

Project Report

AAFC National Potato Variety Trial Results from CDCS, Brooks, AB 2016

Prepared for:
Funding agencies and industry sponsors

Prepared by:

Michele Konschuh¹ and Benoit Bizimungu²

¹Alberta Agriculture and Forestry
Crop Diversification Centre South
301 Horticultural Station Road East
Brooks, AB T1R 1E6

²Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7

March 21, 2017



Introduction

In Alberta, potato industry stakeholders are looking for replacement varieties that use less nitrogen, less water, less pesticide, yet yield superior processing or culinary quality and tonnage. Varieties from breeding programs in Canada, Europe and the United States are often being assessed. Many breeding programs target disease resistance, nitrogen use efficiency and excellent storage potential in addition to increased yield. Tuber yield potential and nutritional requirements are impacted by variety characteristics and by environmental characteristics such as the length of the growing season (Westermann, 1993). As noted by Love et. al (2003), the full potential of a new variety may not be realized until proper management is implemented. There is increasing pressure on potato producers to utilize best management practices to reduce the environmental footprint for potatoes. The costs of such shifts in production practices will be borne primarily by producers.

An ideal French fry variety would have earlier maturity than Russet Burbank, be relatively tolerant of environmental fluctuations, have few defects, yield well and have specific gravity in the desired range (1.086 to 1.092). Good fry color out of the field is an asset, and good fry color out of storage is also very desirable. An ideal chipping variety would produce a good yield of medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have high specific gravity in the desired range (above 1.086). Tubers with a good skin set, good maturity at harvest and low concentration of reducing sugars is also very desirable. Varieties that store well at cooler temperatures are an asset. Ideal fresh market varieties would produce a good yield of creamer or medium sized tubers, be relatively tolerant of environmental fluctuations, have few defects, and have an attractive appearance. Tubers with a good skin set that store well are very desirable.

The purpose of this project was to pool resources to evaluate potential varieties from a range of sources, using a cooperative approach. This trial was established to collect local agronomic data on varieties from breeding programs in Canada, the U.S. and elsewhere. The varieties were planted in replicated plots at the Crop Diversification in Brooks, AB and were provided with 228 lbs/ac N. Alberta data is essential when selecting varieties appropriate for our climate, our customers and industry stakeholders.

Objectives

- A. To evaluate new cultivars for French fry processing;
- B. To evaluate new cultivars for chip processing;
- C. To evaluate new cultivars for fresh consumption; and
- D. To evaluate cultivars from AAFC's National Potato Breeding Program under Alberta conditions.

Materials and Methods

The variety evaluation was conducted in small plots at the Crop Diversification Centre South in Brooks, AB. Fertility for the AAFC plots (228 lbs/ac) was achieved through a combination of soil fertility (128 lbs/ac N; 499 lbs/ac P) and broadcast fertilizer (90 lbs/ac of 11-52-0) incorporated prior to planting. AAFC plots received an additional top-dressing (205 lbs/ac of 44-0-0) at hilling, for a total of 228 lbs/ac N. Entries were planted in duplicate rows in a randomized complete block design along with standard varieties. Each block was planted adjacent to guard rows to reduce any edge effects (see plot plan, Appendix A).

Sencor 75DF (150 g/ac) and Eptam 8E (1.8 L/ac) were applied prior to planting (May 4) to control weeds. Seed of standard cultivars and test cultivars was provided by AAFC. Potatoes were planted May 19 approximately 12 to 15cm deep using a two-row tuber unit planter. Seed was planted at 30cm spacing in 6m rows spaced 90cm apart. Plots were hilled June 3 with a power hiller. The plots were irrigated to maintain soil moisture close to 70%. Foliar fungicides were applied several times during the growing season to prevent early and late blight from developing (Table 1). Insecticide (Matador 120EC; 40 mL/ac) was applied July 27 to control Colorado Potato Beetle.

Table 1: Foliar fungicides applied to the potato crop in 2016 to prevent early and late blight development.

