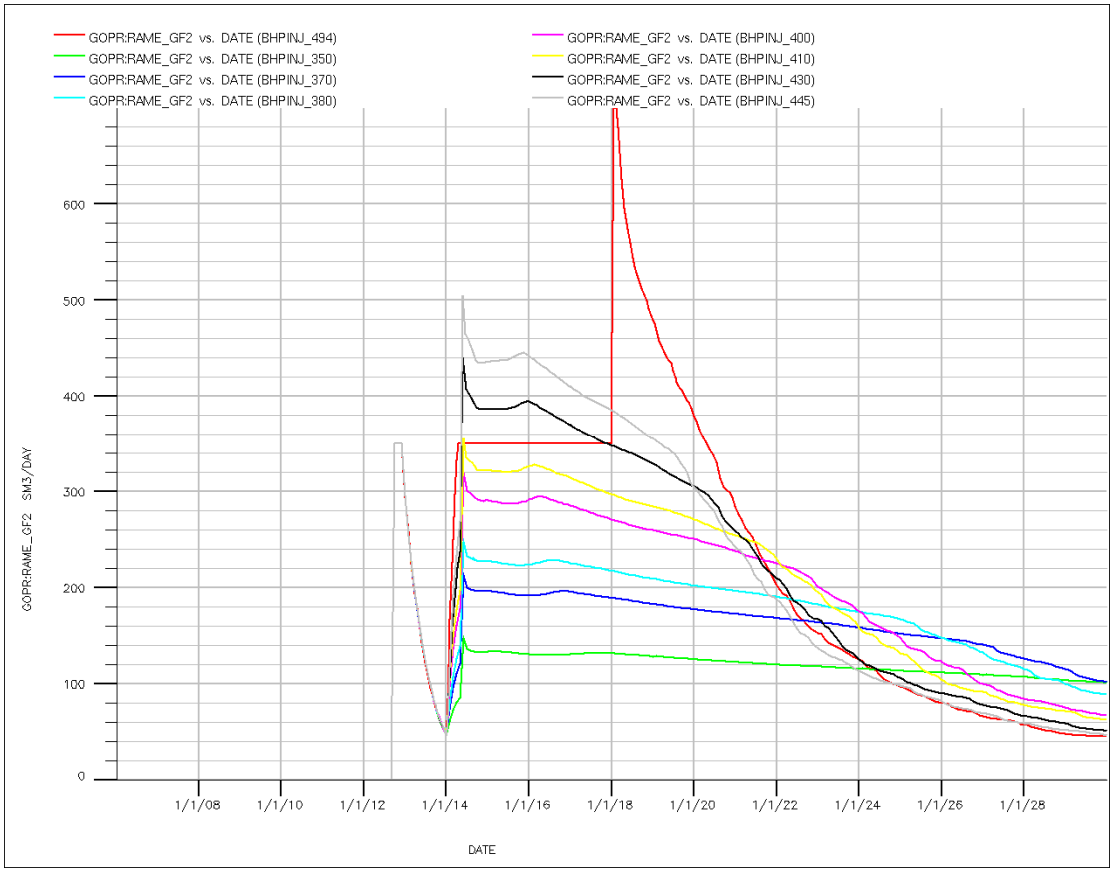
Figur 54: Bunnhullstrykk styrt GGPT GF4



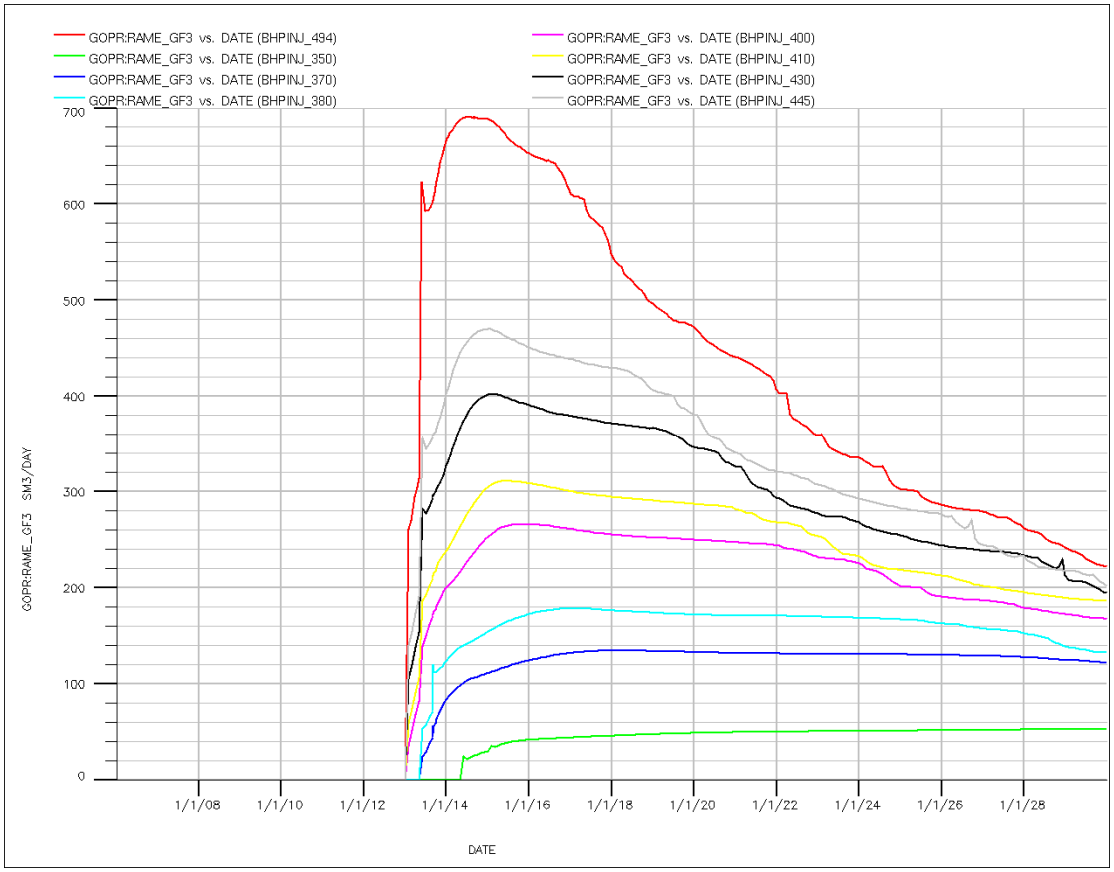
Figur 55: Bunnhullstrykk styrt GGPT GF5



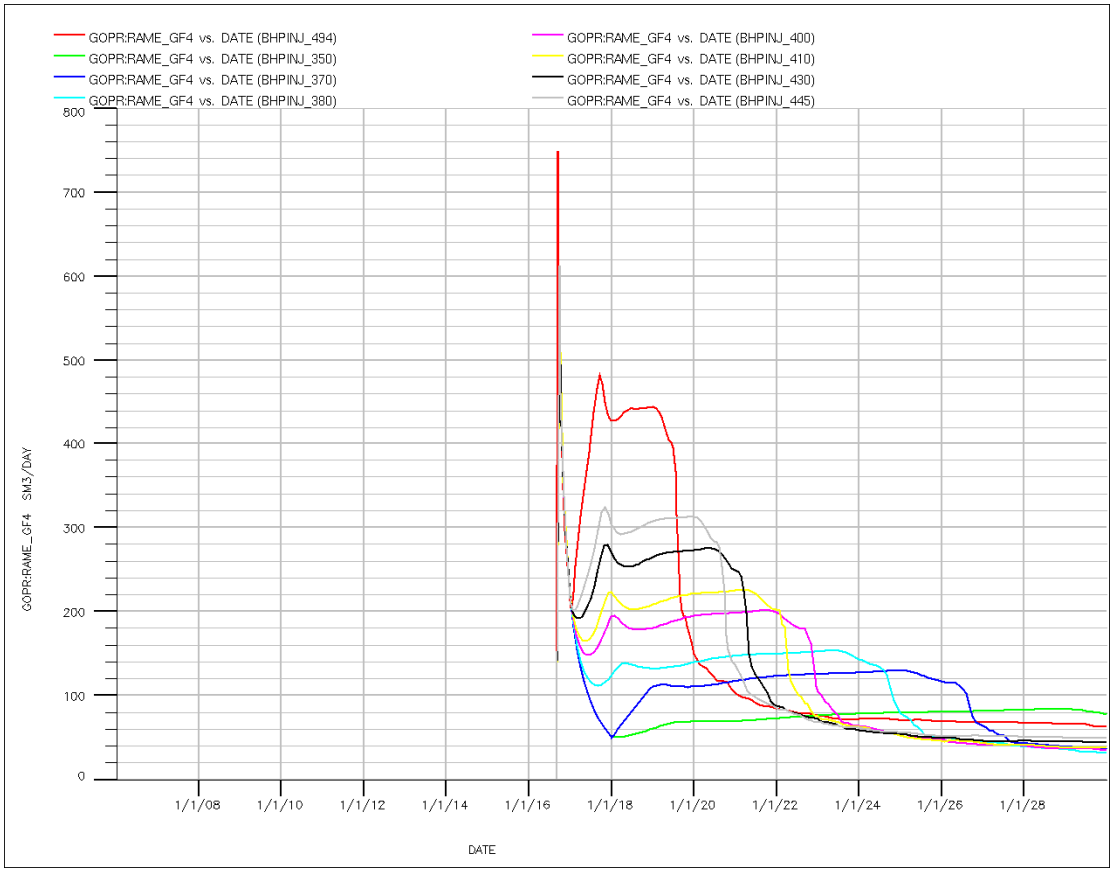
Figur 56: Bunnhullstrykk styrt GGPT GF6



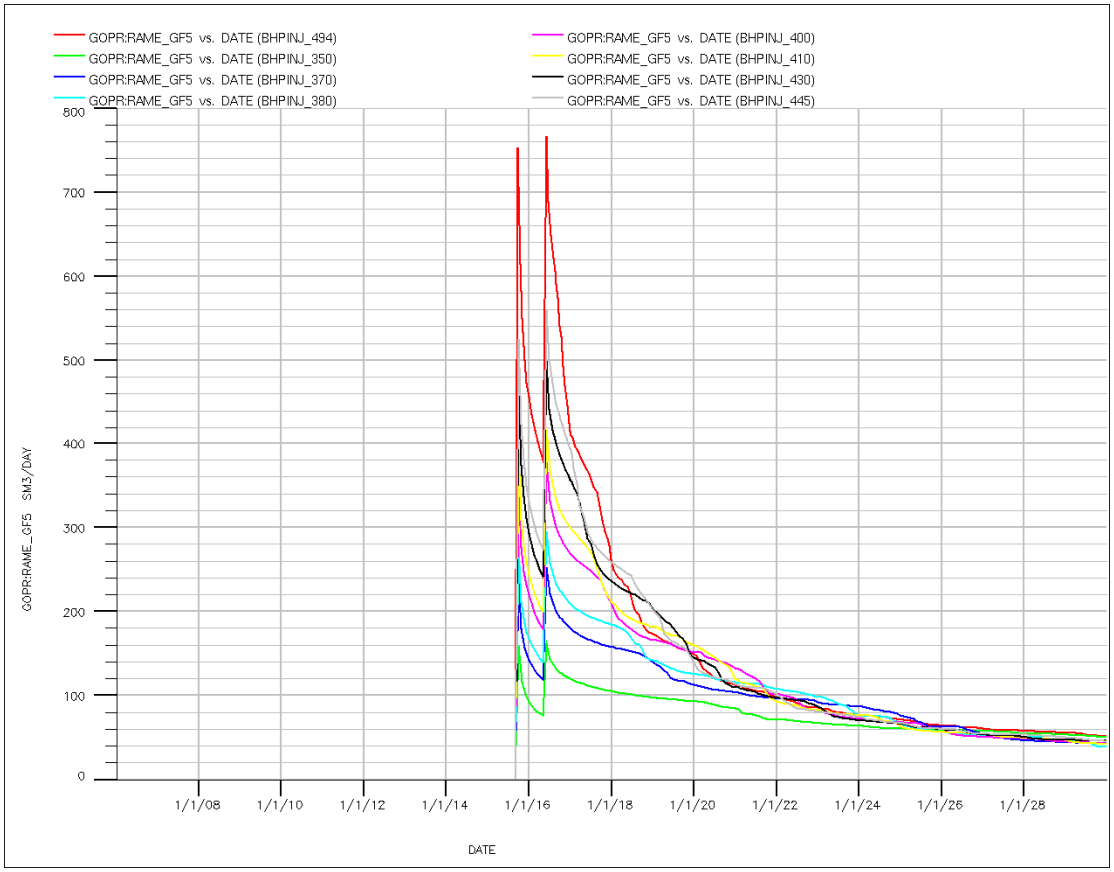
Figur 57: Bunnhullstrykk styrt GOPR GF2



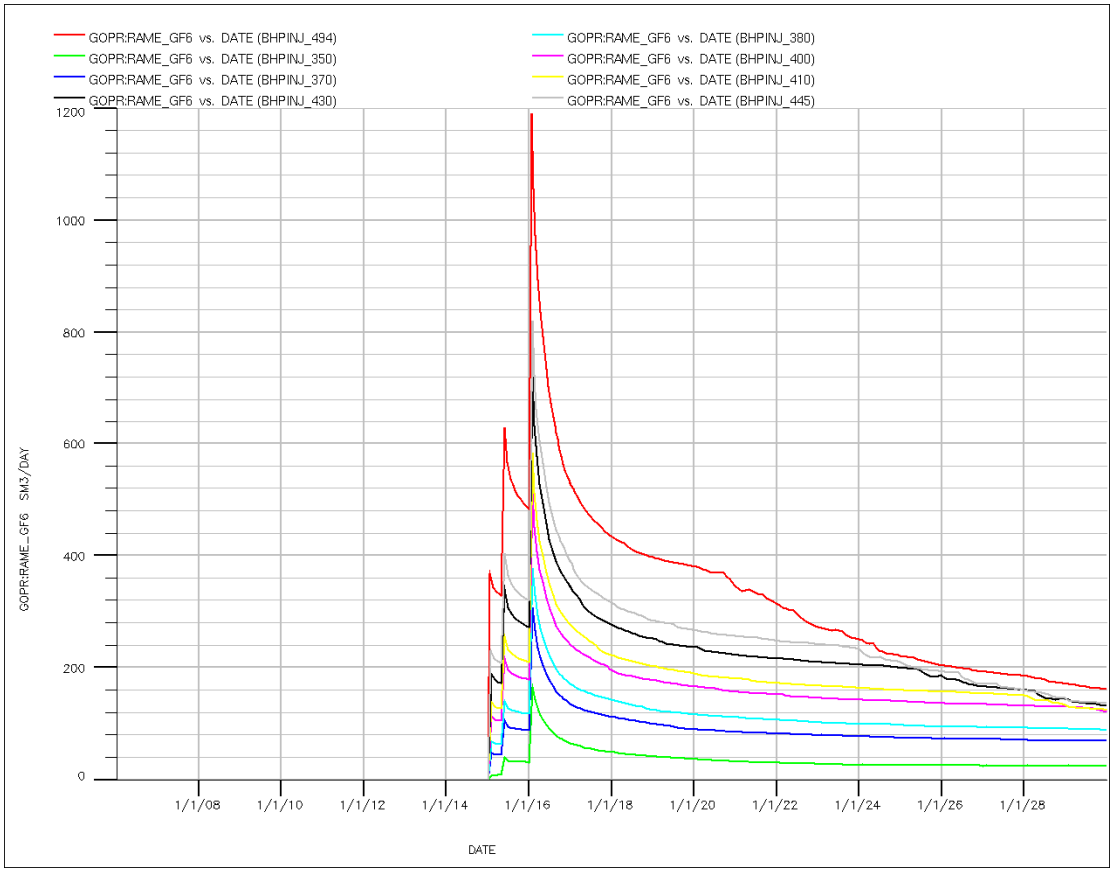
Figur 58: Bunnhullstrykk styrt GOPR GF3



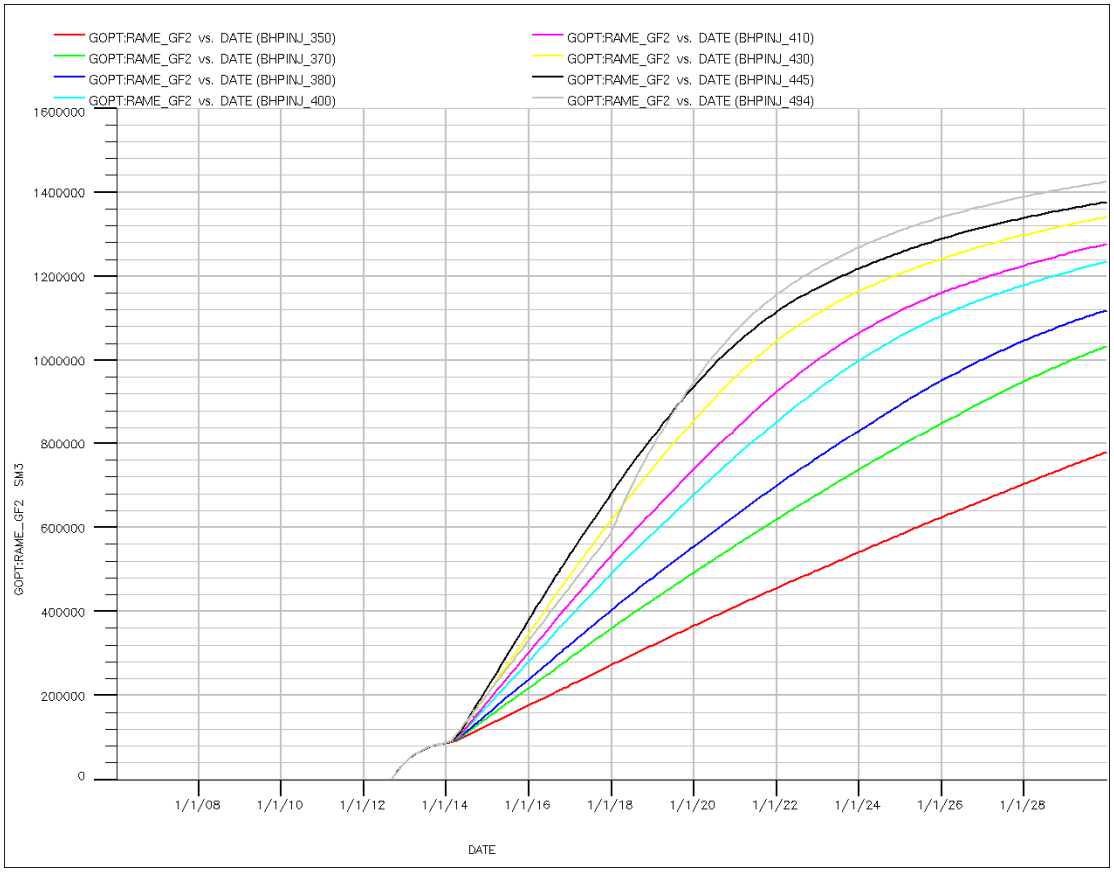
Figur 59: Bunnhullstrykk styrt GOPR GF4



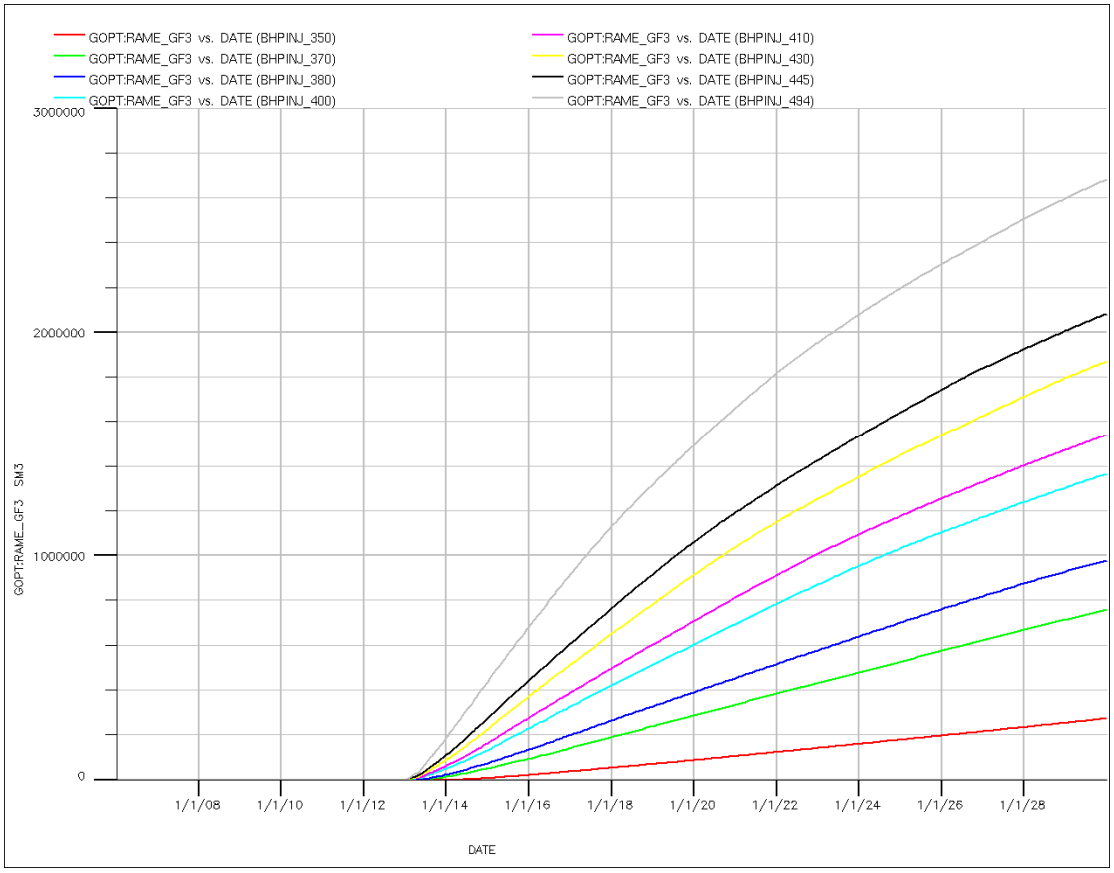
Figur 60: Bunnhullstrykk styrt GOPR GF5



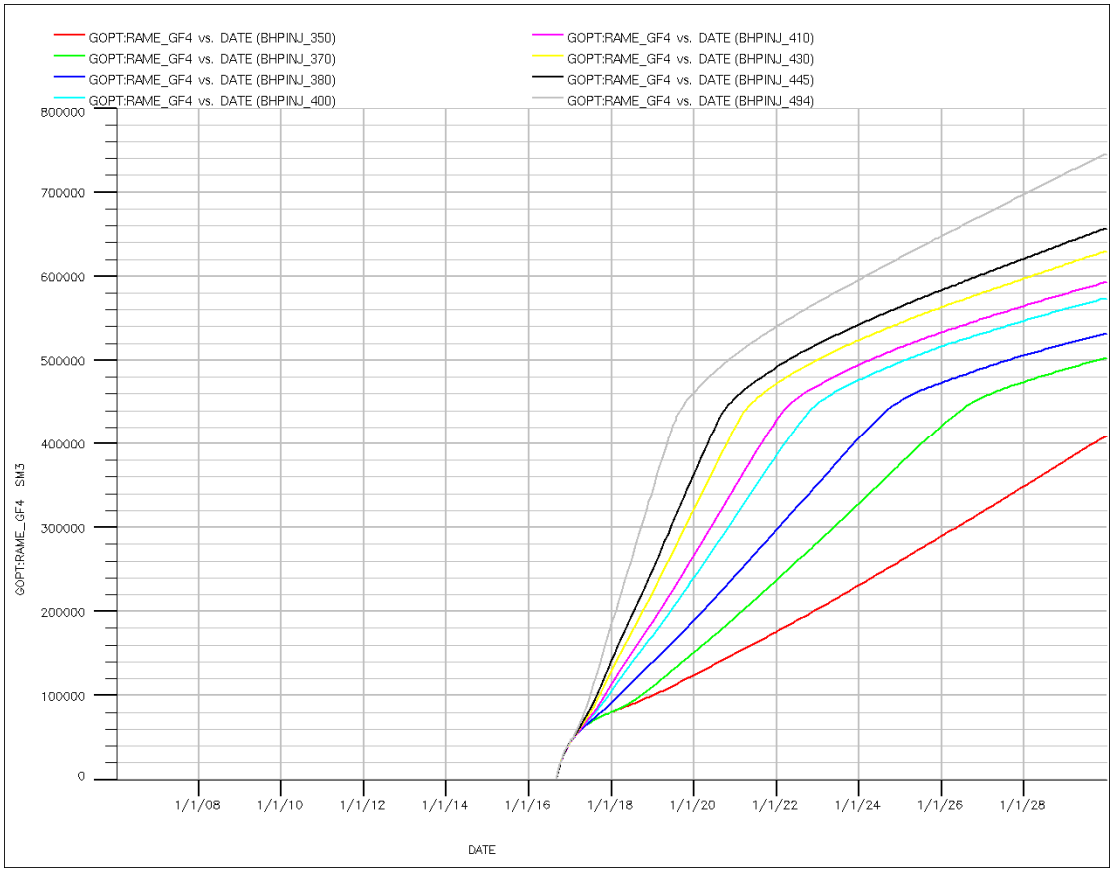
Figur 61: Bunnhullstrykk styrt GOPR GF6



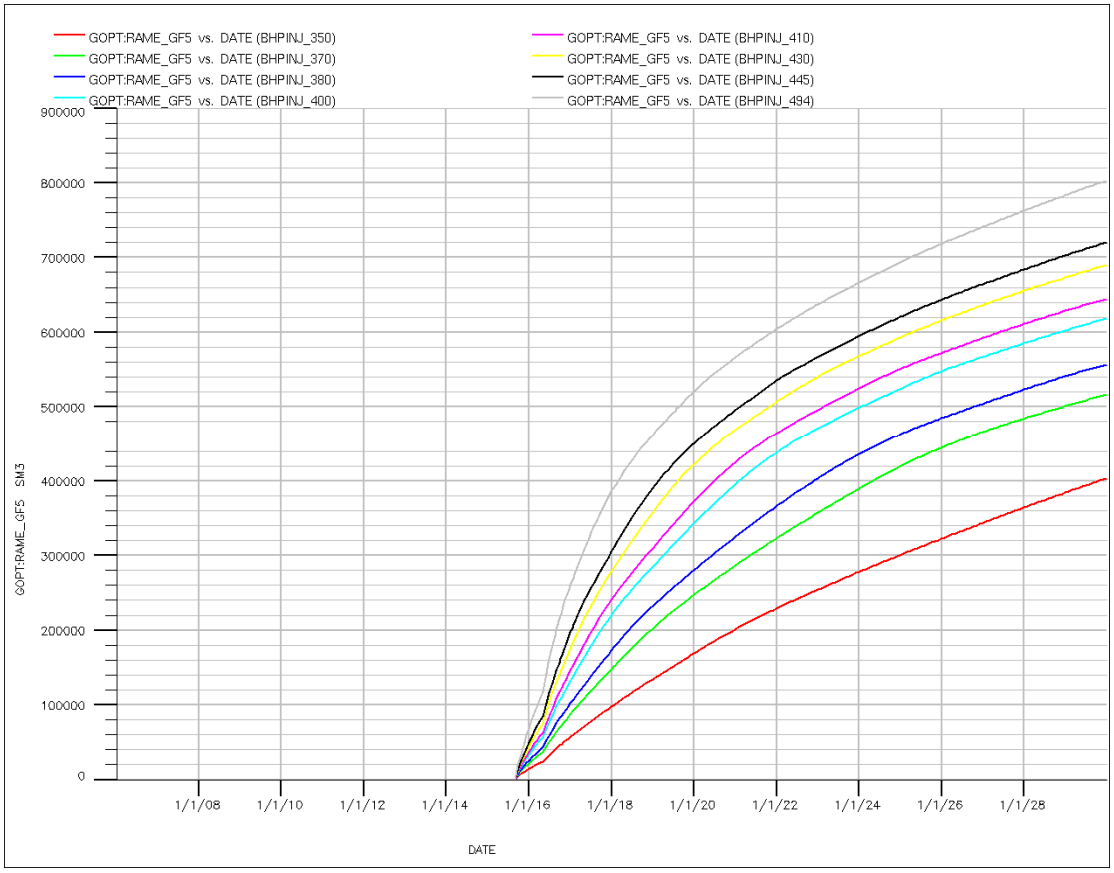
Figur 62: Bunnhullstrykk styrt GOPT GF2



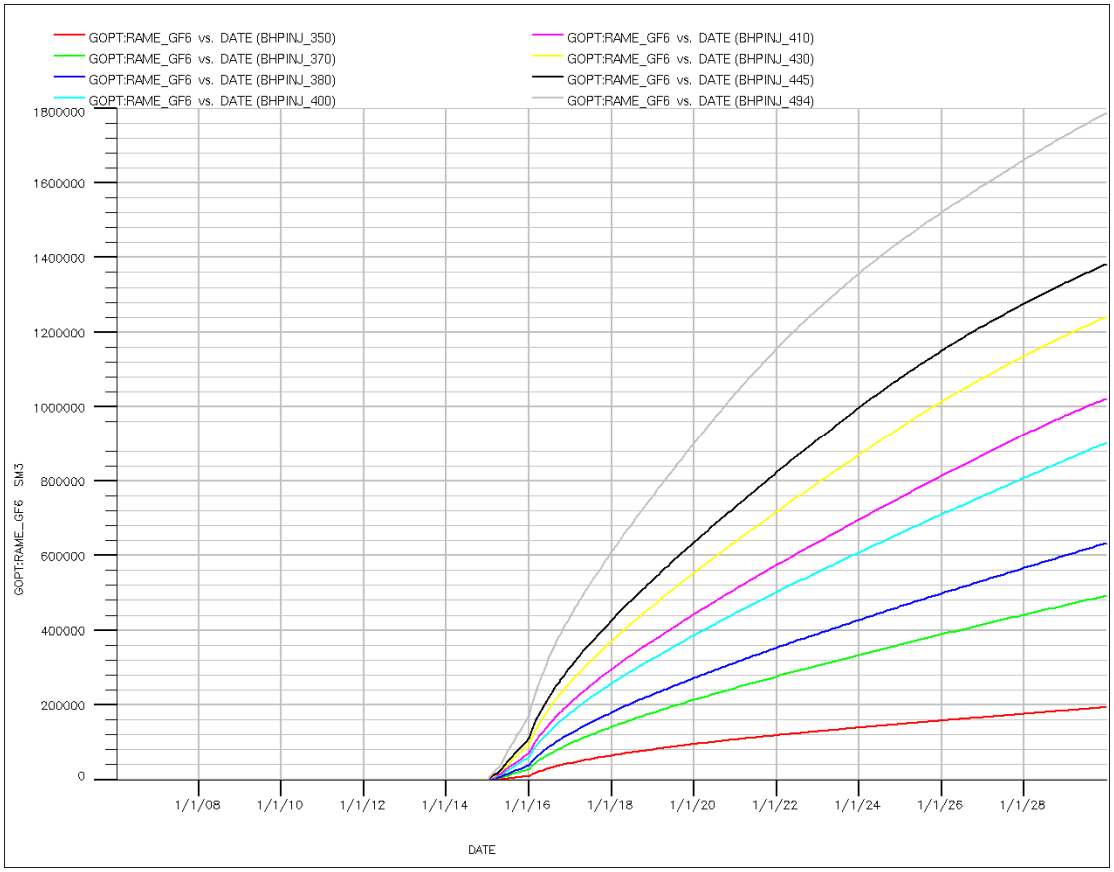
Figur 63: Bunnhullstrykk styrt GOPT GF3



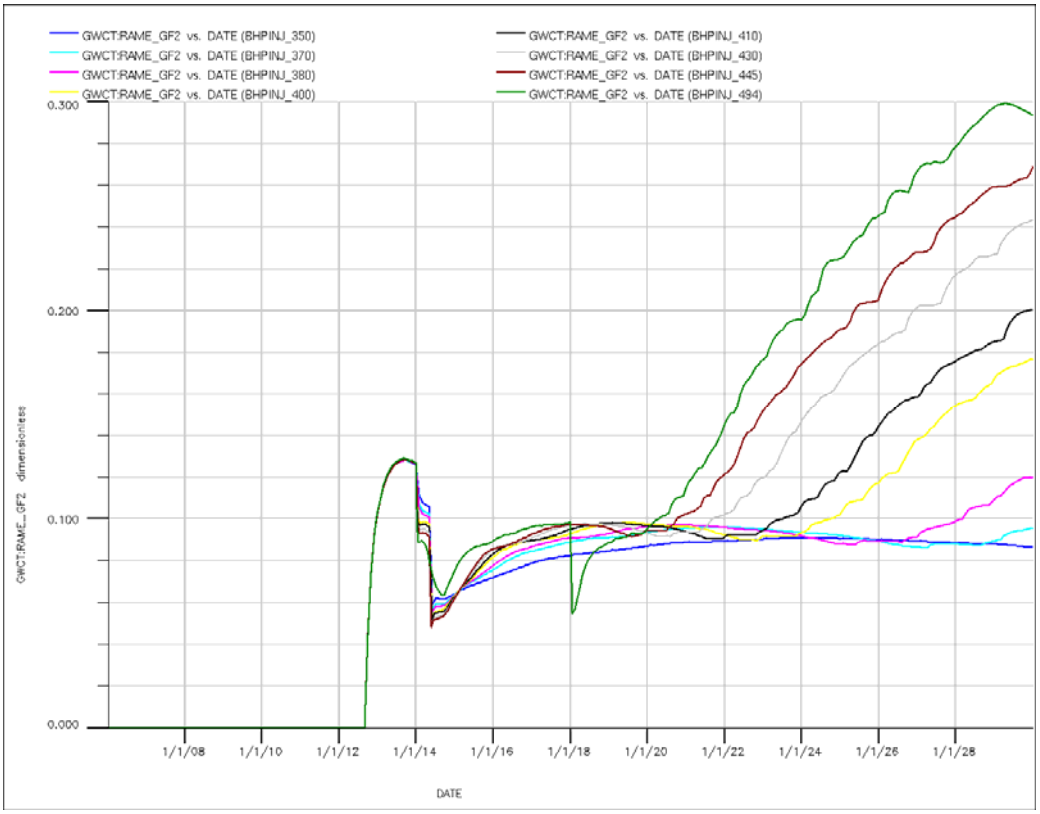
Figur 64: Bunnhullstrykk styrt GOPT GF4



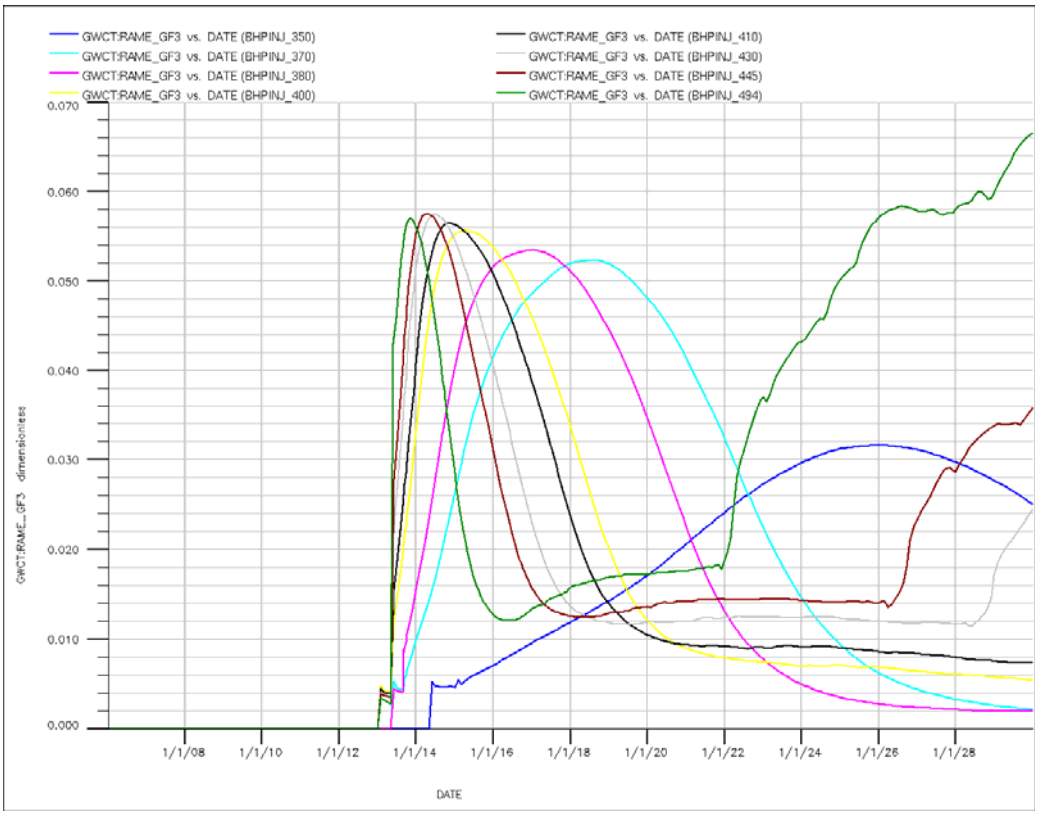
Figur 65: Bunnhullstrykk styrt GOPT GF5



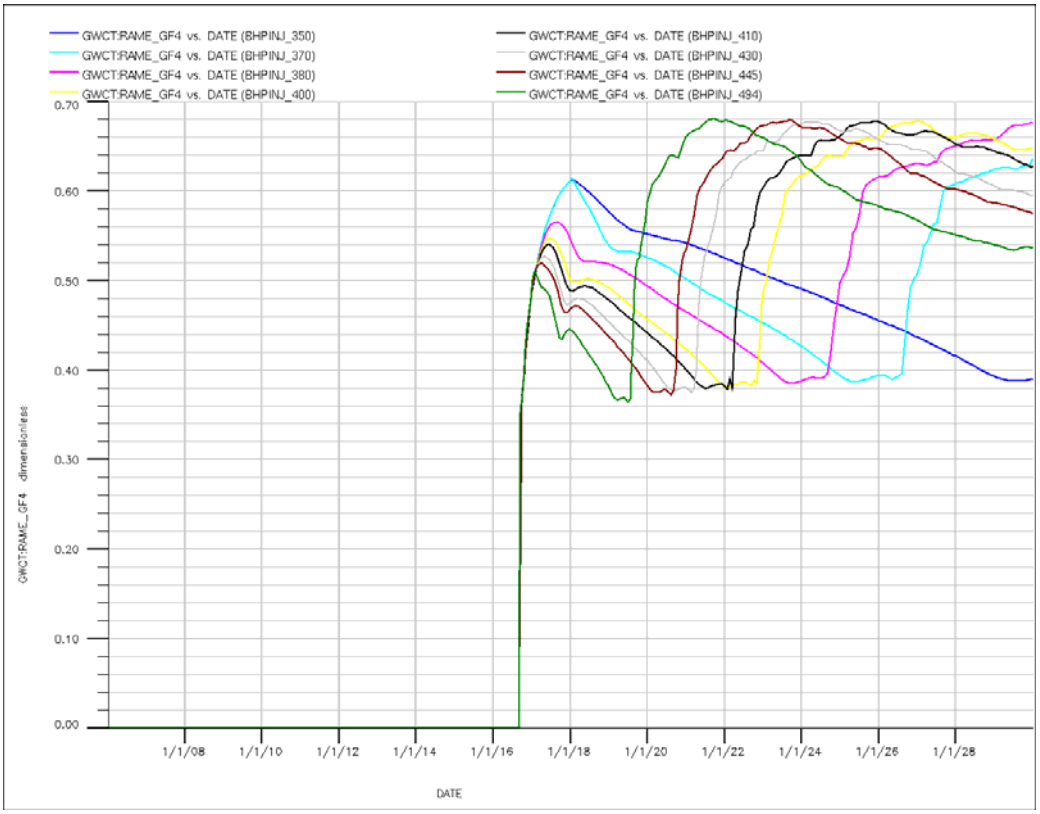
Figur 66: Bunnhullstrykk styrt GOPT GF6



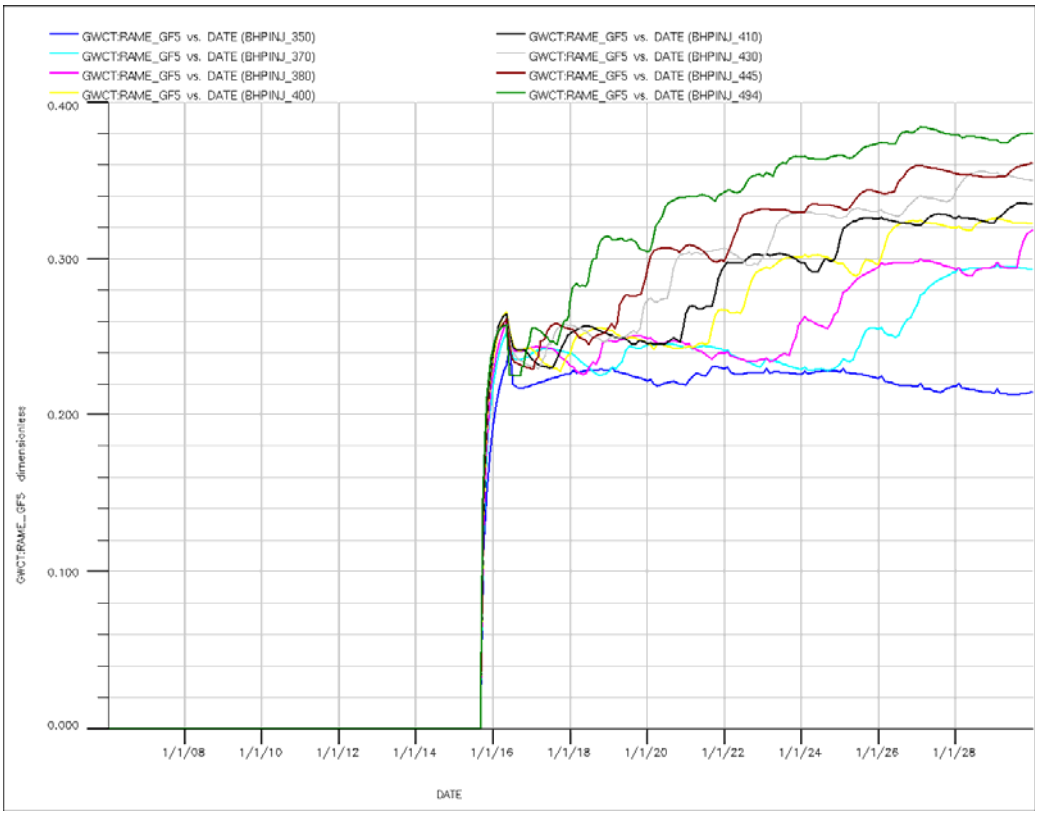
Figur 67: Bunnhullstrykk styrt GWCT GF2



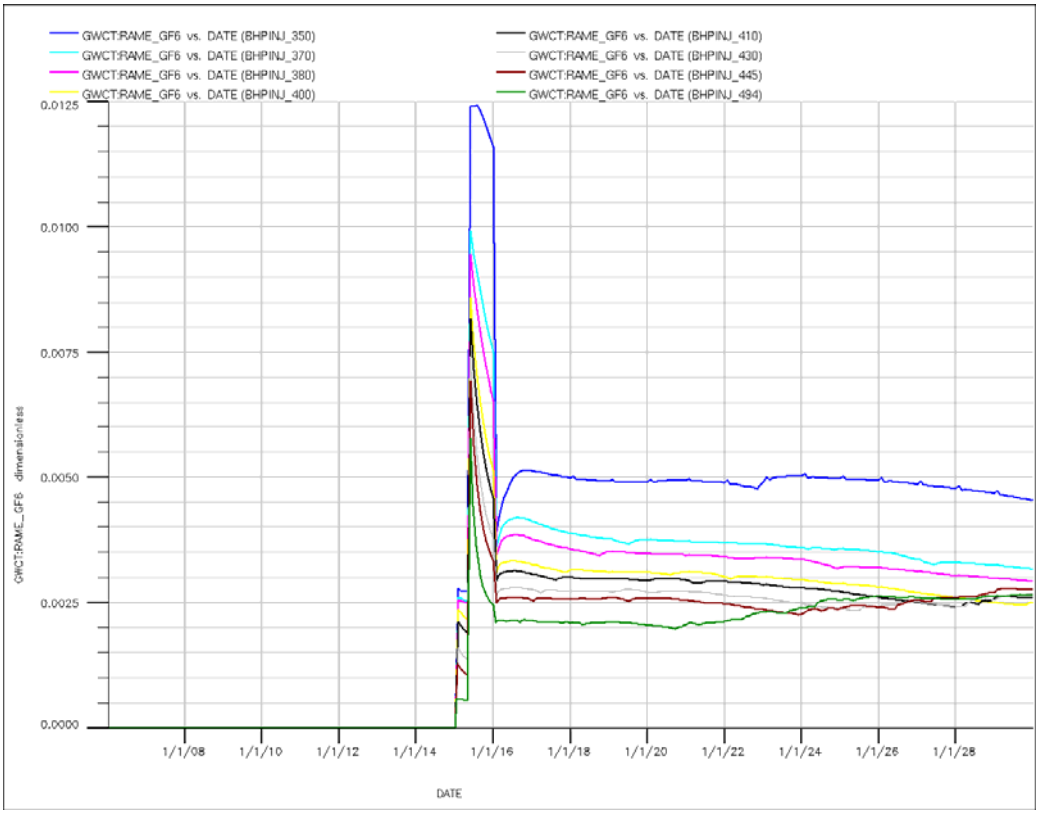
Figur 68: Bunnhullstrykk styrt GWCT GF3



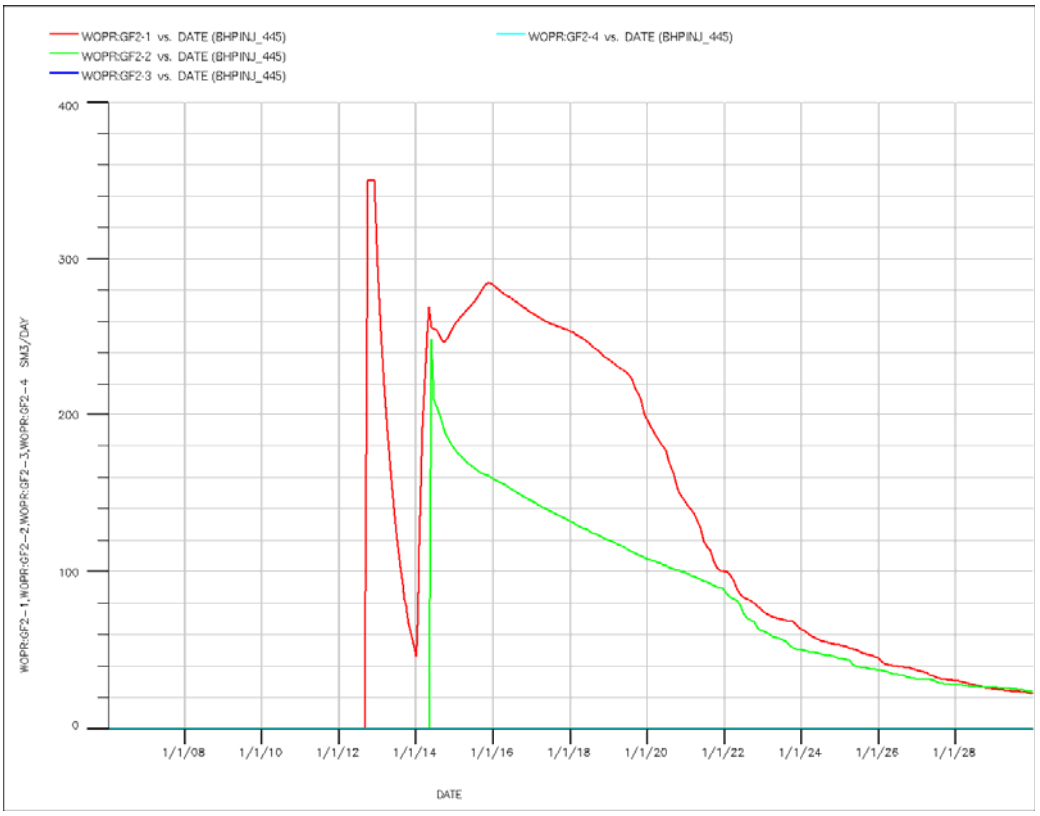
Figur 69: Bunnhullstrykk styrt GWCT GF4



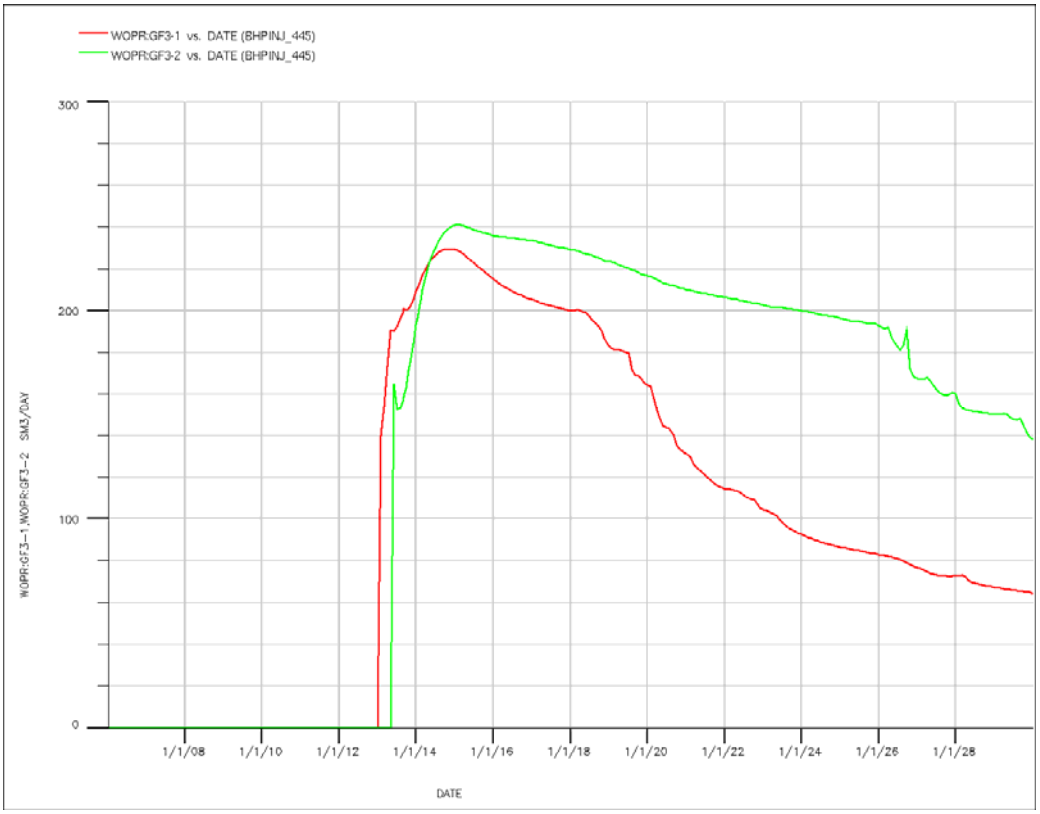
Figur 70: Bunnhullstrykk styrt GWCT GF5



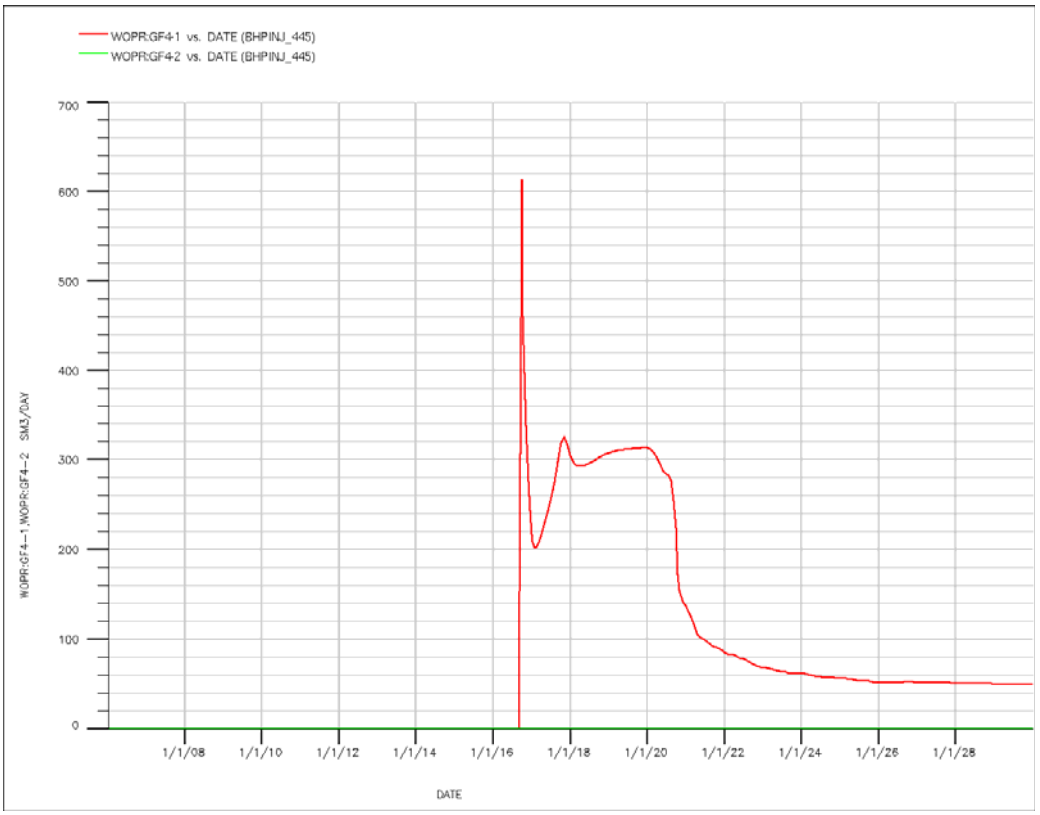
Figur 71: Bunnhullstrykk styrt GWCT GF6



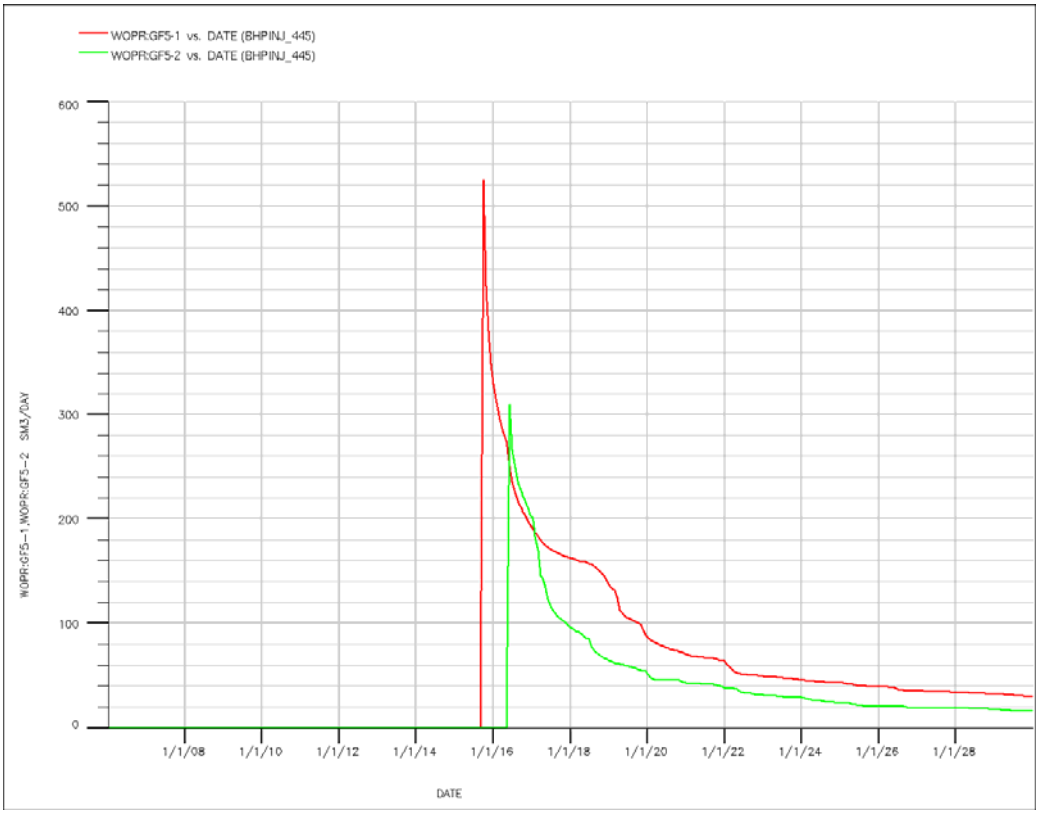
Figur 72: Bunnhullstrykk styrt WOPR GF2



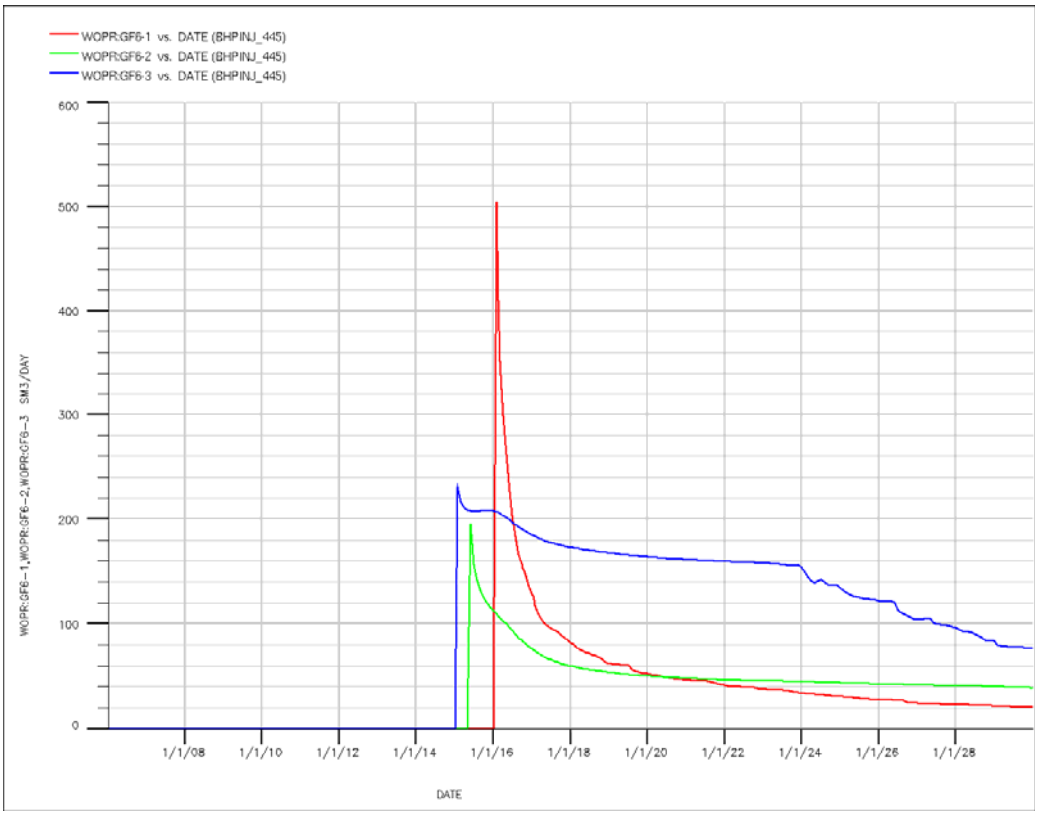
