Monitoring of wintering geese in the AES Geo Energy Wind Farm "St. Nikola" territory and the Kaliakra region in winter 2015/2016

Dr. Pavel Zehtindjiev
Institute of Biodiversity and Ecosystem Research – Bulgarian Academy of Sciences
2 Gagarin Street, 1113 Sofia, Bulgaria
e-mail: pavel.zehtindjiev@gmail.com

Dr. D. Philip Whitfield
Natural Research Ltd
Brathens Business Park
Glassel, Banchory
Aberdeenshire AB31 4BY, Scotland

Photo:Vasil Popov

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32A Cherni Vrah Blvd., 1407 Sofia,
Bulgaria

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Contents

Introduction

This report presents results of the ornithological survey and monitoring at Saint Nikola Wind Farm (SNWF) in the period 01 December 2015 to 15 March 2016, continuing from similar studies in previous winters before and after construction of SNWF including period of carcass searches and Turbine Shut Down System application in winter 2015-2016. As stated in previous reports the primary objective of wintering bird studies at SNWF is to investigate the possible effects of the wind farm on geese populations, notably the Red-breasted Goose *Branta ruficollis* (RBG) due to its globally threatened conservation status. Previous years' wintering studies at SNWF have been reported and presented for download on the AES SNWF website.

To date, as documented by previous reports, there have been no indications that SNWF has had any adverse impact on wintering geese, including RBG, and the more abundant Greater White-fronted Goose (*Anser albifrons*) (GWFG). This report presents the latest results, from the 2015/16 winter monitoring of SNWF.

Methods

Methods were the same as in previous winter surveys. These methods were described in detail by a number of previous reports, available at: http://www.aesgeoenergy.com/site/Studies.html

Data were collected within a 'core study area' that encompassed an area centered on the SNWF wind farm, but with additional areas in a buffer that extended at least 2 km from the wind farm (Figure 1)

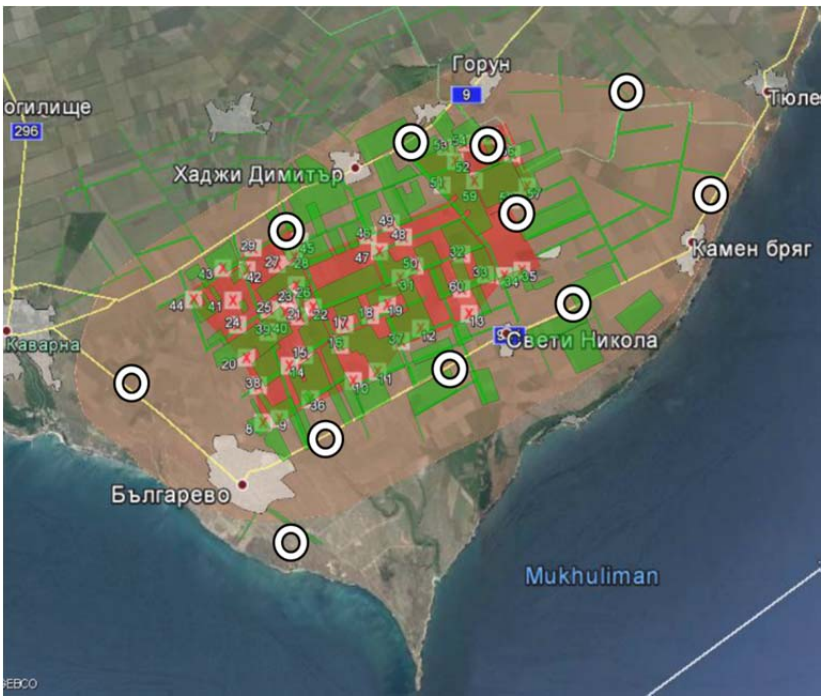


Figure 1. *Map of the "SNWF" study area (red and green), and the "core study area" (brown) and observation points covered by the winter monitoring 2015 – 2016. The green color indicates fields with wheat potentially suitable for feeding geese.*

Searches under turbines for collision victims were set to be undertaken, as in previous winters, under a protocol for a basic seven day search interval as presented in Table 1. Details on the searching methodology were published in previous reports available at the web site http://www.aesgeoenergy.com/site/Studies.html.

Table 1. Number of searches per turbine in the period of winter monitoring (01 December 2015 – 30 March 2016).

№ Turbine	December	January	February	March	Total
8	1	5	5	1	12
9	1	4	5	1	11
10		4	1	1	6
11		4	2	1	7
12	1	3	4	1	9
13	1	5	4	1	11
14	1	3	5	1	10
15	1	4	5	1	11
16	1	4	2	1	8
17	1	4	2	1	8
18	1	4	5	1	11
19	1	2	4	1	8
20	1	4	5	1	11
21		4	3	1	8
22	1	3	2	1	7
23		3	2	1	6
24	1	2	5	1	9
25	1	2	5	1	9
26		5	3	1	9
27		4	3	1	8
28		5	3	1	9
29	1	3	5	1	10
31	1	3	5	1	10
32	1	5	5	1	12
33	1	5	4	1	11
34	1	5	4	1	11
35	1	5	4	1	11
36	1	5	5	1	12
37	1	2	4	1	8
38		4	6	1	11
39	1	3	5	1	10
40	1	2	5	1	9
41	1	2	5	1	9
42	1	2	5	1	9
43	1	2	5	1	9
44	1	2	5	1	9
45		5	4	1	10

№ Turbine	December	January	February	March	Total
46	**1**	**6**	**4**	**1**	**12**
47	**1**	**3**	**4**	**1**	**9**
48	**1**	**2**	**4**	**1**	**8**
49	**1**	**4**	**4**	**1**	**10**
50	**1**	**2**	**5**	**1**	**9**
51	**1**	**3**	**3**	**1**	**8**
52	**1**	**3**	**3**	**1**	**8**
53	**1**	**3**	**3**	**1**	**8**
54	**1**	**3**	**3**	**1**	**8**
55	**1**	**3**	**3**	**1**	**8**
56	**1**	**3**	**3**	**1**	**8**
57	**1**	**3**	**3**	**1**	**8**
58	**1**	**3**	**3**	**1**	**8**
59	**1**	**3**	**3**	**1**	**8**
60	**1**	**5**	**4**	**1**	**11**
Grand Total	**43**	**182**	**203**	**52**	**480**

A detailed description of methods underlying the decisions and procedures for switching off turbines (the Turbine Shutdown System: TSS) under a risk of bird collisions, is described in a number of previous reports and in the Owner Ornithological Monitoring Plan. The feeding grounds and flight activity of geese within the wind farm and surrounding areas identified in the winter surveys were investigated daily and the number of feeding geese at these sites and weather conditions (i.e. heavy mist, fog) were the bases of decisions for the TSS for reduction of the collision risk. As in previous winters, if substantial goose activity at SNWF coincided with weather conditions of adverse visibility then the TSS would be enacted. In addition, given the propensity for some other sensitive or endangered species to occur at SNWF in recent winters (notably Dalmatian Pelican *Pelecanus crispus* – see Results) the TSS has also been enacted to avoid any possibility of collision for such species.

All observations per day were digitalized and mapped for analysis and presentation in this report.

List of participants in the observations

Dr Pavel Zehtindjiev
Senior Field Ornithologist
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences

Victor Metodiev Vasilev
Field ornithologist; Qualified carcass searcher
Senior researcher in the Faculty of Biology, University of Shumen, Bulgaria
Member of BSPB since 1992

Ivailo Antonov Raykov
Field ornithologist; Qualified carcass searcher
Museum of Natural History, Varna
Member of BSPB since 1999

Vesilina Ivanova Raykova
Field ornithologist; Qualified carcass searcher
Museum of Natural History, Varna
Member of BSPB since 1999

Strahil Georgiev Peev
Field ornithologist; Qualified carcass searcher
Student in Faculty of Biology, Sofia University

Karina Ivailova Ivanova
Field ornithologist
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences

Kiril Ivanov Bedev
Field ornithologist; Qualified carcass searcher
Biologist

Yanko Sabev Yankov
Field ornithologist; Qualified carcass searcher
Student in Biology

Vladimir Petrov Petrov
Field ornithologist; Qualified carcass searcher
Student in Biology

Results

Temporal dynamics and composition of species

Geese were observed within the core study area between 24 December 2015 and 14 February 2016. The numbers of geese observed in the core study area each day are presented in Table 2.

Table 2. Geese numbers by species and day of monitoring in the core study area.

Species	A.albifrons	A.anser	Anser/Branta	B.ruficollis	Total
24.12.2015	60				60
3.1.2016	140			10	150
4.1.2016	9				9
5.1.2016	319		805	103	1227
7.1.2016	155		1767	620	2542
8.1.2016	94		2625	910	3629
9.1.2016	532		2505	500	3537
10.1.2016	108		3200	100	3408
11.1.2016		7	845		852
12.1.2016			670	1050	1720
13.1.2016	51		485		536
14.1.2016			1330	42	1372
16.1.2016	9			1	10
17.1.2016	20			45	65

Species	A.albifrons	A.anser	Anser/Branta	B.ruficollis	Total
18.1.2016			190	35	225
19.1.2016	69		1020		1089
20.1.2016	2783	7	13540	652	16982
21.1.2016	360	3	1182		1545
22.1.2016	46	3	150		199
23.1.2016	193		1290		1483
24.1.2016	458		9315	75	9848
25.1.2016	112	2	3588	80	3782
26.1.2016	1274	20	5606	222	7122
27.1.2016	153	9	15549	40	15751
28.1.2016	5663		36299	1700	43662
29.1.2016	2173	5	9070	400	11648
30.1.2016	376		632		1008
31.1.2016	70		212		282
1.2.2016	82	16	179		277
2.2.2016	223		1250	85	1558
3.2.2016	1		260		261
4.2.2016			70		70
5.2.2016	1				1
6.2.2016	22		130		152
7.2.2016	30		170		200
14.2.2016			250		250
Grand Total	**15586**	**72**	**114184**	**6670**	**136512**

All species of geese were present in the core study area between the end of December 2015 and the end of January 2016, apart from a small number seen in the first two weeks of February (Table 2 and Figure 3).