<i>Date of Application</i>	<i>Fungicide</i>	<i>Rate</i>
28 June	Bravo	0.64 L/ac
27 July	Ridomil Gold/Bravo	0.83L/ac
5 Aug	Bravo	0.64 L/ac
20 Aug	Dithane DG	0.91 kg/ac



Figure 1: Variety evaluation trial at CDCS in Brooks, AB August 5, 2016.

Reglone was applied (1.0 L/ac) August 23, 2016. Potatoes were harvested September 7 and 8 using a 1-row Grimme harvester.

Tubers were stored at 8°C until graded. Tubers were graded into size categories (less than 48mm, 48 – 88mm, over 88mm and deformed). A sample of twenty-five tubers (48 – 88mm) from each replicate was used to determine specific gravity using the weight in air over weight in water method. These tubers were cut longitudinally to assess internal defects. Sub-samples of 48-88mm tubers were provided to Lethbridge Research Centre staff for culinary and post-harvest evaluations.

The data presented here have not been statistically analyzed. Data reported are the mean of two replicate rows.

Results – Chipping Cultivars

Sample hills of each cultivar were dug for a field day August 16, 2016. Photos of the chipping cultivars are shown in Figure 2.

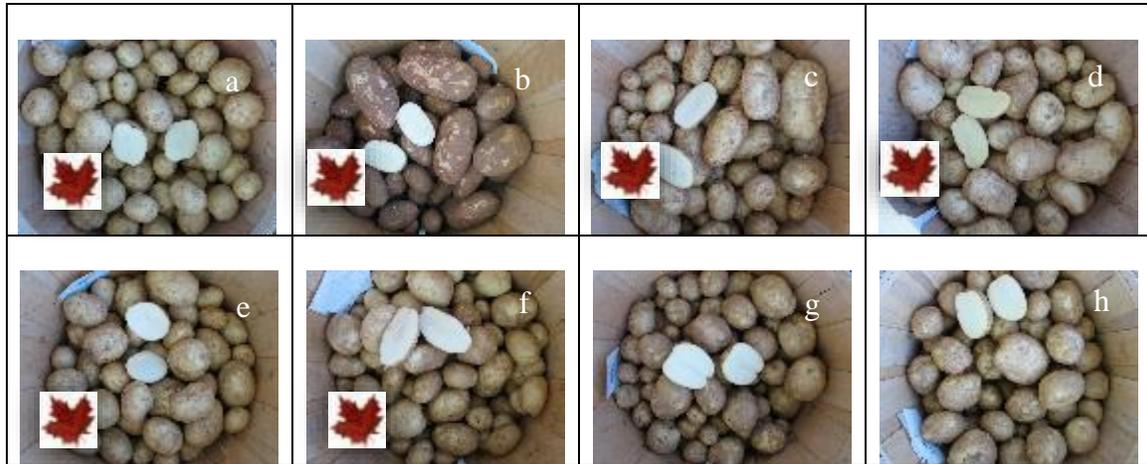


Figure 2. AAFC chipping cultivars at the CDCS field day August 16, 2016: a) F11011, b) F12002, c) F12012, d) F12015, e) F12016, f) F12017, g) Snowden East, and h) Atlantic East.

Yield data (total yield; ton/ac) and specific gravities of each of the chipping cultivars are shown in Table 2. Yield ranged from 24.4 for F12016 to 30.8 ton/ac for Atlantic East. Specific gravity ranged from 1.081 for F12002, F12015 and F12016 to 1.101 for Atlantic East.

Table 2: Estimated total yield (ton/acre) and specific gravity for each chipping cultivar grown at CDCS in Brooks, AB (approximately 228 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
Atlantic East	30.8	1.101
F11011	27.1	1.084
F12002	28.7	1.081
F12012	31.4	1.094
F12015	32.8	1.081
F12016	24.4	1.081
F12017	30.7	1.098
Snowden East	29.9	1.092

The mean percentage of total tuber number in each size category is shown in Table 3.

Table 3: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each chipping cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Atlantic East				
F11011				
F12002				
F12012				
F12015				
F12016				
F12017				
Snowden East				

The yield of tubers (estimated ton/ac) of each chipping cultivar is shown by size category in Table 4. Marketable yield ranged from 12.5 ton/acre for F12017 to 25.8 ton/ac for F12016.