Figur 73: Bunnhullstrykk styrt WOPR GF3



Figur 74: Bunnhullstrykk styrt WOPR GF4



Figur 75: Bunnhullstrykk styrt WOPR GF5



Figur 76: Bunnhullstrykk styrt WOPR GF6

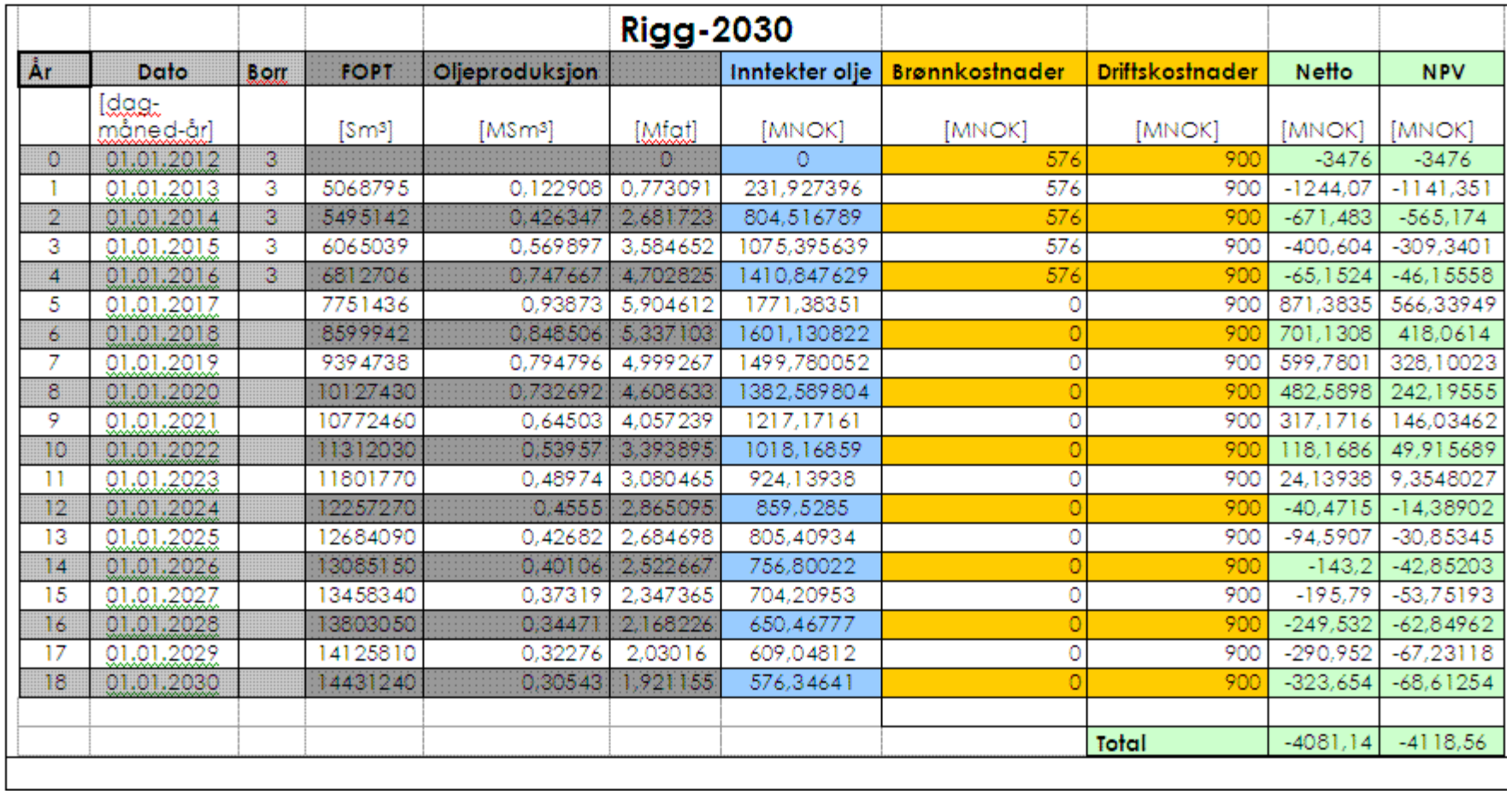
APPENDIKS C – Økonomi

Investeringskostnader			Driftskostnader per anno.		
Plattf.	5000	[MNOK]	Rigg	180	[MUSD]
Rigg	2000	[MNOK]	Plattform	200	[MNOK]
Brønn	192	[MNOK]			

Andre variable		
Olje p.	60	[$/fat]
Diskont.	0,09	[%]
Kurs	5	

Status ved produksjonsstart		
FOPT	4945887	[Sm^3]

Figur 77: Rammetall



Rigg-2030										
År	Dato	Borr	FOPT	Oljeproduksjon		Inntekter olje	Brønnkostnader	Driftskostnader	Netto	NPV
	[dag-måned-år]		[Sm³]	[MSm³]	[Mfat]	[MNOK]	[MNOK]	[MNOK]	[MNOK]	[MNOK]
0	01.01.2012	3			0	0	576	900	-3476	-3476
1	01.01.2013	3	5068795	0,122908	0,773091	231,927396	576	900	-1244,07	-1141,351
2	01.01.2014	3	5495142	0,426347	2,681723	804,516789	576	900	-671,483	-565,174
3	01.01.2015	3	6065039	0,569897	3,584652	1075,395639	576	900	-400,604	-309,3401
4	01.01.2016	3	6812706	0,747667	4,702825	1410,847629	576	900	-65,1524	-46,15558
5	01.01.2017		7751436	0,93873	5,904612	1771,38351	0	900	871,3835	566,33949
6	01.01.2018		8599942	0,848506	5,337103	1601,130822	0	900	701,1308	418,0614
7	01.01.2019		9394738	0,794796	4,999267	1499,780052	0	900	599,7801	328,10023
8	01.01.2020		10127430	0,732692	4,608633	1382,589804	0	900	482,5898	242,19555
9	01.01.2021		10772460	0,64503	4,057239	1217,17161	0	900	317,1716	146,03462
10	01.01.2022		11312030	0,53957	3,393895	1018,16859	0	900	118,1686	49,915689
11	01.01.2023		11801770	0,48974	3,080465	924,13938	0	900	24,13938	9,3548027