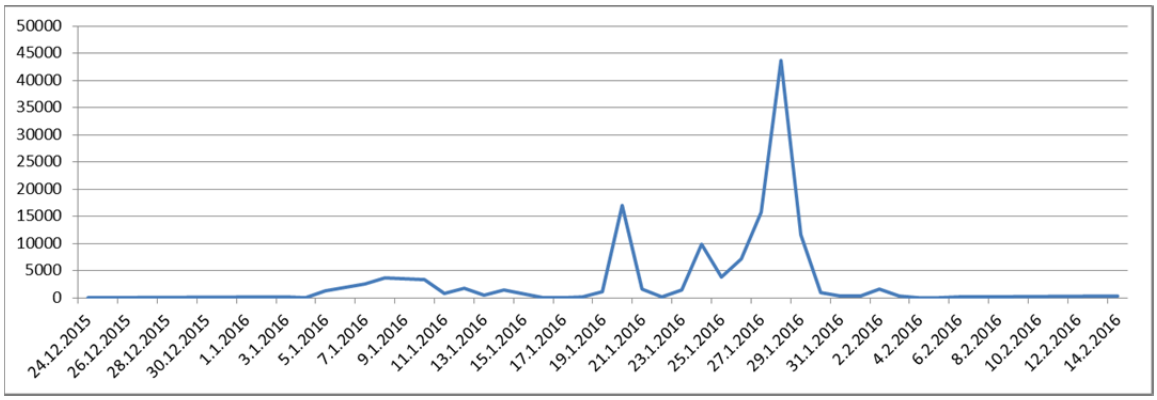


Figure 3. *Temporal distribution of geese (all species) observed in the core study area in winter 2015-2016.*

Unusual for the season, but recorded first in the previous winter (see report winter 2014-2015) several flocks of Dalmatian Pelicans (*Pelecanus crispus*) were observed on 5th, 8th and 14th of January as well as on 2nd and 3rd of February. Other unusual records for the season were one singleton and two flocks of Cranes (*Grus grus*) registered on 1st and 5th of March respectively. Another unusual rarity, the Demoiselle Crane (*Grus virgo*) was observed as a

flock of three birds, recorded outside the monitoring period on the last day of March 2016, and therefore not reported below (Table 3).

The number of birds per species, excluding geese species, is presented in Table 3.

Table 3. The total number of observed birds of different species (excluding geese: see Table 2 for geese) in the core study area (Figure 1) recorded in winter season 2015 - 2016.

Species	December	January	February	March	Grand Total
A. alba		27			27
A. strepera		14			14
A.arvensis		530			530
A.cinerea		1			1
A.clypeata			3		3
A.gentilis		2	2		4
A.nisus	3	8	2		13
A.platyrhynchos		866	360		1226
Accipiter sp.			1		1
Anas sp.		521			521
Anser sp.		28			28
B. bubo			1		1
B.buteo	136	80	17	6	239
B.lagopos	4	22		1	27
B.rufinus	1	1		1	3
C.aeruginosus		7		2	9
C.alpina		3			3
C.corax	1	2			2
C.cornix		3		2	6
C.cyaneus	21	40	26	10	97
C.cygnus		146	20		166
C.monedula		35			35
C.oenas		2			2
C.olor		1060	621		1681
Cygnus sp.		1073	453		1526
E.alba		4	1		5
F.cherug			1		1
F.columbarius	2	4	6		12
F.peregrinus		1			1
F.tinnunculus	2	2	4		8
Falco sp.		1			1
G.grus				30	30
H.albicilla		6			6
L. michahellis		9	52		61
L.canus		21			21
L.excubitor			2		2
M. calandra		300	500		800

Species	December	January	February	March	Grand Total
M.alba			12		12
P. apricaria			8		8
P.carbo	177	422	634	320	1553
P.crispus		43	13	1	57
P.perdix		14	2		16
Ph. pygmaeus		2			2
Pl.apricaria	313		70		383
S.rusticolax		1			1
St.vulgaris	13601	5000	310		18911
T.ferrugenea		30			30
T.ochropus			3		3
V.vanellus	26	2			28
Grand Total	**14287**	**10333**	**3124**	**373**	**28117**

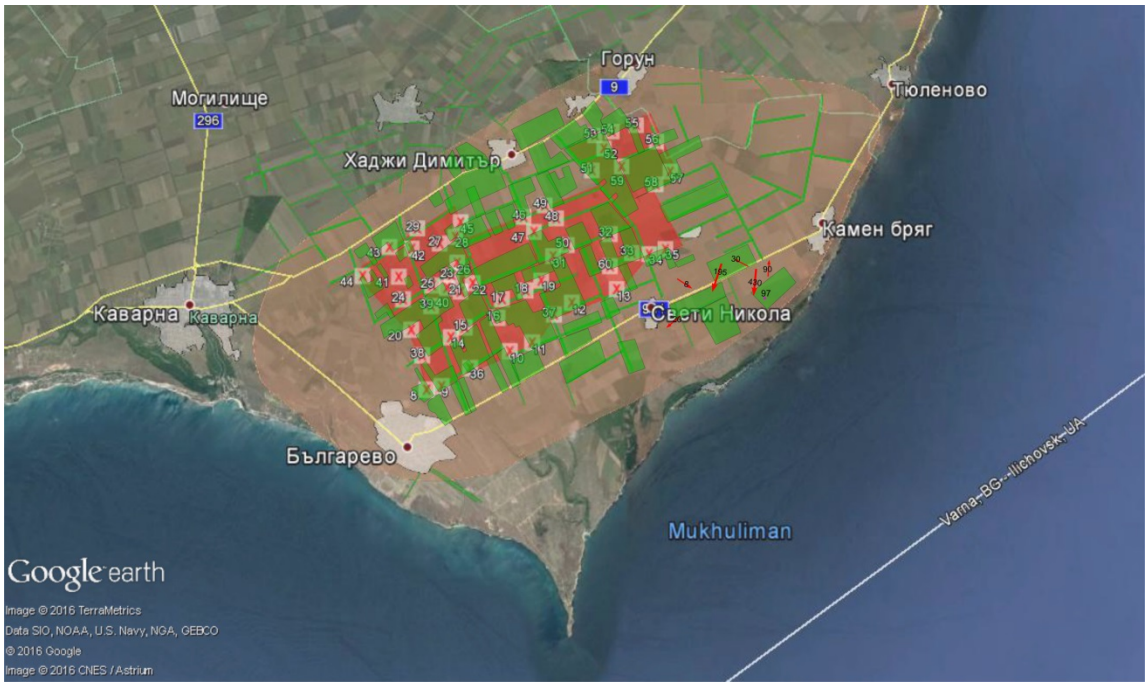
Total number of observed goose species and their locations

The total numbers of all observed individuals of three species of goose, RBG (*Branta ruficollis*), GWFG (*Anser albifrons*) and Greylag Goose (*Anser anser*) in all observation points during the whole period of the winter monitoring 2015-2016 in the core study area, are shown in Table 4.

Table 4. The number of geese of different species recorded in the core study area (data from visual observations in winter 2015/2016).

Speies	December	January	February	Total
A.albifrons	60	15167	359	15586
A.anser		56	16	72
Anser/Branta		111875	2309	114184
B.ruficollis		6585	85	6670
Grand Total	**60**	**133683**	**2769**	**136512**

The recorded movements of geese as well as feeding locations are mapped day by day. Identification of all individuals in the mixed flocks of geese is impossible from a distance in early morning and evening hours. The numbers indicated in the maps below represent total geese numbers observed day by day in the period when RBG were present in the core study area. The blue and red arrows represent morning and evening movements respectively.



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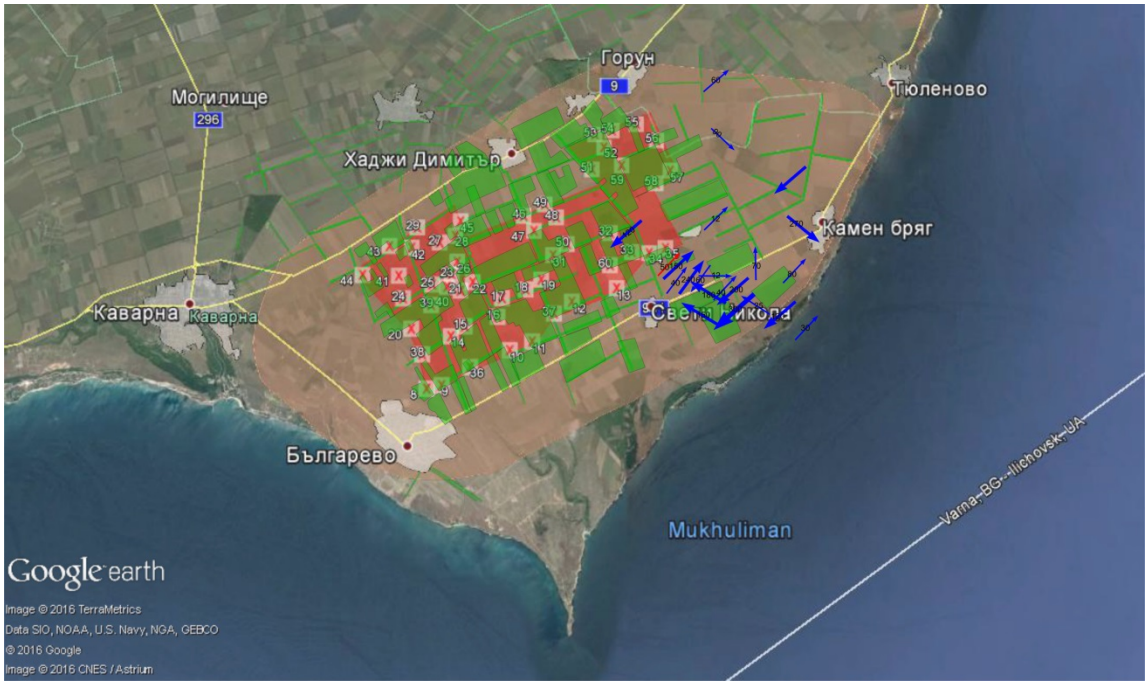