Table 4: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each chipping cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Atlantic East	3.1	24.5	3.1	0.1
F11011	5.9	21.3	0.0	0.0
F12002	5.1	23.5	0.0	0.1
F12012	5.1	25.1	0.0	1.2
F12015	4.4	24.0	1.5	0.3
F12016	4.0	25.8	0.1	0.3
F12017	9.5	12.5	0.0	0.0
Snowden East	3.5	23.1	1.7	0.0

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart or brown center was noted in one tuber of Atlantic. Some tubers from each sample exhibited stem-end discoloration and this may be an indication that wilt organisms were present. Common scab and black scurf lesions were not present on the subsamples examined.

Results– French Fry Cultivars

Sample hills of each cultivar were dug for a field day August 27, 2015. Photos of the French fry cultivars are shown in Figure 3.

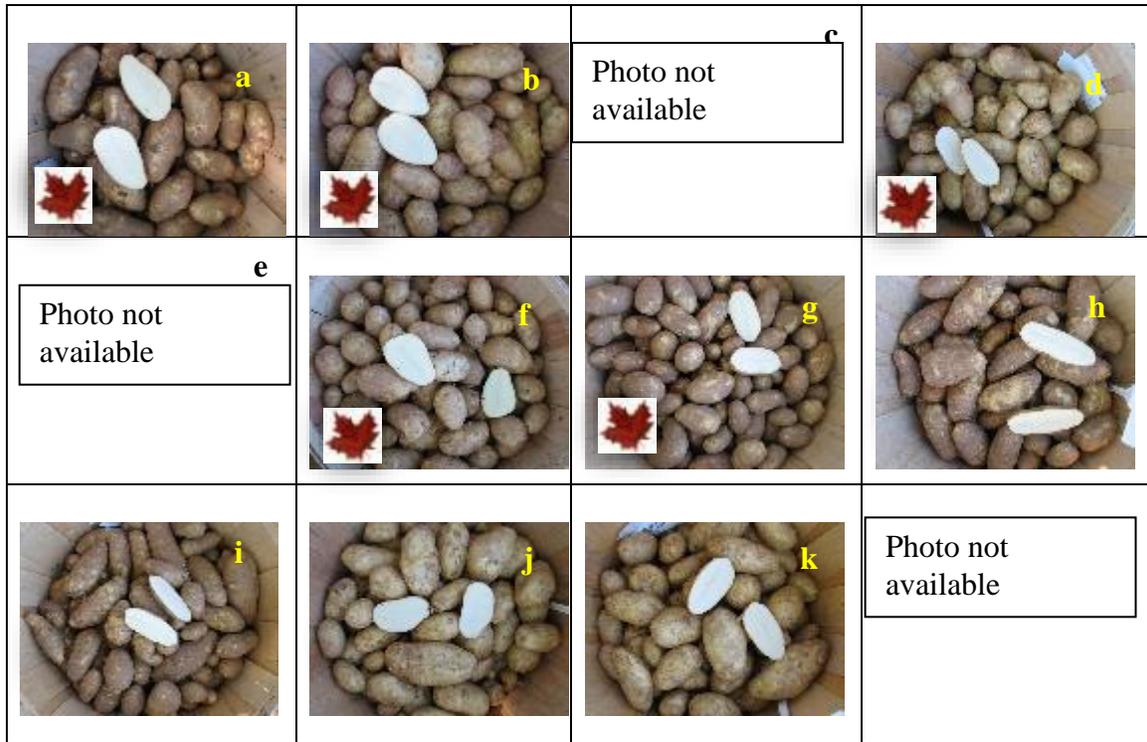


Figure 3. AAFC French fry cultivars at the CDCS field day August 16, 2016: a) F12004., b) F12008., c) F11001, d) F12011, e) CV01236-3, f) CV08104-5, g) WV10075rus-1, h) Russet Burbank E, i) Russet Burbank W, j).Shepody E, and k) Shepody W.