12	01.01.2024		12257270	0,4555	2,865095	859,5285	0	900	-40,4715	-14,38902
13	01.01.2025		12684090	0,42682	2,684698	805,40934	0	900	-94,5907	-30,85345
14	01.01.2026		13085150	0,40106	2,522667	756,80022	0	900	-143,2	-42,85203
15	01.01.2027		13458340	0,37319	2,347365	704,20953	0	900	-195,79	-53,75193
16	01.01.2028		13803050	0,34471	2,168226	650,46777	0	900	-249,532	-62,84962
17	01.01.2029		14125810	0,32276	2,03016	609,04812	0	900	-290,952	-67,23118
18	01.01.2030		14431240	0,30543	1,921155	576,34641	0	900	-323,654	-68,61254
								Total	-4081,14	-4118,56

Figur 78: Beregningsgrunnlag for rigg med levetid til 2030

					Plattform-2030					
År	Dato	Borr	FOPT	Oljeproduksjon		Inntekter olje	Brønnkostnader	Driftskostnader	Netto	NPV
	[dag-måned-år]		[Sm³]	[MSm³]	[Mfat]	[MNOK]	[MNOK]	[MNOK]	[MNOK]	[MNOK]
0	01.01.2012	3			0	0	576	200	-5776	-5776
1	01.01.2013	3	5068795	0,122908	0,773091	231,927396	576	200	-544,073	-499,1492
2	01.01.2014	3	5495142	0,426347	2,681723	804,516789	576	200	28,51679	24,002011
3	01.01.2015	3	6065039	0,569897	3,584652	1075,395639	576	200	299,3956	231,18837
4	01.01.2016	3	6812706	0,747667	4,702825	1410,847629	576	200	634,8476	449,74207
5	01.01.2017		7751436	0,93873	5,904612	1771,38351	0	200	1571,384	1021,2915
6	01.01.2018		8599942	0,848506	5,337103	1601,130822	0	200	1401,131	835,44853
7	01.01.2019		9394738	0,794796	4,999267	1499,780052	0	200	1299,78	711,0242
8	01.01.2020		10127430	0,732692	4,608633	1382,589804	0	200	1182,59	593,50195
9	01.01.2021		10772460	0,64503	4,057239	1217,17161	0	200	1017,172	468,33407
10	01.01.2022		11312030	0,53957	3,393895	1018,16859	0	200	818,1686	345,60325