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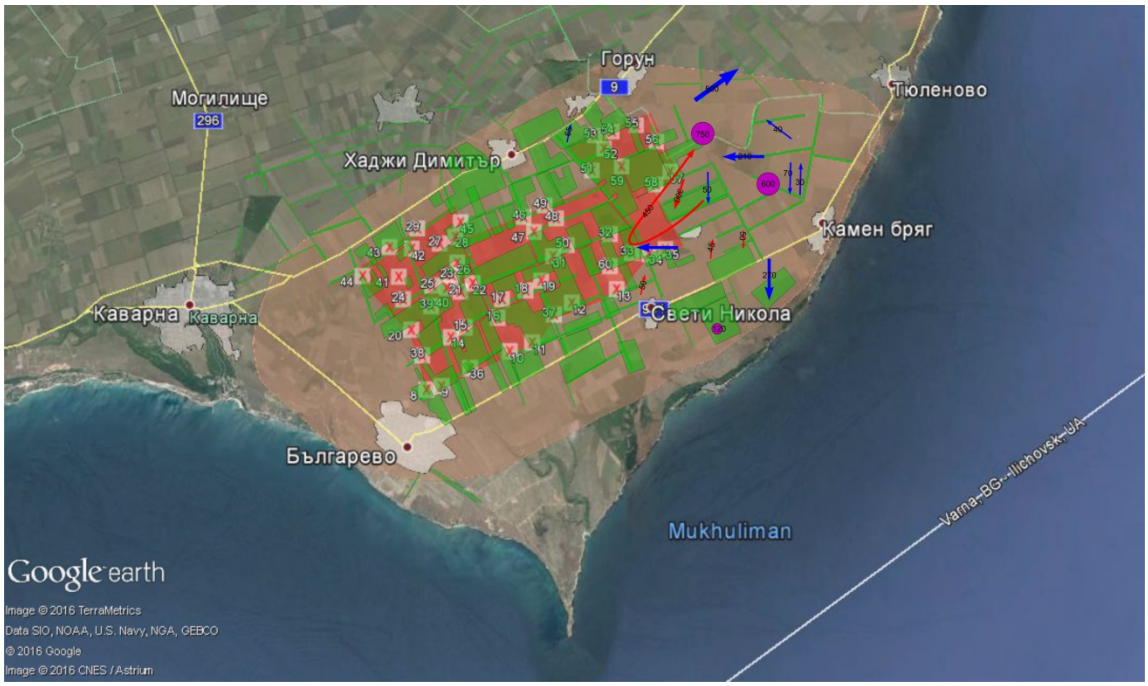

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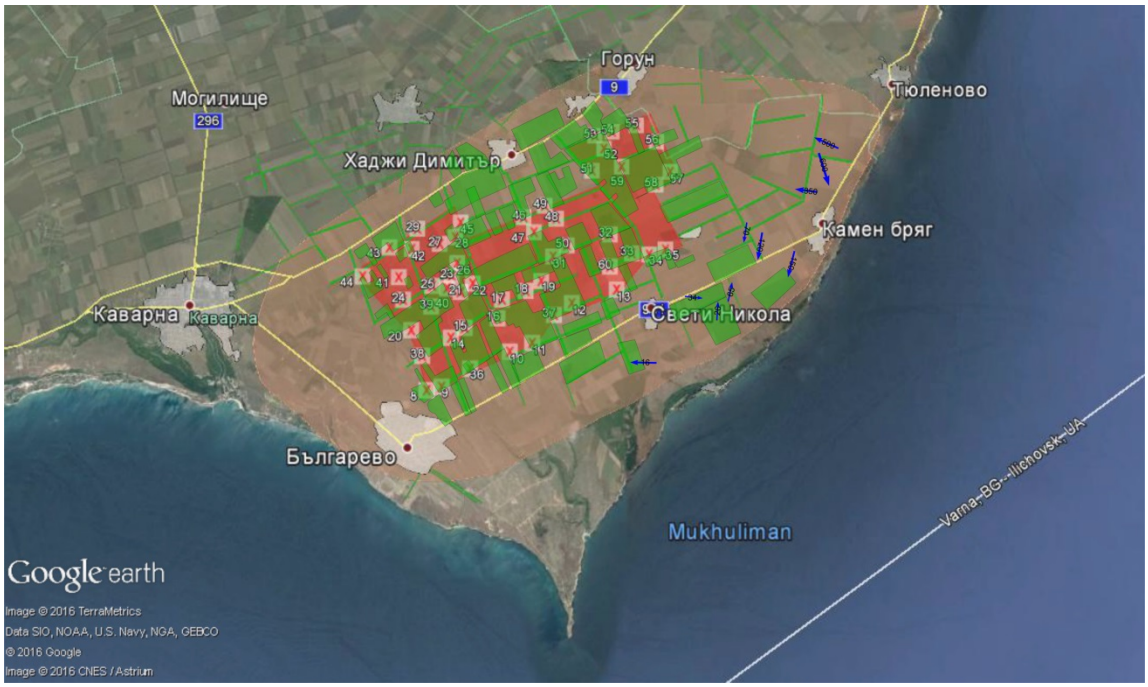

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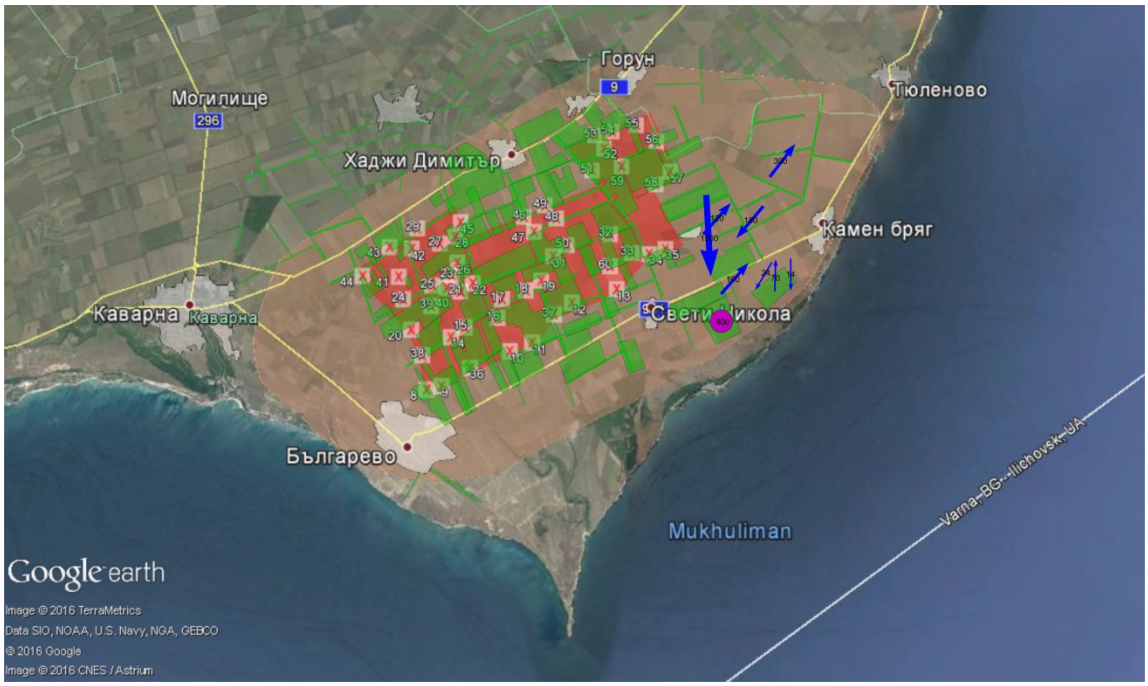

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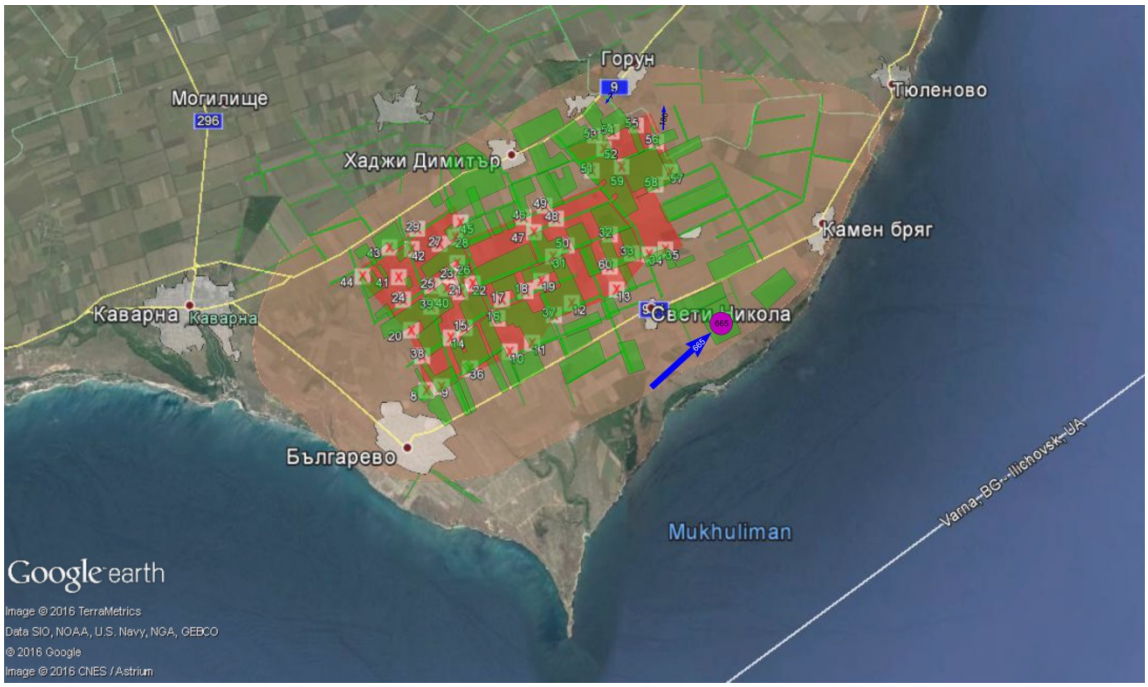