Yield data (total yield; ton/ac) and specific gravities of each of the French fry cultivars are shown in Table 5. Total yield ranged from 25.4 ton/ac for F12004 to 39.7 ton/ac for Shepody West. Specific gravity ranged from 1.072 for F12008 to 1.085 for F12011.

Table 5: Estimated total yield (ton/acre) and specific gravity for each French fry cultivar grown at CDCS in Brooks, AB (approximately 228 lbs/ac nitrogen). Data shown is the mean of two replicates.

	Yield (ton/ac)	SG
F12004	25.4	1.078
F12008	38.3	1.072
F12011	33.9	1.085
CV01236-3	33.9	1.078
CV08104-5	33.3	1.084
WV10075rus-1	29.6	1.085
R.Burbank East	27.6	1.077
R.Burbank West	33.8	1.078
Shepody East	31.3	1.075
Shepody West	39.7	1.077

The mean percentage of total tuber number in each size category is shown in Table 6.

Table 6: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each French fry cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
F12004	47	53	0	0
F12008	40	58	1	1
F12011	38	62	0	0
CV01236-3	51	48	0	1
CV08104-5	41	55	0	4
WV10075rus-1	86	12	0	1
R.Burbank East	46	40	0	13
R.Burbank West	50	45	0	5
Shepody East	34	62	2	2
Shepody West	26	67	3	4

The yield of tubers (estimated ton/ac) of each French fry cultivar is shown by size category in Table 7. Yield of 48 – 88mm tubers ranged from 7.1 ton/ac of WV10075rus-1 to 31.6 ton/ac of Shepody West.

Table 7: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each French fry cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
F12004	5.8	19.3	0.3	0.0
F12008	6.2	30.0	2.1	0.3
F12011	4.9	27.4	1.0	0.6
CV01236-3	9.5	24.0	0.0	0.4
CV08104-5	5.3	26.6	0.0	1.5
WV10075rus-1	21.8	7.1	0.0	0.6
R.Burbank East	5.1	16.4	0.6	5.5
R.Burbank West	8.4	22.1	0.6	2.7
Shepody East	3.9	24.4	1.9	1.1
Shepody West	3.0	31.6	3.2	1.9

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Hollow heart was noted in one tuber of WV10075rus-1 and one Russet Burbank tuber. Some tubers from each sample exhibited stem-end discoloration and this may indicate the presence of wilt organisms. Black scurf was only noted on individual tubers of F12011 and Russet Burbank.

Results – Fresh Market Cultivars

Sample hills of each cultivar were dug for a field day August 16, 2016. Photos of the yellow/white fresh market cultivars are shown in Figure 4.



Figure 4. AAFC yellow/white fresh market cultivars at the CDCS field day August 16, 2016: a) F12043, b) F12051, c) F12059, d) FV15920-01, e) WV10532-1, f) Yukon Gold East; and g) Yukon Gold West.

Photos of the purple/red-skinned fresh market cultivars are shown in Figure 5.



Figure 5. AAFC purple/red-skinned fresh market cultivars at the CDCS field day August 16, 2016: a) F12041, b) F12044, c) F12049, d) F12057, e) F12060, f) F12061, g) F12077, h) F12094, i) WV5888-2, j) Chieftain, and k) Norland E.

Yield data (total yield; ton/ac) and specific gravities of each of the fresh market cultivars are shown in Table 8. Total yield ranged from 23.6 ton/ac for F12094 to 45.4 ton/ac for FV15920-01. Specific gravity ranged from 1.067 for F12094 and WV5888-2 to 1.085 for Yukon Gold.

Table 8: Estimated total yield (ton/acre) and specific gravity for each fresh market FM) cultivar grown at CDCS in Brooks, AB (approximately 228 lbs/ac nitrogen). Data shown is the mean of two replicates.