11	01.01.2023		11801770	0,48974	3,080465	924,13938	0	200	724,1394	280,6278
12	01.01.2024		12257270	0,4555	2,865095	859,5285	0	200	659,5285	234,48528
13	01.01.2025		12684090	0,42682	2,684698	805,40934	0	200	605,4093	197,4716
14	01.01.2026		13085150	0,40106	2,522667	756,80022	0	200	556,8002	166,6205
15	01.01.2027		13458340	0,37319	2,347365	704,20953	0	200	504,2095	138,4247
16	01.01.2028		13803050	0,34471	2,168226	650,46777	0	200	450,4678	113,45921
17	01.01.2029		14125810	0,32276	2,03016	609,04812	0	200	409,0481	94,520049
18	01.01.2030		14431240	0,30543	1,921155	576,34641	0	200	376,3464	79,783083
								Total	6218,86	-289,62

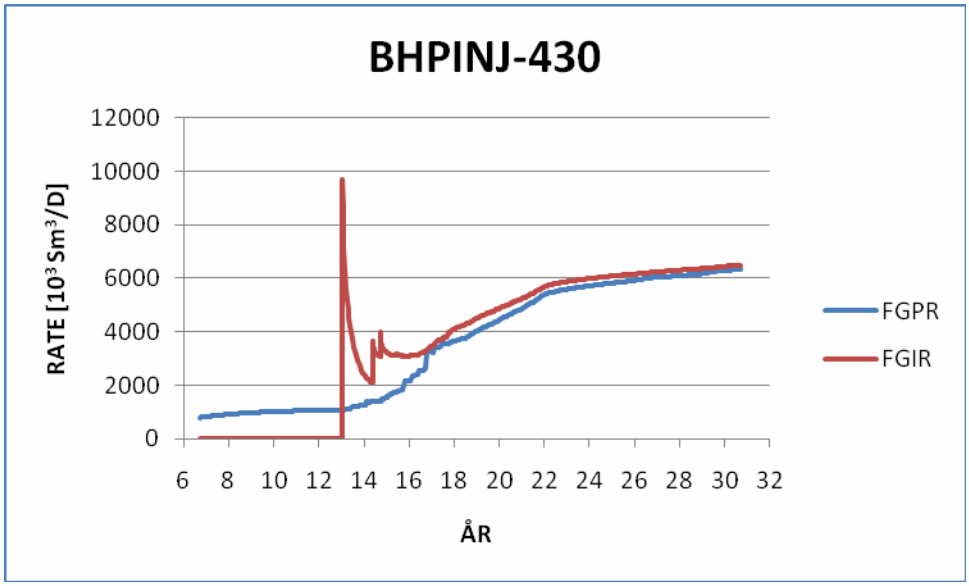
Figur 79: Beregningsgrunnlag for plattform med levetid til 2030

Plattform-2040

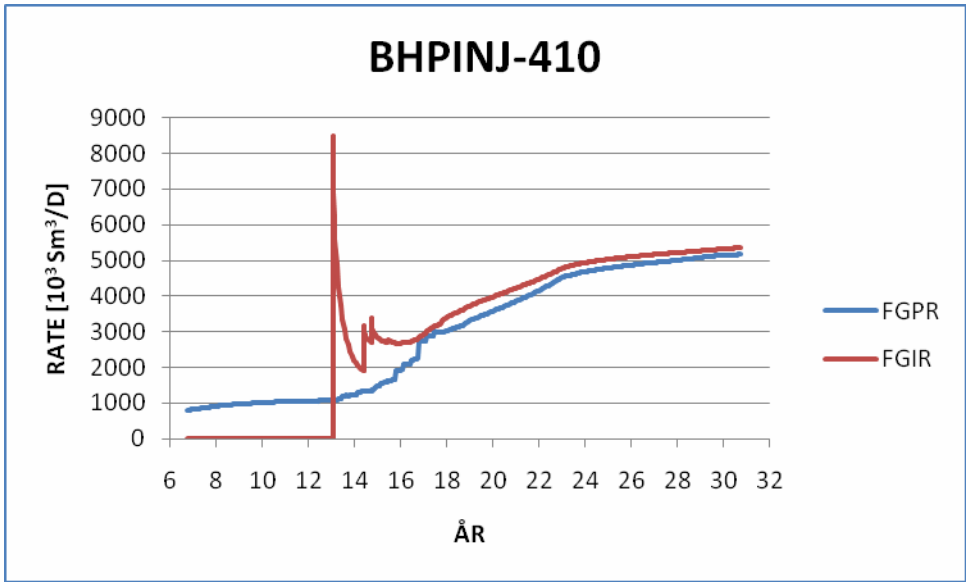
År	Dato	Borr	FOPT	Oljeproduksjon	[MBpl]	Inntekter olje	Brønnkostnader	Driftskostnader	Netto	NPV
	dd.mm.åååå		[Sm³]	[MSm³]		[MNOK]	[MNOK]	[MNOK]	[MNOK]	[MNOK]
0	01.01.2012	3			0	0	576	200	-5776	-5776
1	01.01.2013	3	5068795	0.122908	0.773091	231.927396	576	200	-544.073	-499.1492
2	01.01.2014	3	5495142	0.426347	2.681723	804.516789	576	200	28.51679	24.002011
3	01.01.2015	3	6065039	0.569897	3.584652	1075.395639	576	200	299.3956	231.18837
4	01.01.2016	3	6812706	0.747667	4.702825	1410.847629	576	200	634.8476	449.74207
5	01.01.2017		7751436	0.93873	5.904612	1771.38351	0	200	1571.384	1021.2915
6	01.01.2018		8599942	0.848506	5.337103	1601.130822	0	200	1401.131	835.44853
7	01.01.2019		9394738	0.794796	4.999267	1499.780052	0	200	1299.78	711.0242
8	01.01.2020		10127460	0.732692	4.608633	1382.589804	0	200	1182.59	593.50195