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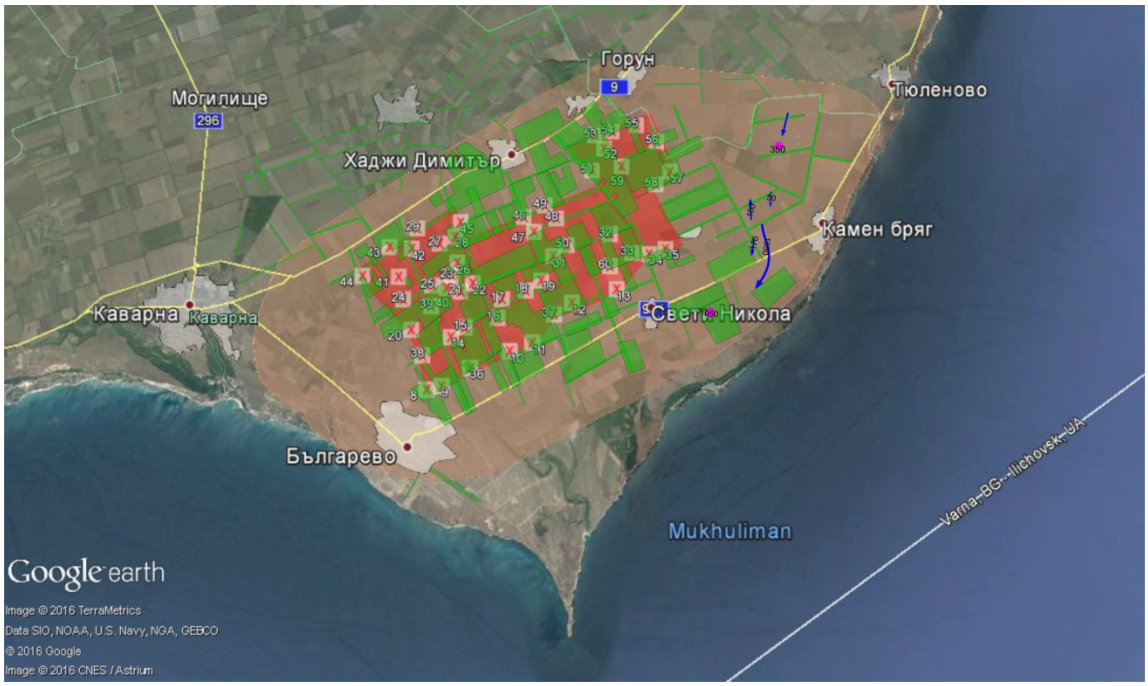

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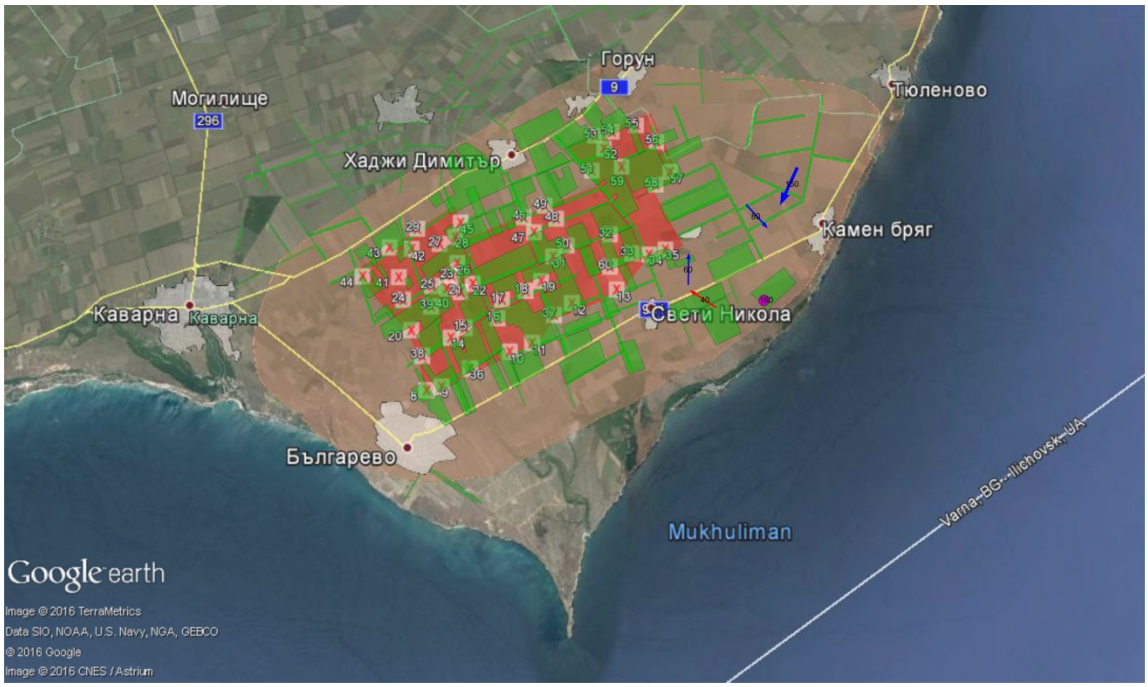

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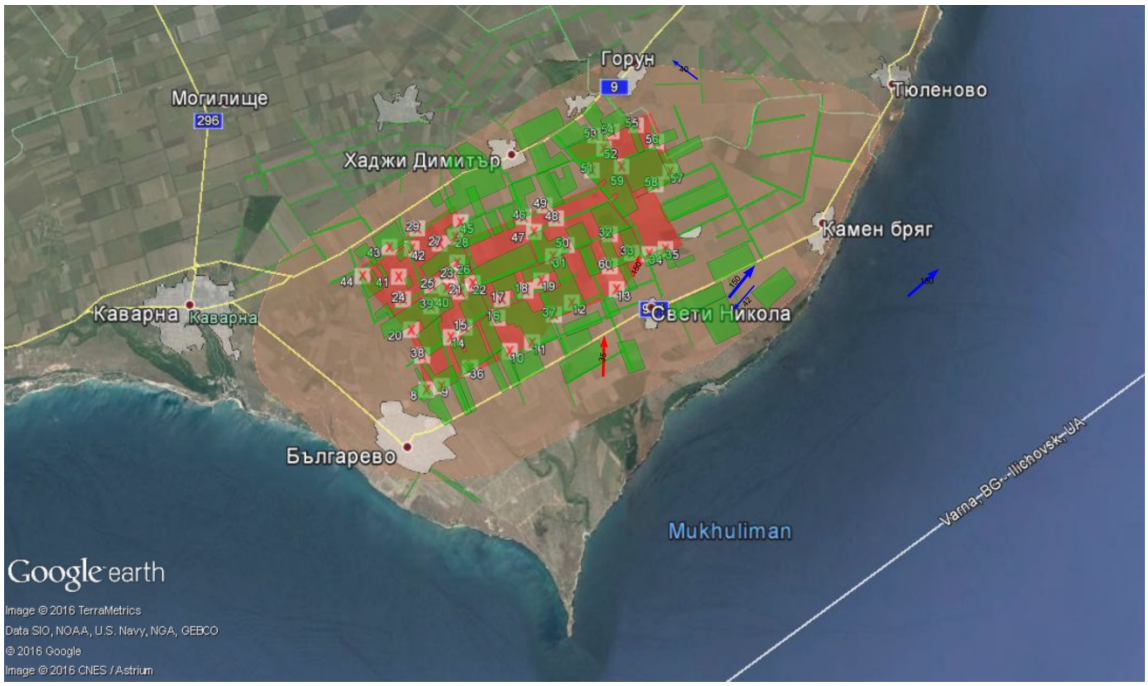

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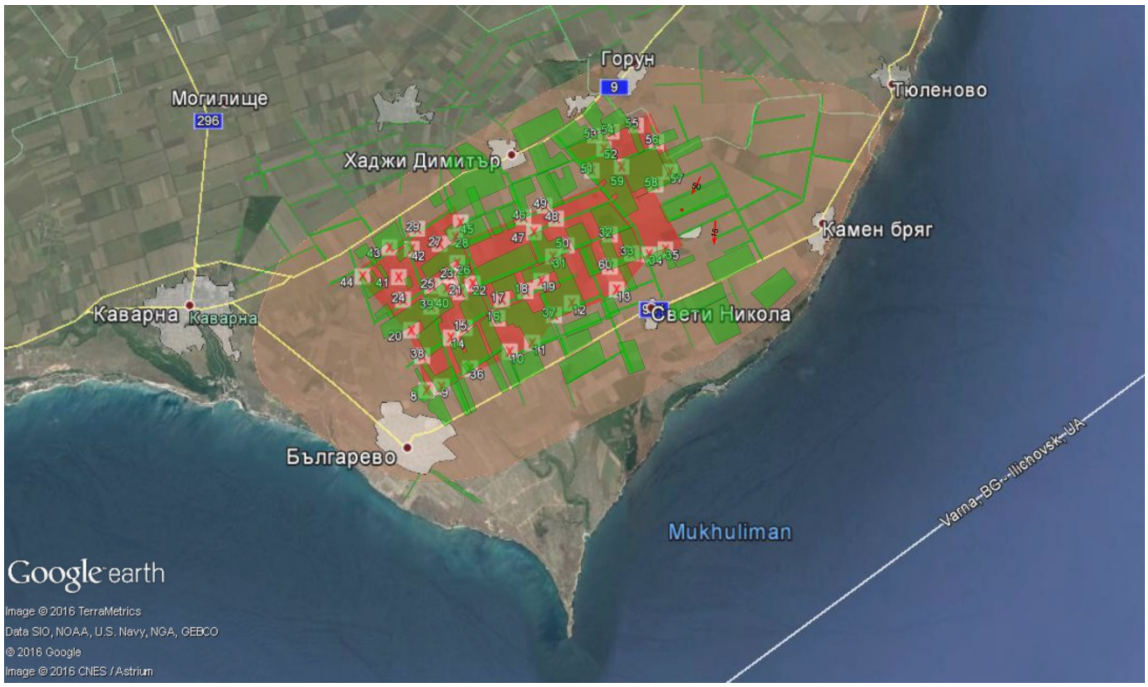