	End Use	Yield (ton/ac)	SG
Yellow/white			
F12043	FM	29.1	1.076
F12051	FM	32.6	1.078
F12059	FM	39.4	1.080
FV15920-01	FM	45.4	1.078
WV10532-1	FM	38.0	1.083
Yukon Gold East	FM check	27.4	1.085
Yukon Gold West	FM check	28.2	1.082
Red-skinned			
F12041	FM	33.9	1.081
F12044	FM	42.3	1.083
F12049	FM	36.4	1.081
F12057	FM	39.6	1.081
F12060	FM	22.2	1.075
F12061	FM	33.9	1.076
F12077	FM	34.6	1.084
F12094	FM/AO/Fingerling	23.6	1.067
WV5888-2	FM/CR	38.4	1.067
Chieftain	FM check	40.3	1.073
Norland East	FM check	33.5	1.064

The mean percentage of total tuber number in each size category is shown in Table 9.

Table 9: Percentage of total tuber number in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed) for each fresh market cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	No. of <48mm	No. of 48 to 88mm	No. of > 88mm	No. of deformed
Yellow				
F12043	38	61	1	0
F12051	29	65	6	0
F12059	34	65	1	0
F12044	20	73	7	0
FV15920-01	38	60	1	0
WV10532-1	32	68	0	0
Yukon Gold East	21	72	4	3
Yukon Gold West	49	39	2	11
Red-skinned				
F12041	27	69	4	1
F12044	20	73	7	0
F12049	37	61	1	1
F12057	46	53	1	0
F12060	24	69	4	3
F12061	33	66	1	0
F12077	36	64	0	0
F12094	89	10	0	1
WV5888-2	46	53	1	1
Chieftain	20	73	6	1
Norland East	24	71	3	1

The yield of tubers (estimated ton/ac) of each fresh market cultivar is shown by size category in Table 10.

Table 10: Estimated yield (ton/ac) in each size category (< 48mm, 48 to 88mm, > 88mm, and deformed tubers) for each fresh market cultivar grown at approximately 228 lbs/ac. Data shown is the mean of two replicates.

	Yield of <48mm (ton/ac)	Yield of 48 to 88mm (ton/ac)	Yield of > 88mm (ton/ac)	Yield of deformed (ton/ac)
Yellow				
F12043	3.8	24.0	1.1	0.1
F12051	2.8	24.3	5.4	0.0
F12044	1.7	33.3	4.6	2.6
F12059	5.4	32.9	0.9	0.3
FV15920-01	6.4	35.8	2.8	0.5
WV10532-1	21.8	7.1	0.0	0.6
Yukon Gold East	1.2	22.2	2.9	1.0
Yukon Gold West	4.6	17.1	2.5	4.0
Red-skinned				
F12041	2.9	27.1	3.7	0.3
F12044	1.7	33.3	4.5	2.6
F12049	4.7	30.0	1.6	0.2
F12057	6.3	31.9	1.0	0.4
F12060	2.0	17.4	2.1	0.8
F12061	4.4	28.6	0.8	0.2
F12077	5.6	28.9	0	0.1
F12094	17.5	5.6	0.0	0.5
WV5888-2	8.4	28.5	0.8	0.6
Chieftain	3.2	31.1	5.7	0.4
Norland East	2.4	28.0	2.6	1.1

Tuber samples used to measure specific gravity were evaluated for hollow heart, other internal defects and scab. There were very few internal defects observed in the tubers examined. Some tubers from each sample exhibited stem-end discoloration and this may indicate the presence of a wilt organism. Common scab lesions were only noted on one WV5888-2 tuber and eight tubers of Yukon Gold.

Conclusions

The 2016 variety trial included a number of cultivars with potential in southern Alberta. Atlantic and Snowden were included in the trial as standard varieties to compare to 6 chipping cultivars. Russet Burbank and Shepody were included in the trial as standard varieties to compare 6 French fry cultivars with. Yukon Gold, Chieftain and Norland were included in the trial as standard varieties to compare with 15 fresh market cultivars.

The trial was designed to provide regional data for a wide range of potato cultivars. All cultivars were planted at the same in-row spacing, the N rate was approximately 228 lbs/ac, and harvest was scheduled for full-season varieties. Addressing the agronomic needs, such as plant density, fertility requirements, and harvest timing for each variety may well result in improvements to yield and size profiles when compared to the results in this trial.