9	01.01.2021		10772460	0.64503	4.057239	1217.17161	0	200	1017.172	468.33407
10	01.01.2022		11312080	0.53957	3.393895	1018.16859	0	200	818.1686	345.60325
11	01.01.2023		11801770	0.48974	3.080465	924.13938	0	200	724.1394	280.6278
12	01.01.2024		12257270	0.4555	2.865095	859.5285	0	200	659.5285	234.48528
13	01.01.2025		12684090	0.42682	2.684698	805.40934	0	200	605.4093	197.4716
14	01.01.2026		13085150	0.40106	2.522667	756.80022	0	200	556.8002	166.6205
15	01.01.2027		13458340	0.37319	2.347365	704.20953	0	200	504.2095	138.4247
16	01.01.2028		13803050	0.34471	2.168226	650.46777	0	200	450.4678	113.45921
17	01.01.2029		14125810	0.32276	2.03016	609.04812	0	200	409.0481	94.520049
18	01.01.2030		14431240	0.30543	1.921155	576.34641	0	200	376.3464	79.783083
19	01.01.2031		14720800	0.28956	1.821332	546.39972	0	200	346.3997	67.371167
20	01.01.2032		15001240	0.28044	1.763968	529.19028	0	200	329.1903	58.737715
21	01.01.2033		15273520	0.27228	1.712641	513.79236	0	200	313.7924	51.367202
22	01.01.2034		15536630	0.26311	1.654962	496.48857	0	200	296.4886	44.52716
23	01.01.2035		15792320	0.25569	1.608229	482.48703	0	200	282.487	38.921454
24	01.01.2036		16037850	0.24553	1.544384	463.31511	0	200	263.3151	33.284331
25	01.01.2037		16274070	0.23622	1.485824	445.74714	0	200	245.7471	28.498764
26	01.01.2038		16500660	0.22659	1.425251	427.57533	0	200	227.5753	24.212311
27	01.01.2039		16717880	0.21722	1.366314	409.89414	0	200	209.8941	20.487307
28	01.01.2040		16925740	0.20786	1.307439	392.23182	0	200	192.2318	17.214061
29	01.01.2041		17125810	0.20007	1.25844	377.53209	0	200	177.5321	14.585067
								Total	9103.51	109.59