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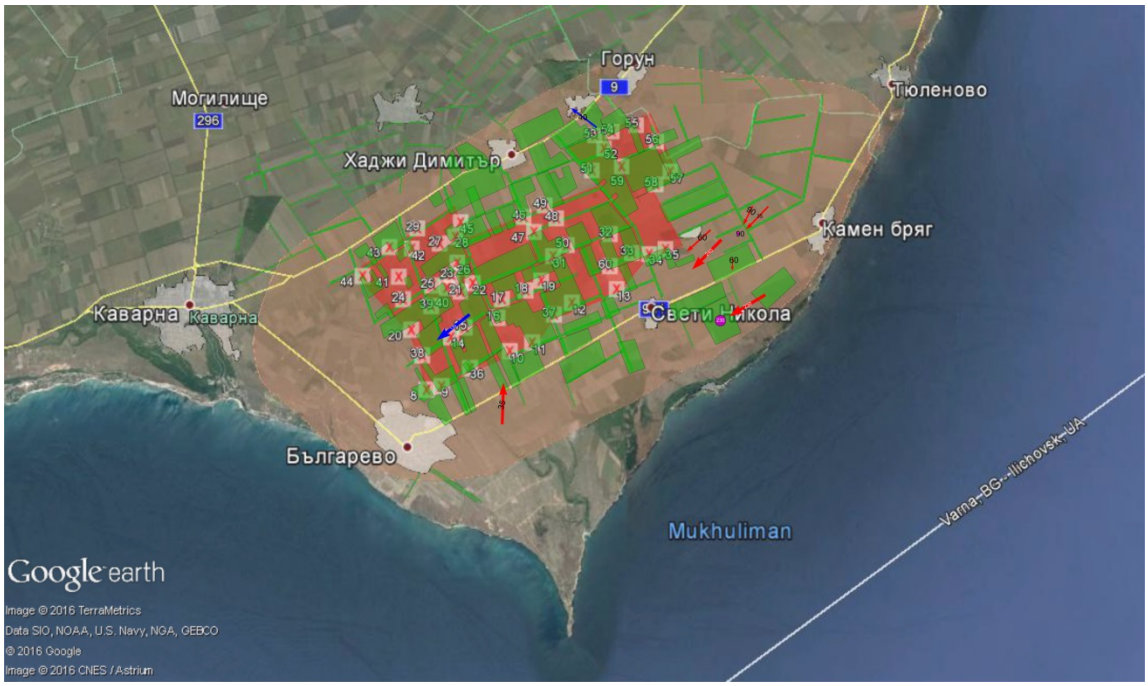

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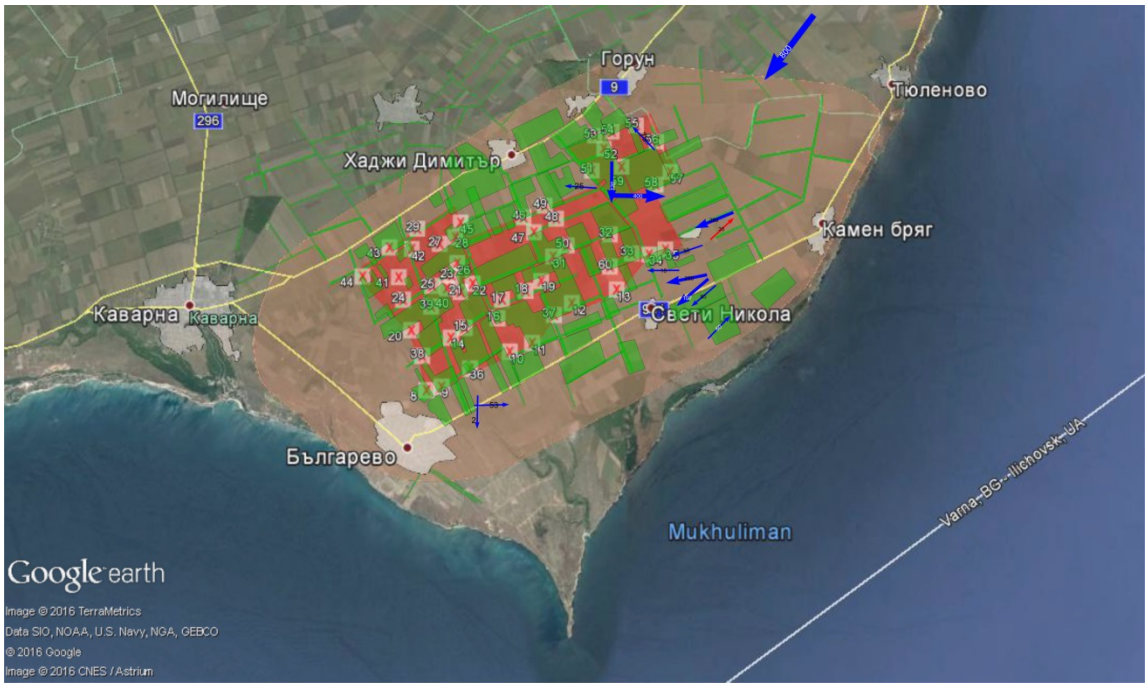

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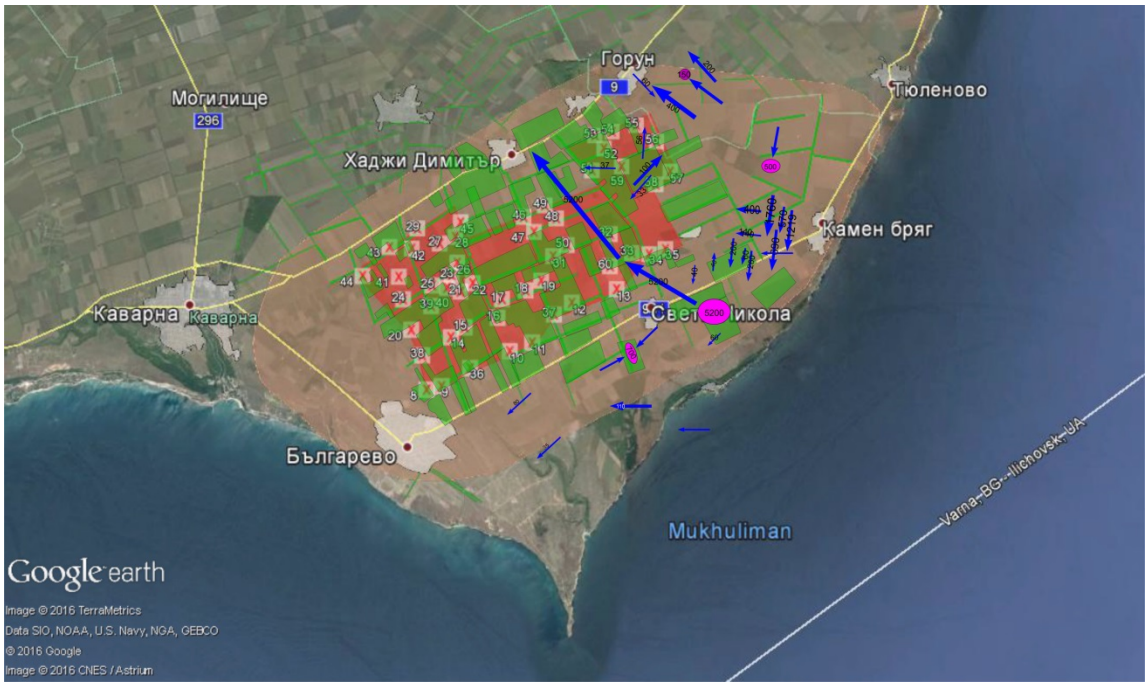

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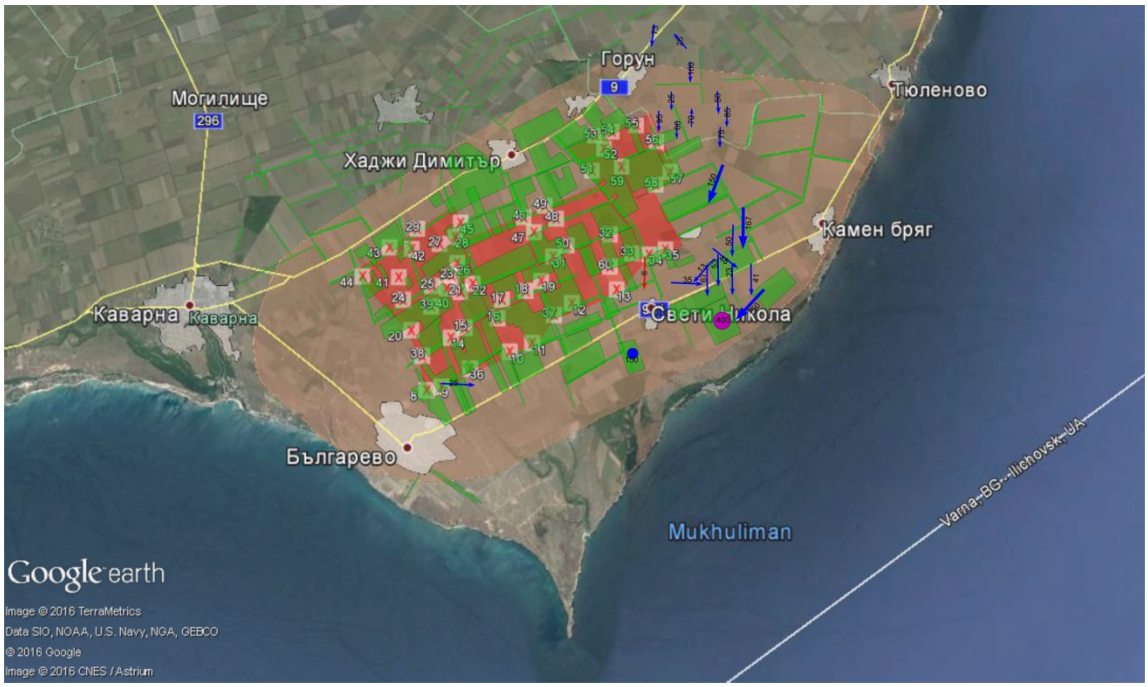