References

- Love, S.L., R. Novy, D. Corsini, and P. Bain. 2003. Variety Selection and management. In: Potato Production Systems (J.C. Stark and S.L. Love, eds.). University of Idaho Agricultural Communications, Moscow, ID. pp: 21-47.
- Westermann, D.T. 1993. Fertility management. In: Potato Health Management (R.C. Rowe, ed.). APS Press, St. Paul, MN. pp: 77-86.

Acknowledgements

Thank you to seasonal staff Mary-Lou Benci, William Lai, Rebecca Pemberton and Kaylene MacKinnon for technical support throughout the trial. This project is generously funded through the Canadian Agri-Science Cluster for Horticulture 2, in partnership with Agriculture and Agri-Food Canada's Agri-Innovation Program, a Growing Forward 2 initiative, the Canadian Horticultural Council, Alberta Agriculture and Forestry, the Potato Growers of Alberta and through cash and in-kind contributions from potato industry partners:

Alberta Seed Producers Inc.
ConAgra Foods, Lamb Weston Division
Edmonton Potato Growers
Little Potato Company
Old Dutch Foods
New Zealand Institute of Plants and Food Research
Parkland Seed Potatoes
Prairie Gold Produce
Rockyview Seed Potatoes
Solanum International Inc.
Tuberosum Technologies Inc.

Contact Information:

Michele Konschuh, Ph.D.
Potato Research Scientist
Alberta Agriculture and Forestry, CDCS
301 Horticultural Station Road East
Brooks, AB T1R 1E6
403-362-1314 phone
403-362-1306 fax
Michele.Konschuh@gov.ab.ca

and

Benoit Bizimungu, Ph.D.
Potato Breeder
Agriculture and Agri-Food Canada
Potato Research Centre
850 Lincoln Road P.O. Box 20280
Fredericton, NB E3B 4Z7
506-452-4880
506-452-3316
Benoit.Bizimungu@AGR.GC.CA

Appendix A Plot Plan

AAFC - 2016 - Brooks				N 		Planted May 9			
20 Seed pieces per row				12 x 74 = 888 m ²					
Guard = Norland									
12	Guard	Guard	Guard	Guard	Guard	Guard	Guard	Guard	Guard
11	1001 Chieftain East	1011 F12011	1021 CV08104-5	1031 Norland East	2001 F12012	2011 F12057	2021 F12059	2031 F12049	
10	1002 F12059	1012 Snowden East	1022 F12051	1032 Yukon Gold West	2002 F12044	2012 F12094	2022 F12017	2032 F12041	
9	1003 F12044	1013 Atlantic East	1023 F11011	1033 WV10532-1	2003 F12051	2013 CV01236-3	2023 F12002	2033 Yukon Gold East	
8	1004 F12043	1014 R.Burbank East	1024 F12002	1034 F12041	2004 Atlantic East	2014 Yukon Gold West	2024 F12011	2034 F12060	
7	1005 Sshepody West	1015 Shepody East	1025 F12057	1035 Yukon Gold East	2005 CV08104-5	2015 F12043	2025 F12015	2035 Chieftain East	
6	1006 F12004	1016 F12008	1026 F12015	1036 F12061	2006 Shepody West	2016 F12008	2026 Norland East	2036 WV10532-1	
5	1007 FV15920-01	1017 CV01236-3	1027 F12094	Guard	2007 Snowden East	2017 F12004	2027 F12061	Guard	
4	1008 F12017	1018 WV10075rus-1	1028 F12016	Guard	2008 Shepody East	2018 FV15920-01	2028 F11011	Guard	
3	1009 F12060	1019 F12012	1029 WV5888-2	Guard	2009 WV10075rus-1	2019 R.Burbank East	2029 WV5888-2	Guard	
2	1010 F12049	1020 R.Burbank West	1030 F12077	Guard	2010 R.Burbank West	2020 F12016	2030 F12077	Guard	
1	Guard	Guard	Guard	Guard	Guard	Guard	Guard	Guard	
	6 m	3 m			10m	6m	3m		