Figur 80: Beregningsgrunnlag for plattform med levetid til 2030

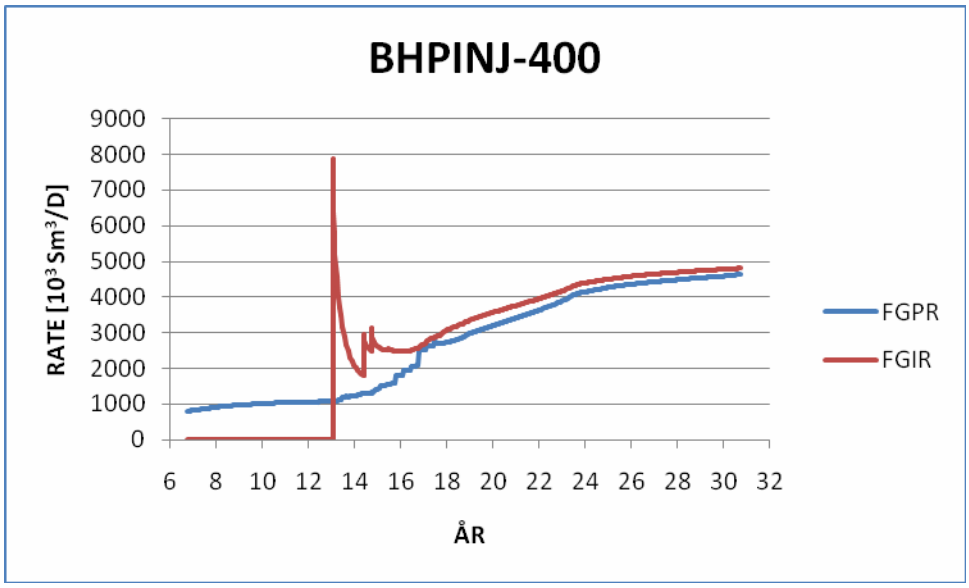
APPENDIKS D – SENSITIVITETSANALYSE



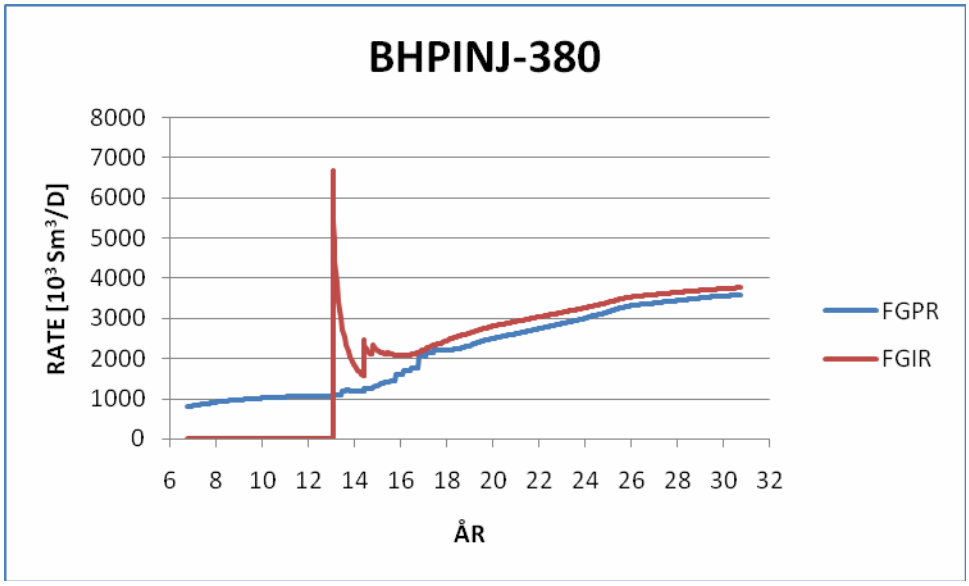
Figur 81: FGPR vs FGIR ved 430 bar



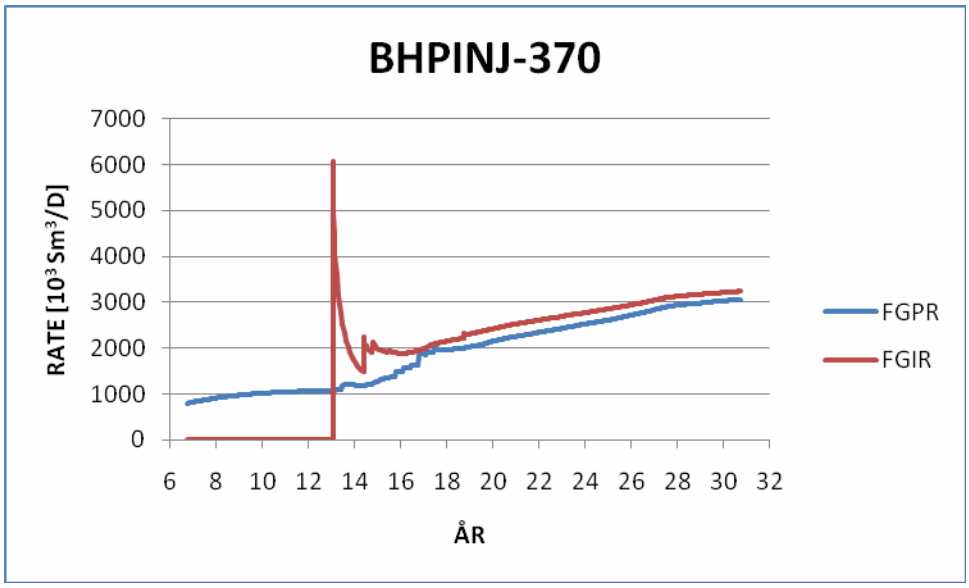
Figur 82: FGPR vs FGIR ved 410 bar



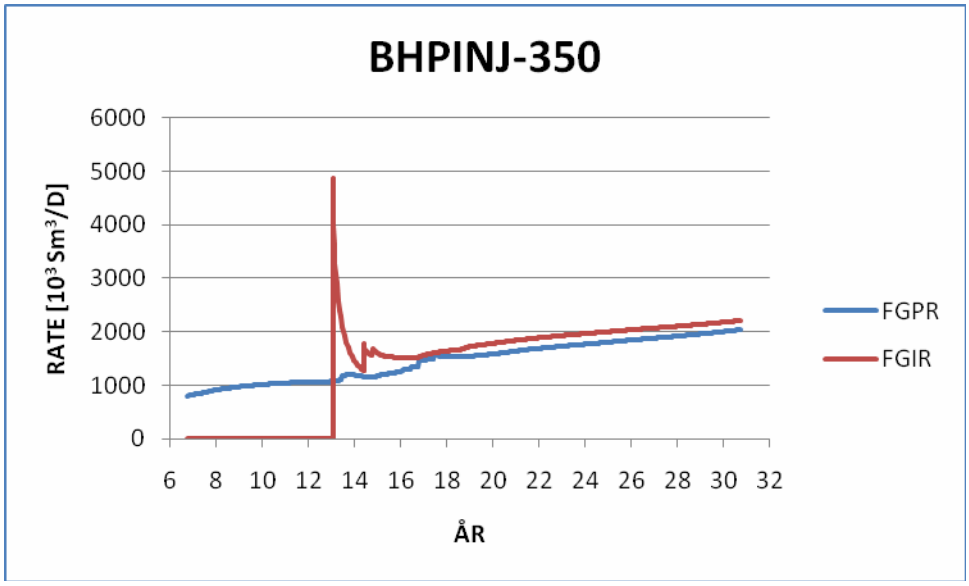
Figur 83: FGPR vs FGIR ved 400 bar



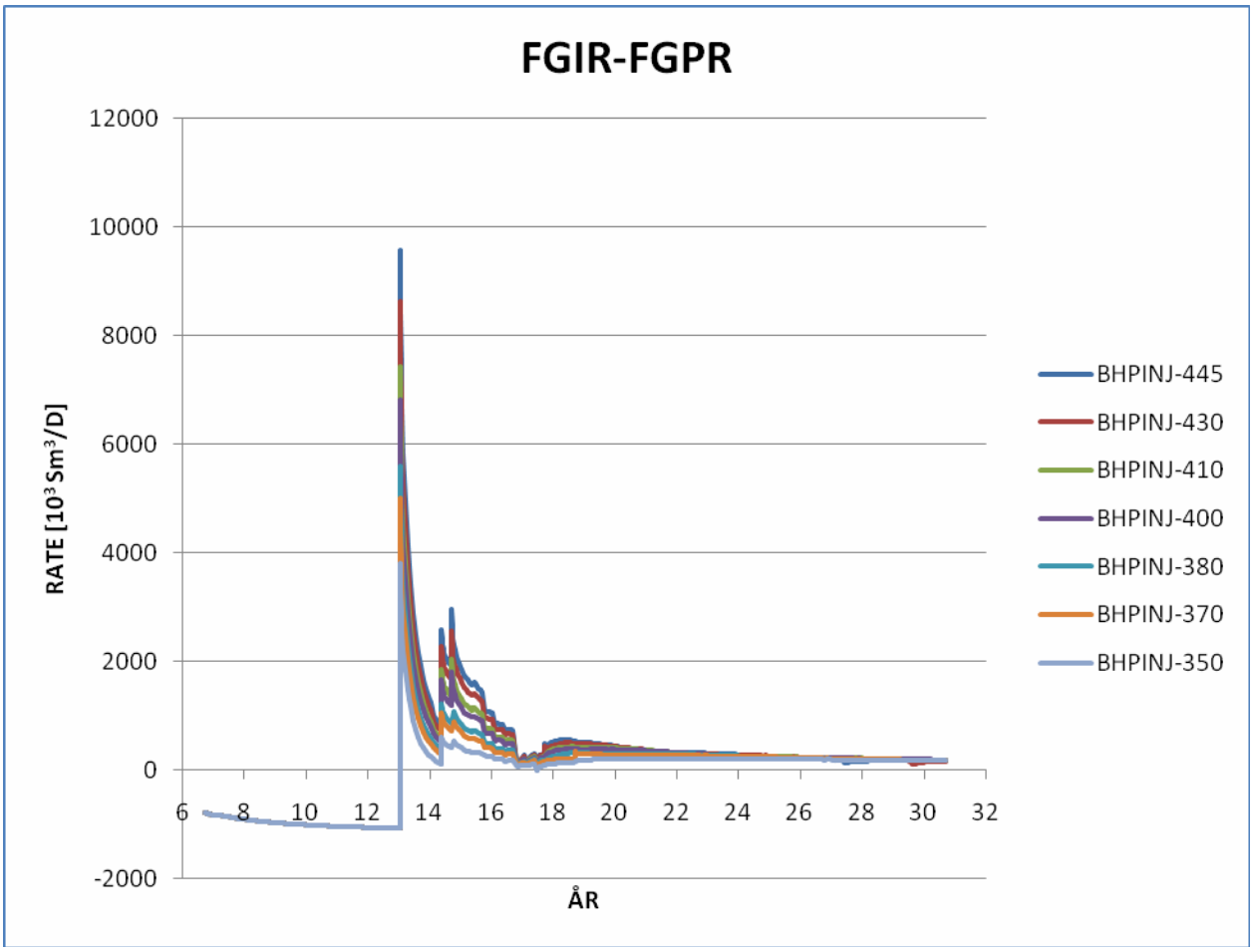
Figur 84: FGPR vs FGIR ved 380 bar



Figur 85: FGPR vs FGIR ved 370 bar



Figur 86: FGPR vs FGIR ved 350 bar



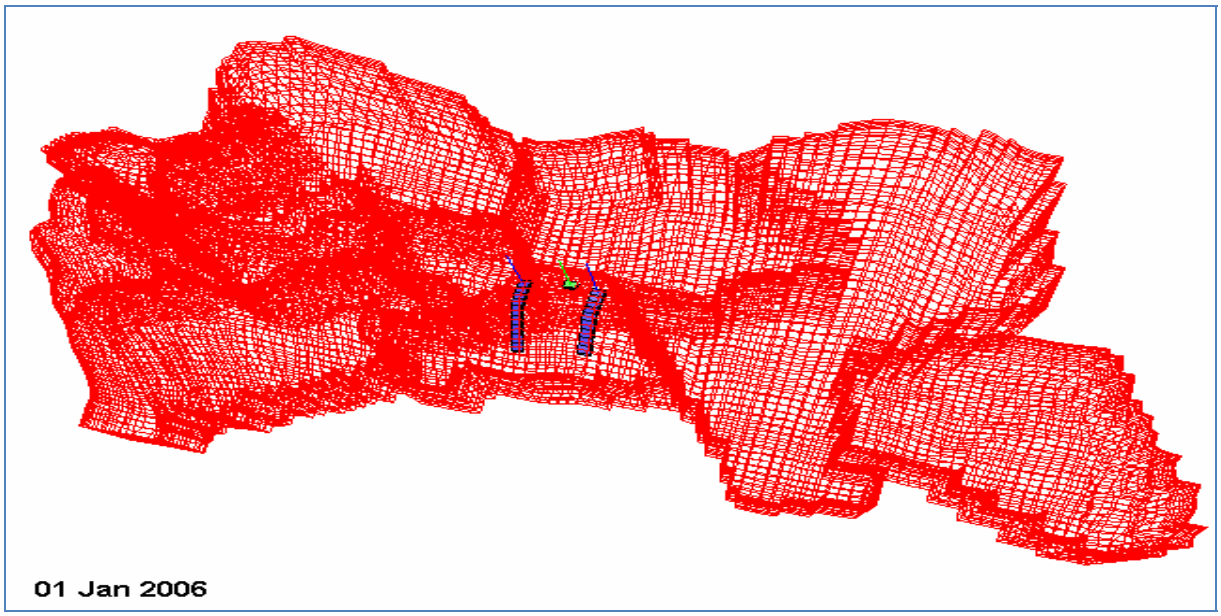
Figur 87: Differanse mellom FGIR og FGPR