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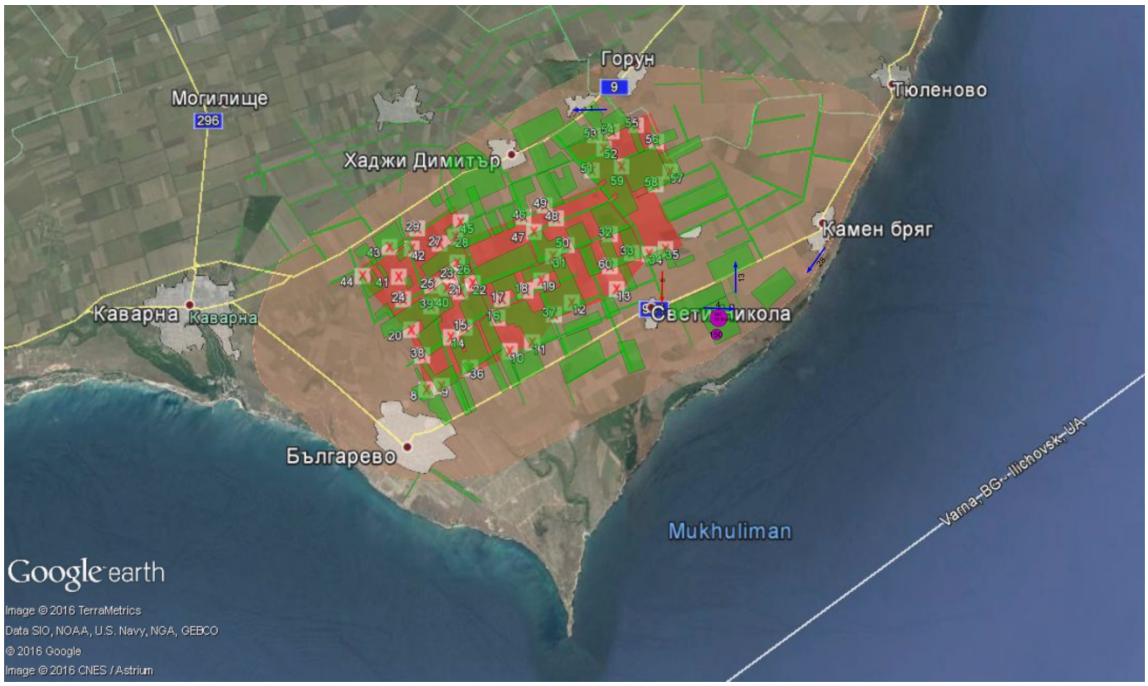

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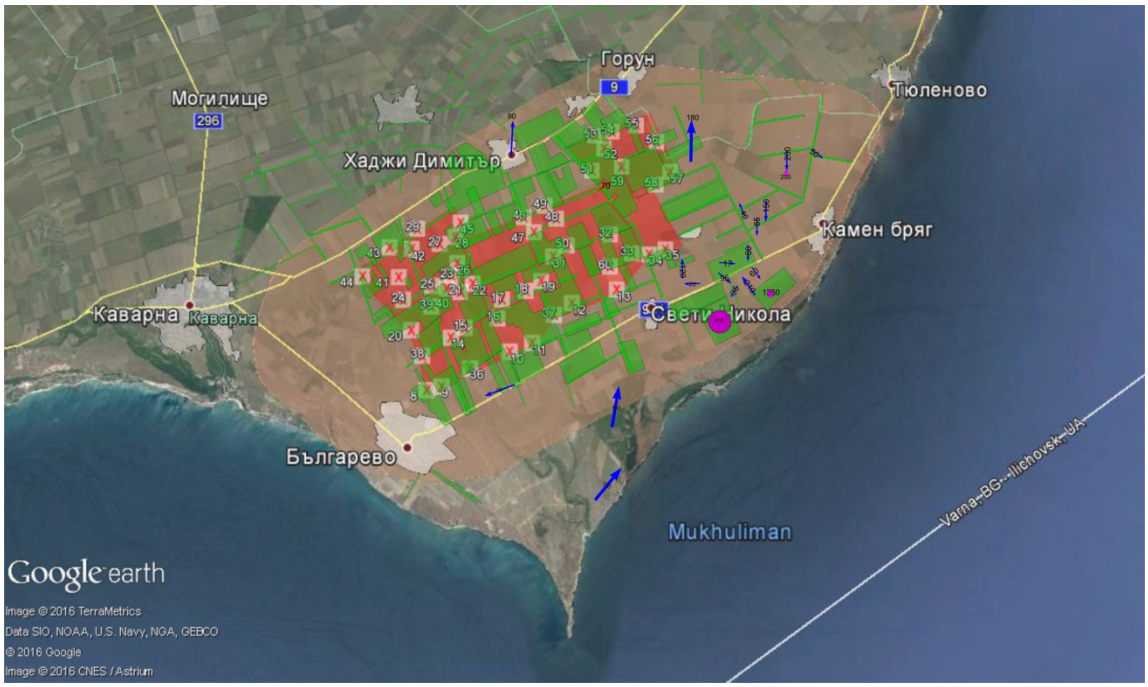

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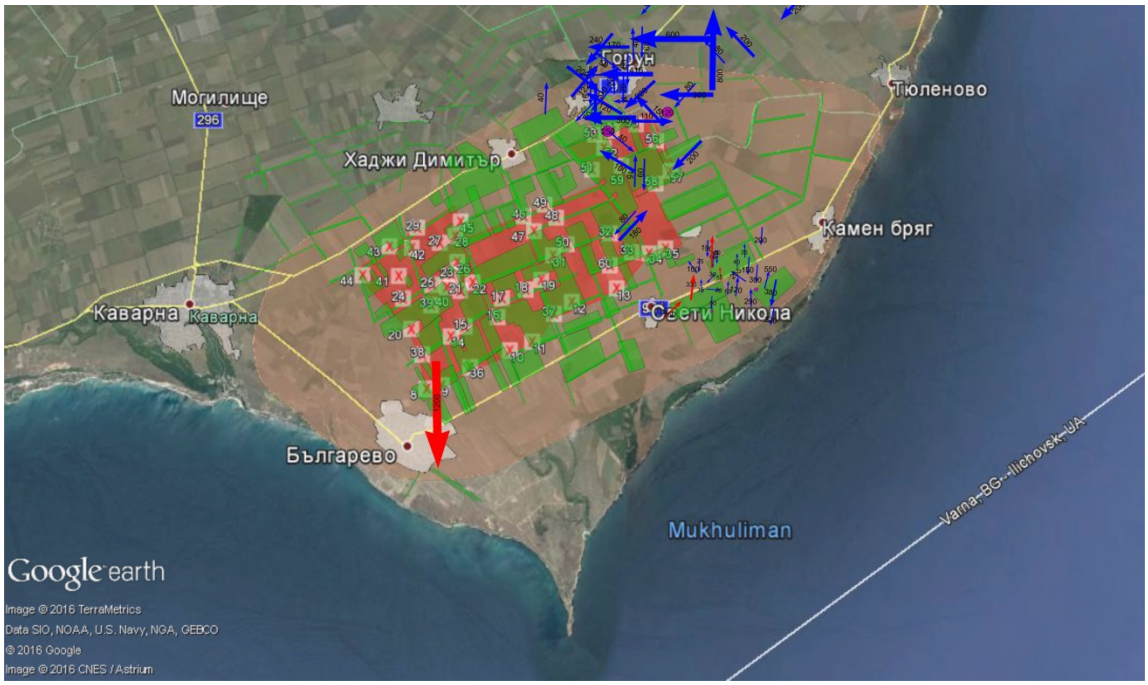

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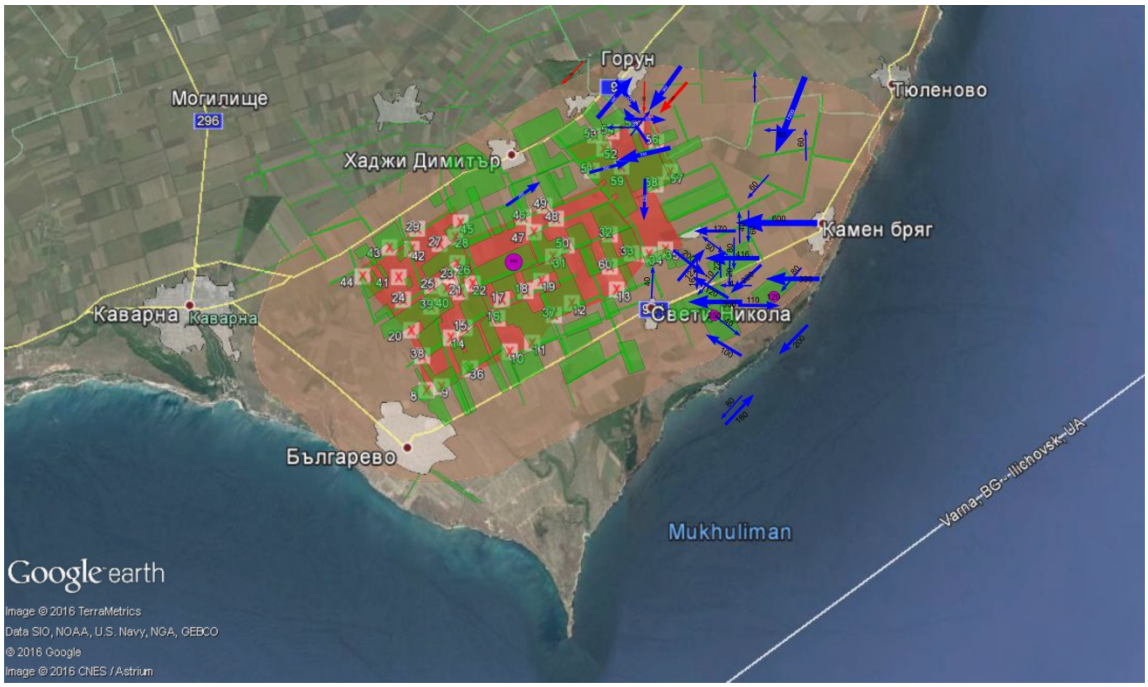