APPENDIKS E – Brønnplassering og lengder

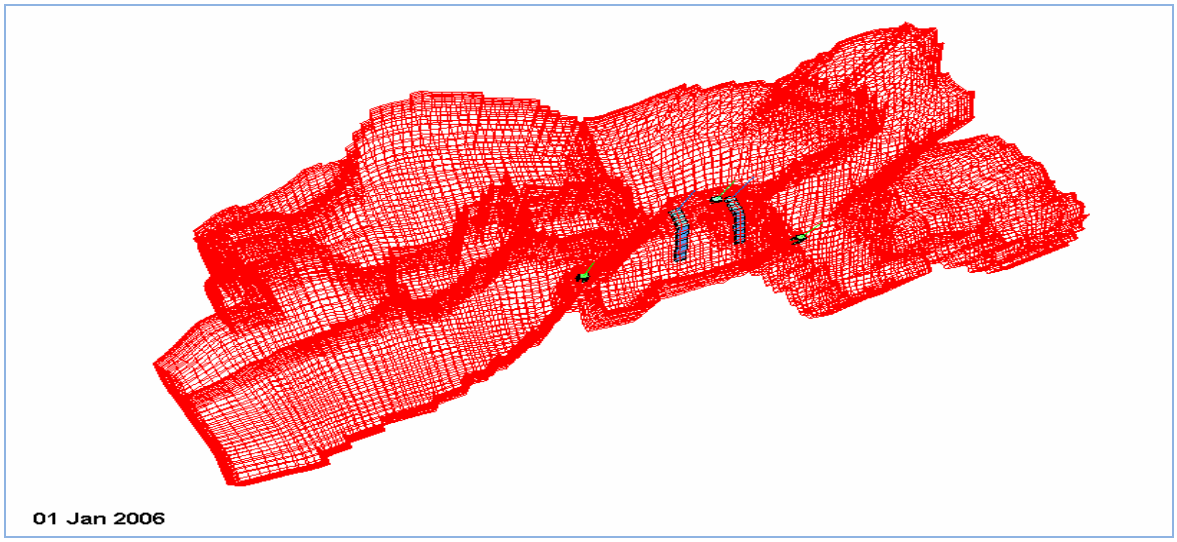
Brønn	Dyp	Kompletteringsretning			Kompletterings-lengde i meter
		X	Y	Z	
GF3-INJ1	3060			9	81
GF2-1	3280	8	4		760
GF3-1	3255	5			350
GF3-2	3260			8	72
GF5-INJ1	3150			5	45
GF2-INJ1	3212		5		250
GF2-2	3250		8		400
GF2-INJ2	3295			5	45
GF6-3	3206			7	63
GF6-2	3170	10			700
GF5-1	3280	6	3		570
GF6-1	3270	5	2		450
GF5-2	3246	7	2		590
GF4-1	3282		7		350
GF4-INJ1	3280		6		300

GF2

CASE 1:



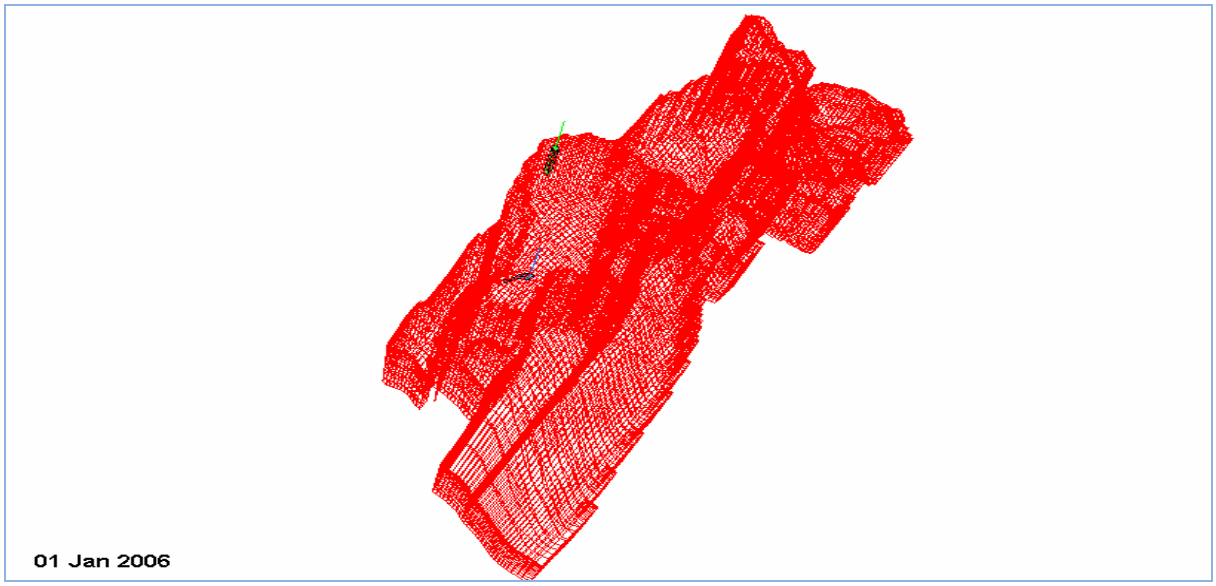
CASE2:



GF3

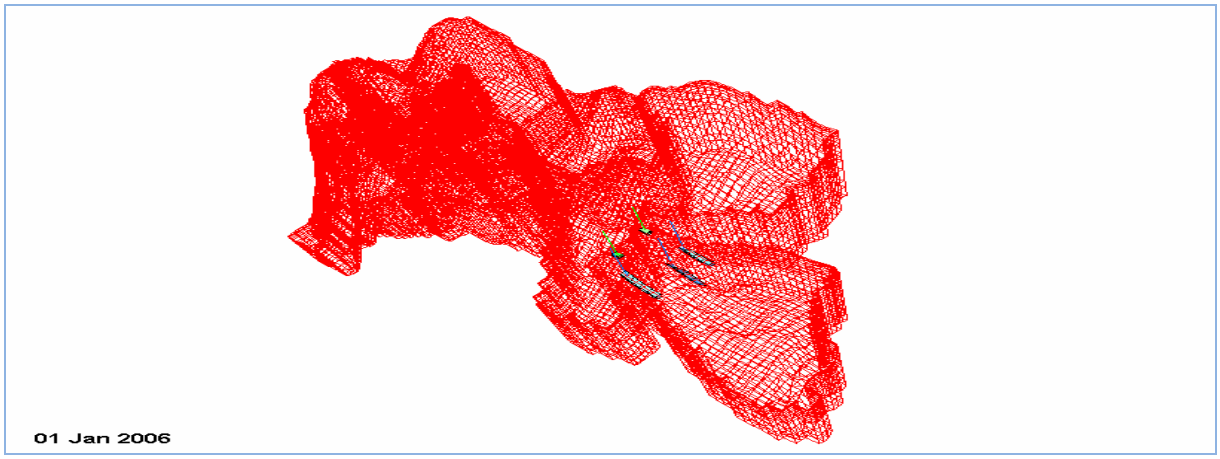
Case1

Case 2

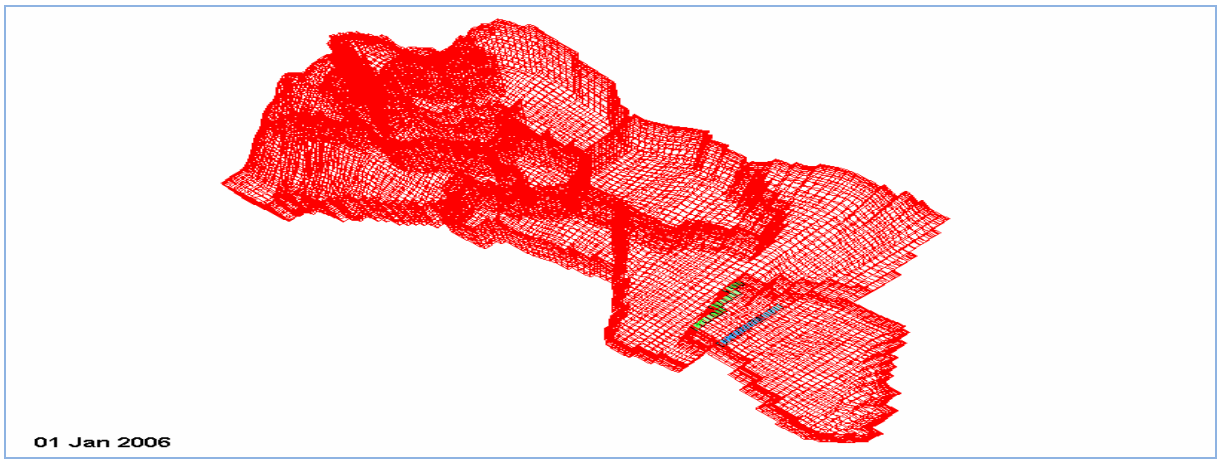


GF4

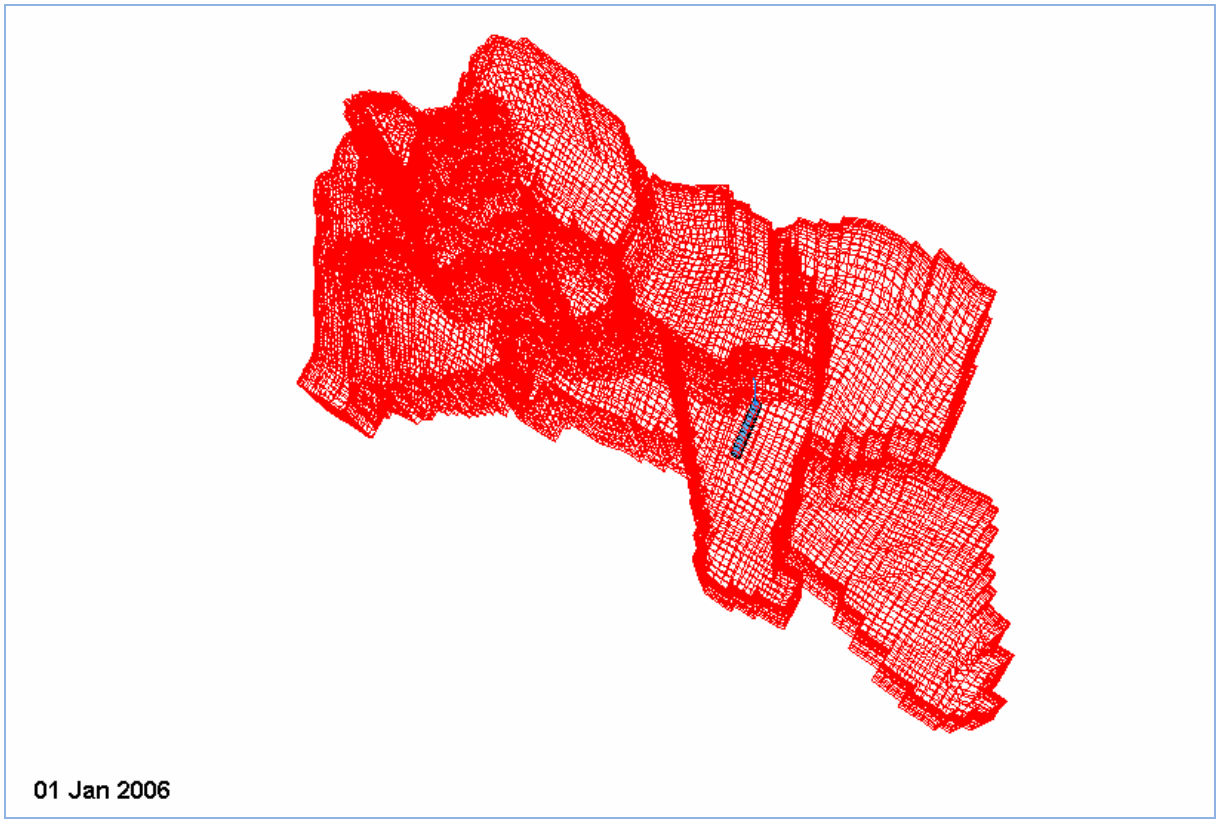
Case 1



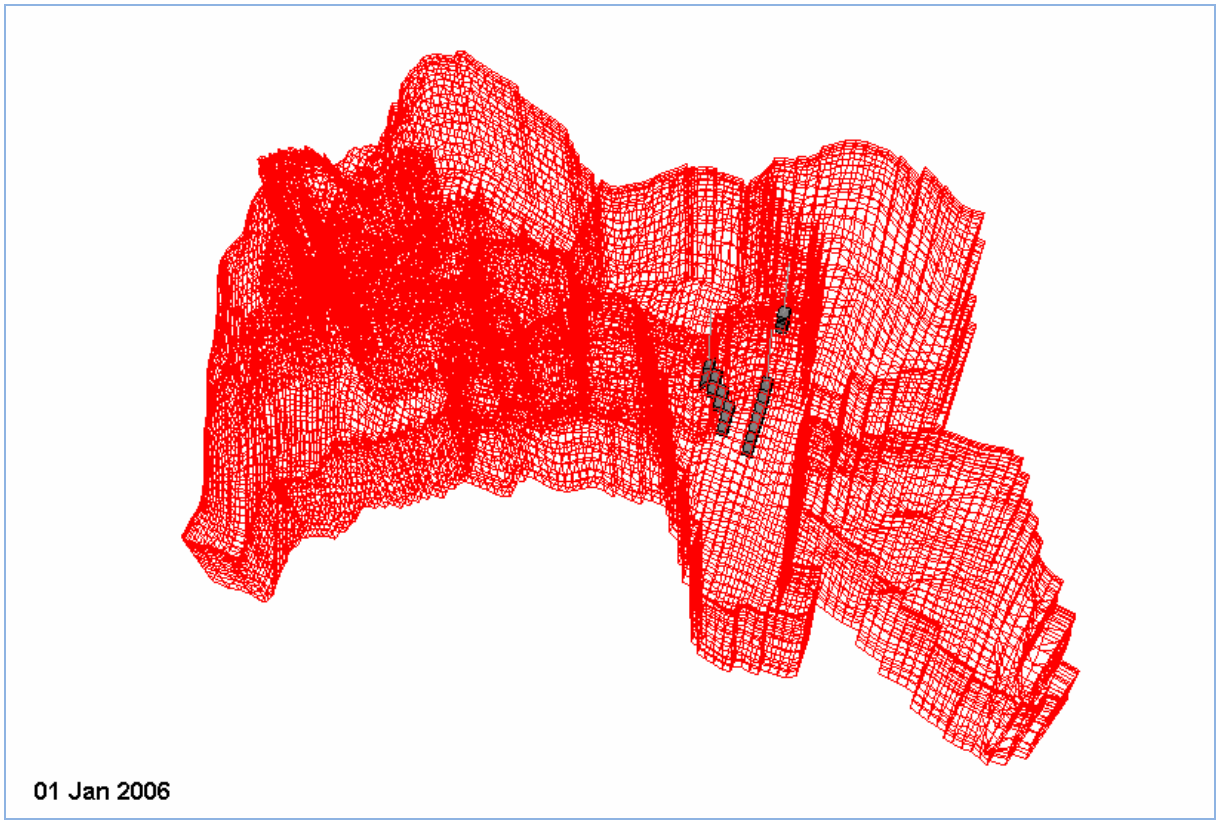
Case 2



GF5
Case 1

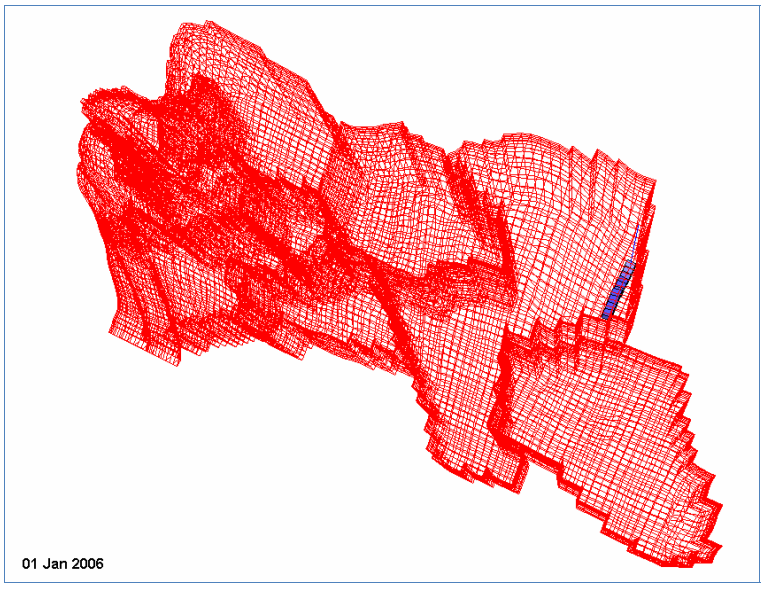


Case 2

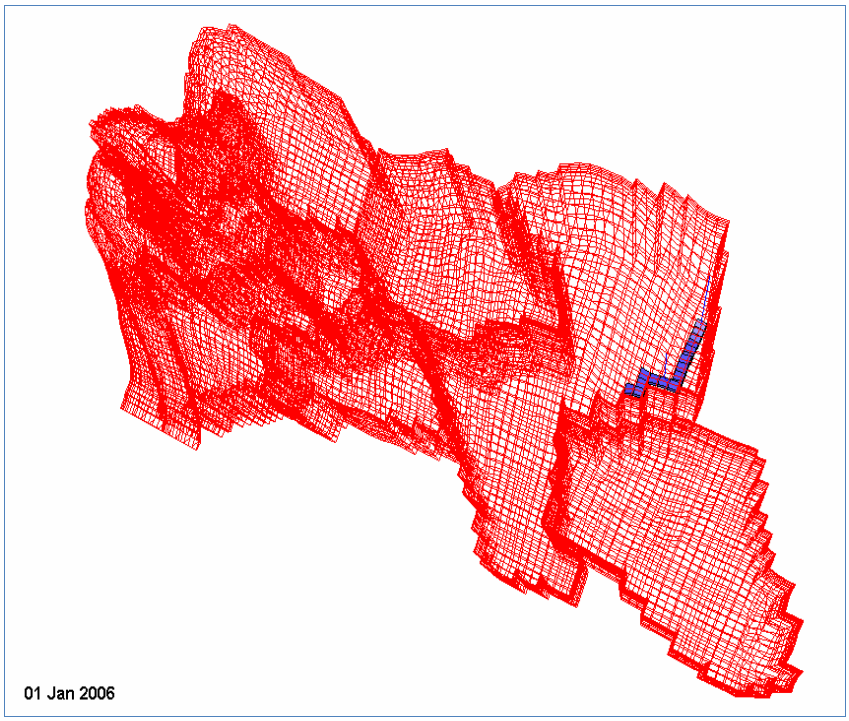


GF6

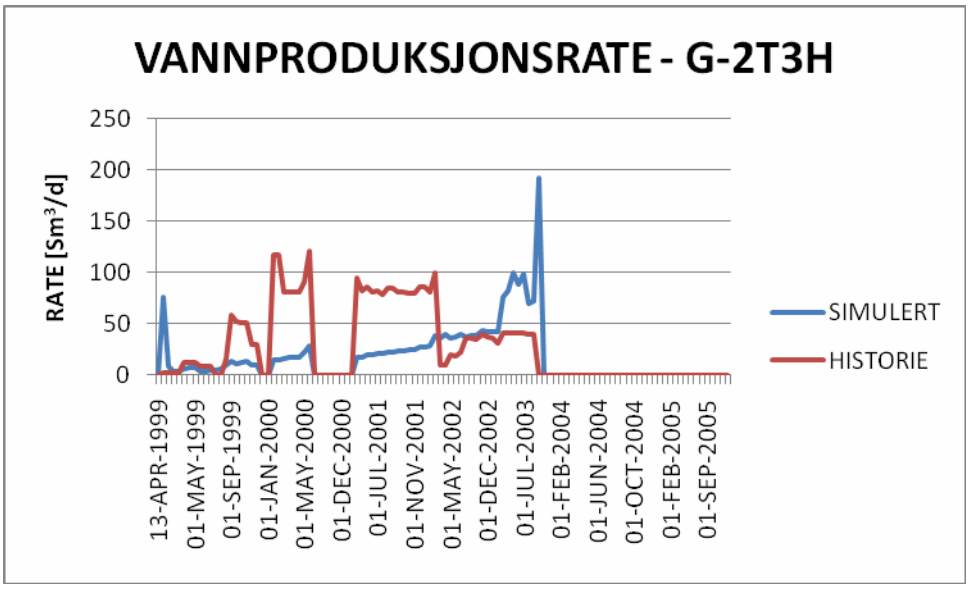
Case 1

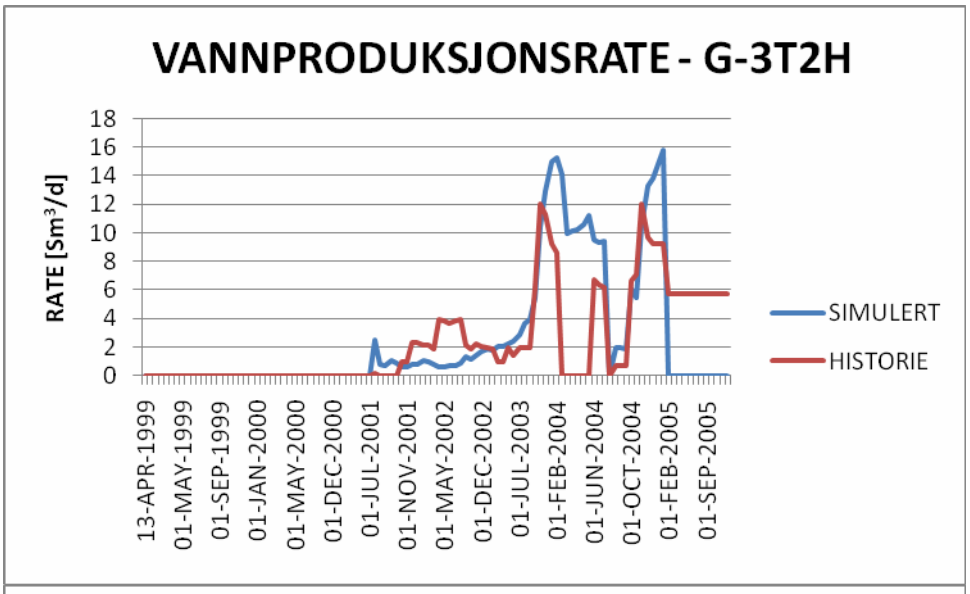


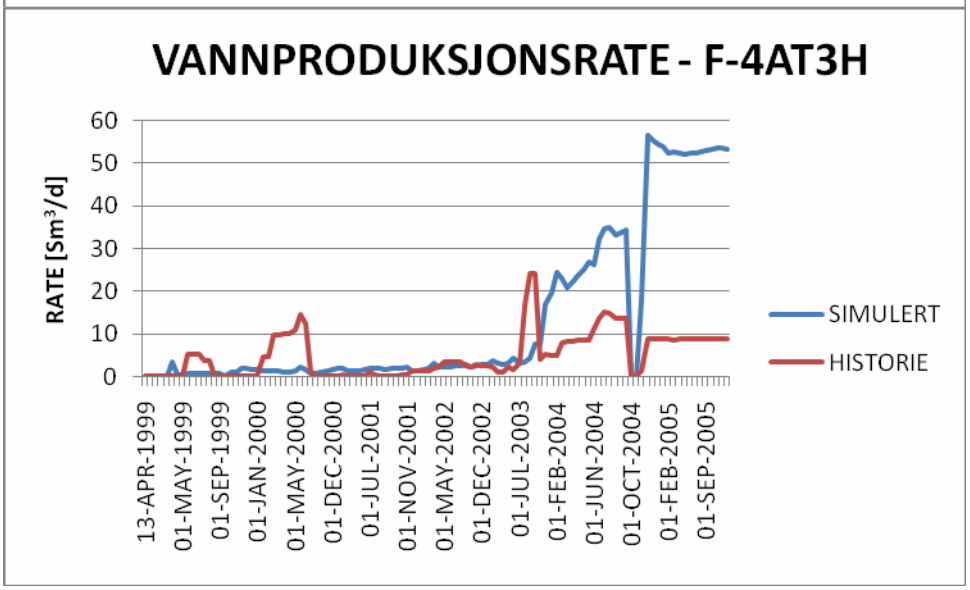
Case 2

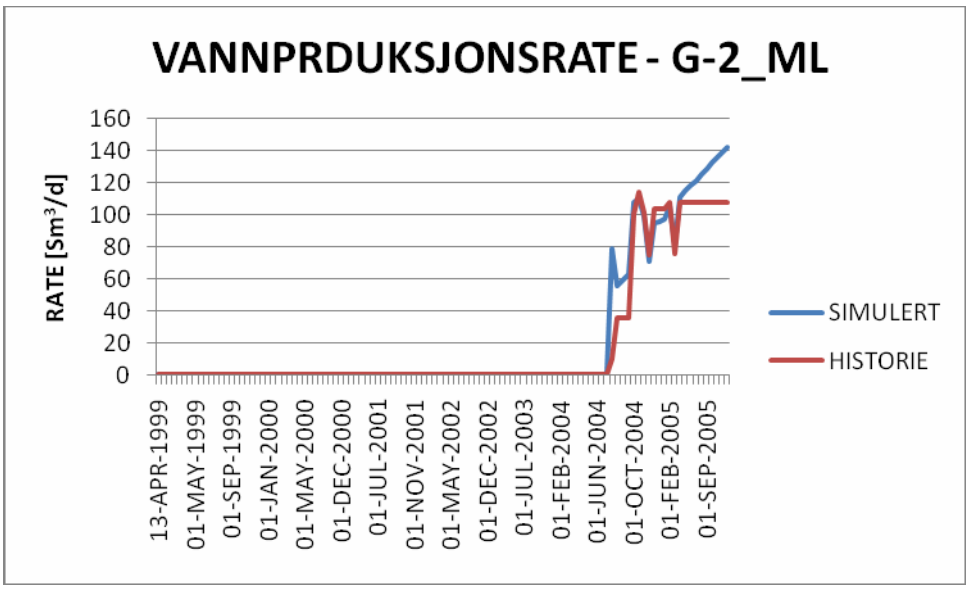


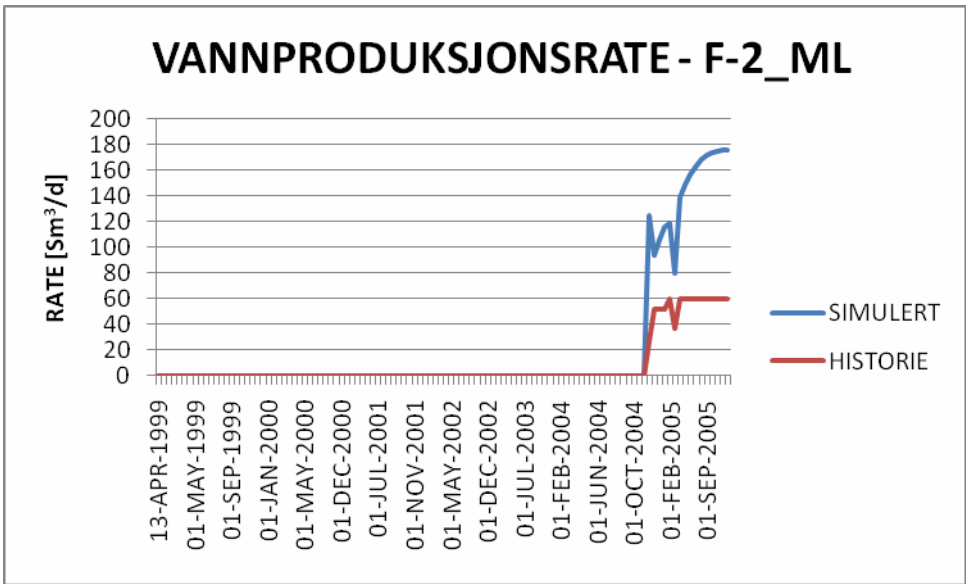
Appendiks F – Historisk vannproduksjonsrate vs. simulert




VANNPRODUKSJONSRATE - G-3T2H
RATE [Sm³/d]
18
16
14
12
10
8
6
4
2
0
13-APR-1999
01-MAY-1999
01-SEP-1999
01-JAN-2000
01-MAY-2000
01-DEC-2000
01-JUL-2001
01-NOV-2001
01-MAY-2002
01-DEC-2002
01-JUL-2003
01-FEB-2004
01-JUN-2004
01-OCT-2004
01-FEB-2005
01-SEP-2005
SIMULERT
HISTORIE


VANNPRODUKSJONSRATE - F-4AT3H
RATE [Sm³/d]
60
50
40
30
20
10
0
13-APR-1999
01-MAY-1999
01-SEP-1999
01-JAN-2000
01-MAY-2000
01-DEC-2000
01-JUL-2001
01-NOV-2001
01-MAY-2002
01-DEC-2002
01-JUL-2003
01-FEB-2004
01-JUN-2004
01-OCT-2004
01-FEB-2005
01-SEP-2005
SIMULERT
HISTORIE


VANNPRDUKSJONSRATE - G-2_ML
RATE [Sm³/d]
160
140
120
100
80
60
40
20
0
13-APR-1999
01-MAY-1999
01-SEP-1999
01-JAN-2000
01-MAY-2000
01-DEC-2000
01-JUL-2001
01-NOV-2001
01-MAY-2002
01-DEC-2002
01-JUL-2003
01-FEB-2004
01-JUN-2004
01-OCT-2004
01-FEB-2005
01-SEP-2005
SIMULERT
HISTORIE


VANNPRODUKSJONSRATE - F-2_ML
RATE [Sm³/d]
200
180
160
140
120
100
80
60
40
20
0
13-APR-1999
01-MAY-1999
01-SEP-1999
01-JAN-2000
01-MAY-2000
01-DEC-2000
01-JUL-2001
01-NOV-2001
01-MAY-2002
01-DEC-2002
01-JUL-2003
01-FEB-2004
01-JUN-2004
01-OCT-2004
01-FEB-2005
01-SEP-2005
SIMULERT
HISTORIE