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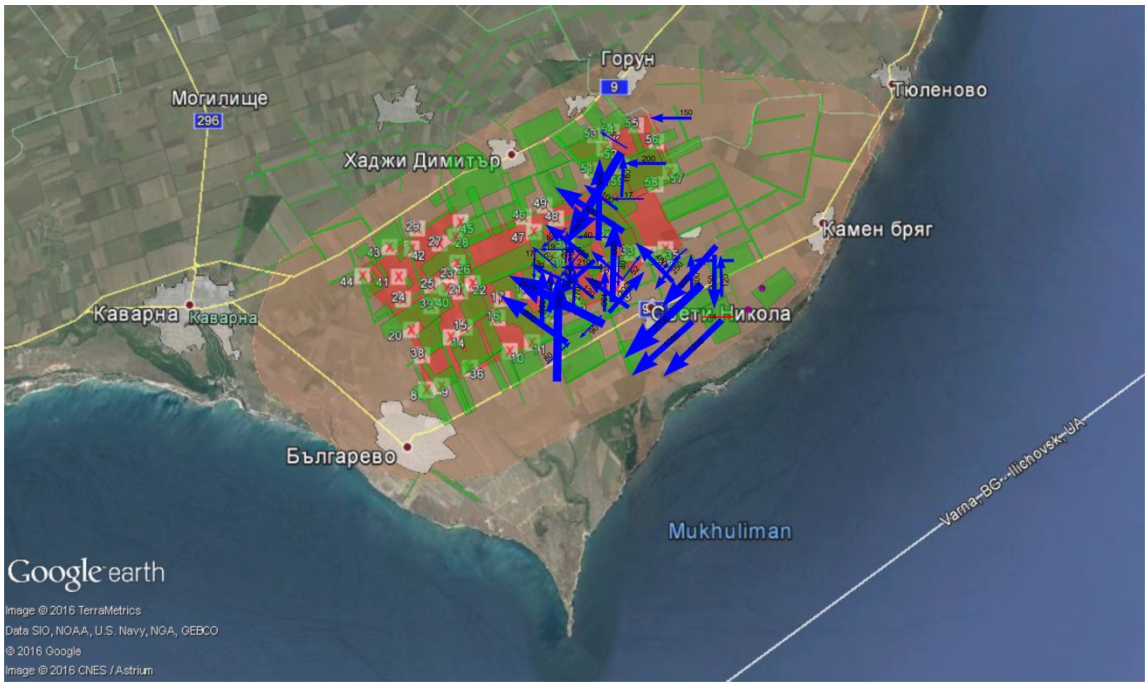

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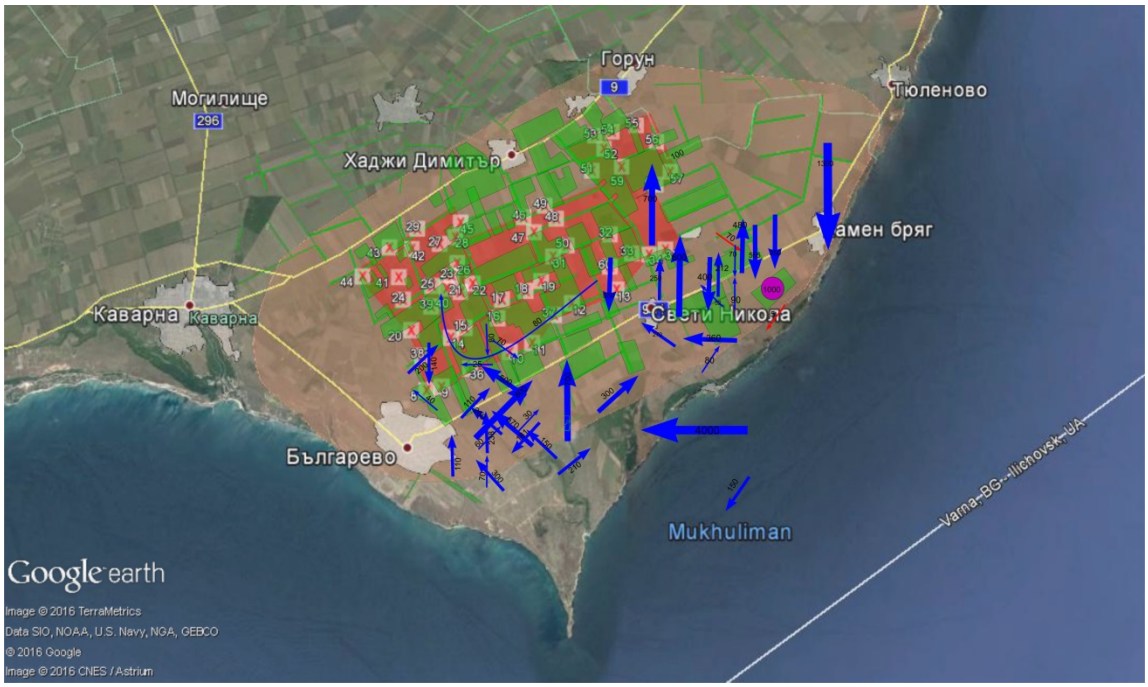

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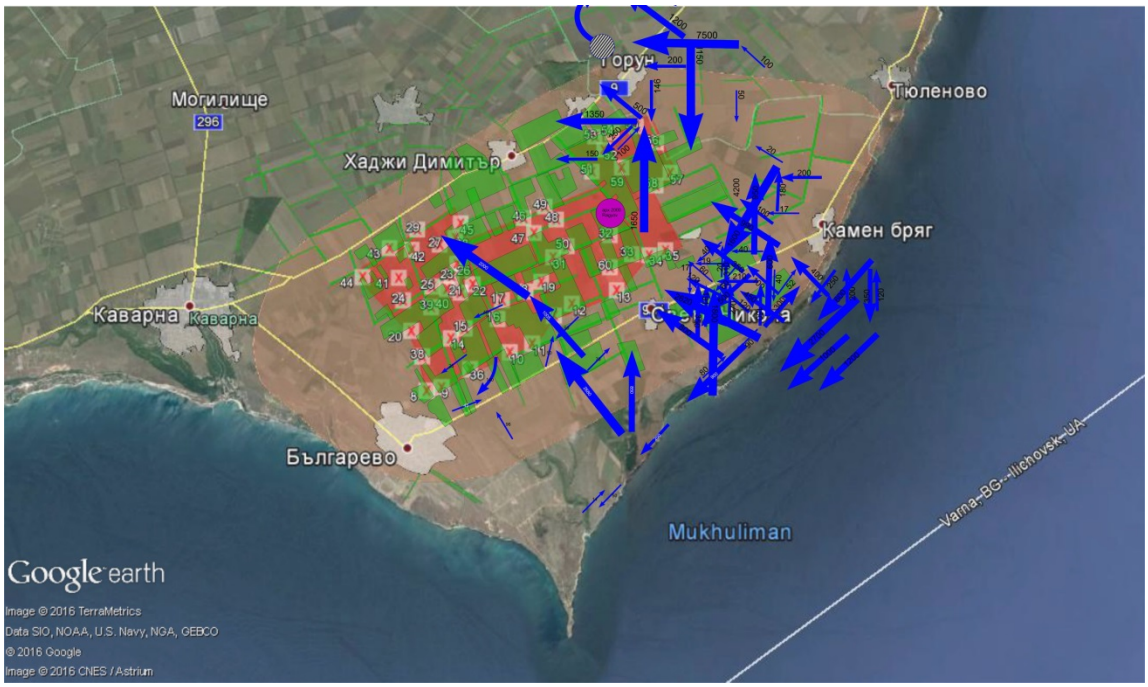

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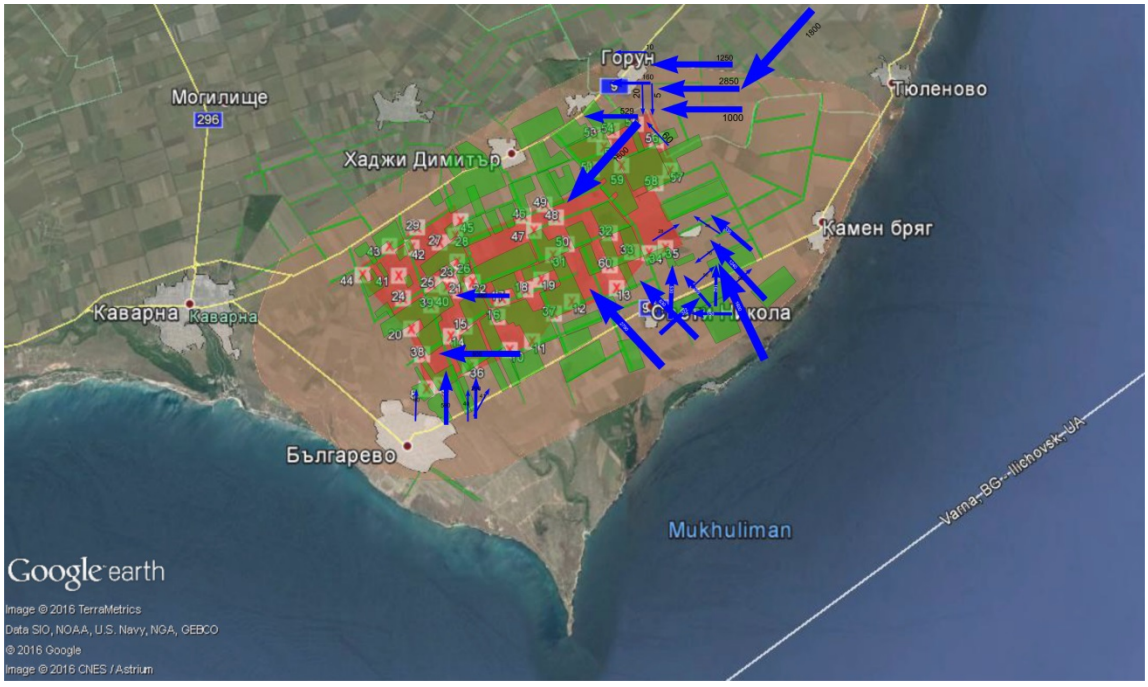

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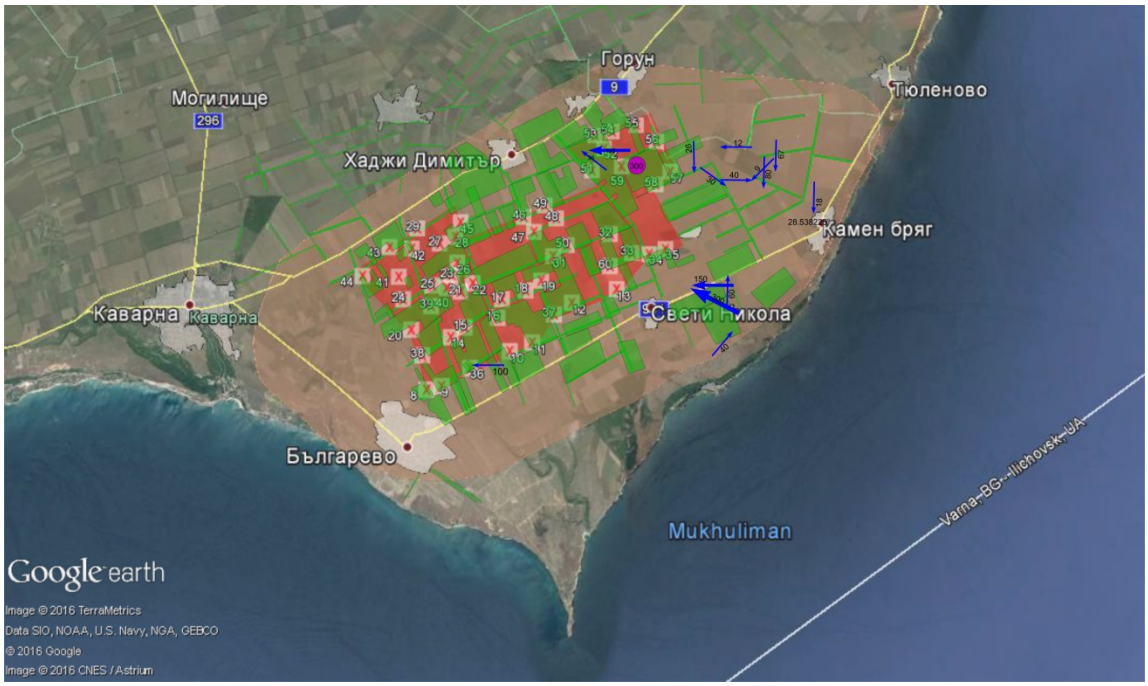

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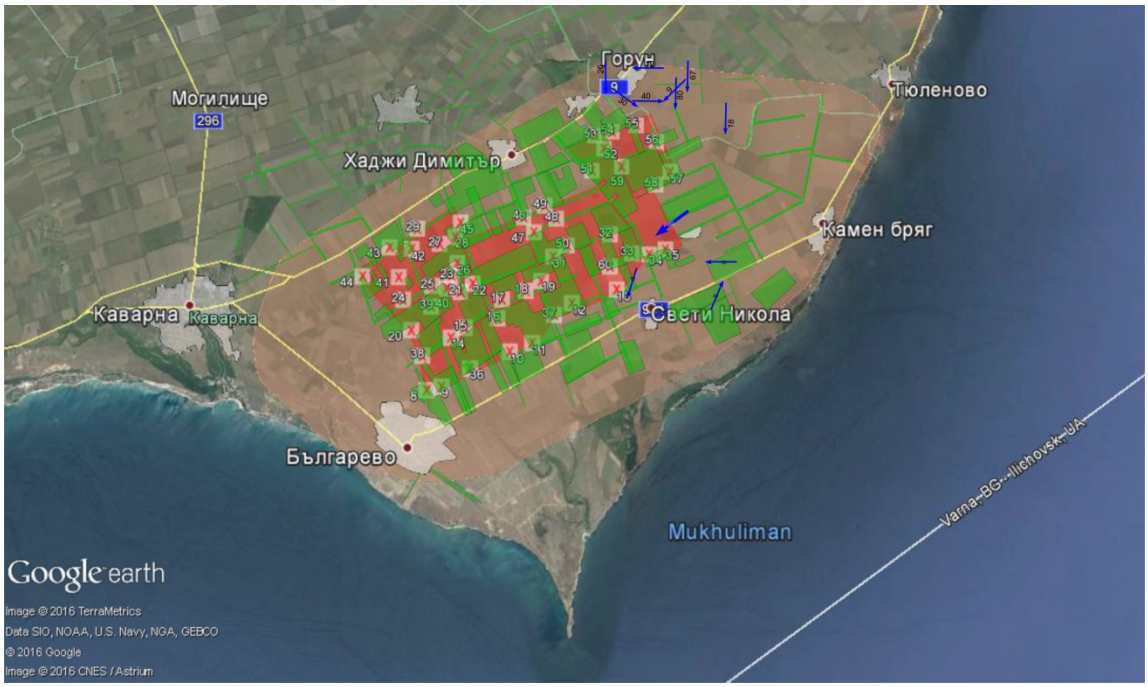

31.01.2016

Table 5. Numbers of observed feeding geese, by species, in the core study area with indicated geographic coordinates of every observed flock.

Date	Time	Species	Number	Location /Lat	Location / Lon
8.1.2016	12:15	A.albifrons	60	43.431415°	28.517359°
8.1.2016	12:15	B. ruficollis	60	43.431415°	28.517359°
10.1.2016	08:40	A.albifrons	280	43.431415°	28.517359°
10.1.2016	08:40	B. ruficollis	620	43.431415°	28.517359°
11.1.2016	10:40	A.albifrons	260	43.431415°	28.517359°
11.1.2016	10:40	B. ruficollis	345	43.431415°	28.517359°
13.1.2016	10:20	A.albifrons	100	43.431415°	28.517359°
13.1.2016	10:20	B. ruficollis	150	43.431415°	28.517359°
18.1.2016	13:20	Anser/Branta	90	43.453196°	28.524235°
20.1.2016	07:53	A.albifrons	150	43.431415°	28.517359°
20.1.2016	07:53	B. ruficollis	200	43.431415°	28.517359°
20.1.2016	09:00	B. ruficollis	350	43.432882°	28.516737°
20.1.2016	09:00	A. albifrons	1779	43.432882°	28.516737°
20.1.2016	09:00	Anser/Branta	3170	43.432882°	28.516737°
20.1.2016	10:25	A. albifrons	600	43.424065°	28.486522°
20.1.2016	10:25	B. ruficollis	100	43.424065°	28.486522°
21.1.2016	09:30	A.albifrons	400	43.431415°	28.517359°
21.1.2016	09:50	A.albifrons	150	43.428078°	28.487750°
22.1.2016	10:00	A.albifrons	100	43.434358°	28.514805°
22.1.2016	10:00	B. ruficollis	50	43.434358°	28.514805°
24.1.2016	08:17	Anser/Branta	550	43.458023°	28.527470°
25.1.2016	09:52	A.albifrons	100	43.438340°	28.537737°
25.1.2016	09:52	B. ruficollis	100	43.438340°	28.537737°
25.1.2016	10:20	Anser/Branta	500	43.447834°	28.447619°
27.1.2016	09:20	Anser/Branta	1000	43.441406°	28.538225°
30.1.2016	08:45	Anser/Branta	300	43.473299°	28.489301°

Observations of geese activity in the winter 2015-2016 revealed a prevalence of morning flights when geese usually headed from the sea to the agricultural fields passing through the SNWF territory.

Geese were not observed in the core study area in December and first few days of January in numbers which can be considered relevant to potential collision risk. The maximum number of geese including RBG in SNWF was observed in mixed species flocks between 24th and 30th of January

The proportion of RBG could not be precisely evaluated but in all the observations available with identified proportion of species it was between 10% and 50%. The numbers of geese observed in February and March were much lower than the number of geese in January.

Under good visibility and in close distance when species could be identified and counted, around 6000 RBG flights were estimated in total in the airspace above the core study area for the whole winter 2015/2016. Estimated totals of all geese seen flying and feeding within SNWF were around 130000.

Carcass monitoring results

All 52 turbines were programmed to be searched every seventh day (when turbines where accessible) for carcasses during the whole winter survey period (01 December 2015 – 15

March 2016). The searches continued after 15th of March with lower frequency until the end of the month. The actual frequencies of searches are presented in Table 1. The environmental conditions (ambient temperature, rain and snow coverage) which may have an impact on the frequency and results of the searches has been previously discussed in several winter monitoring reports available at: http://www.aesgeoenergy.com/site/Studies.html.

In February 2010 a trial was conducted to examine the searcher efficiency and carcass persistence rate during winter (see report on 2009/10 winter). The results from such trials are important to calibrate the results of systematic searches for collision victims and to inform the timing and frequency of these searches (see previous monitoring reports at: http://www.aesgeoenergy.com/site/Studies.html.

As it had been some time since such a trial had been conducted in winter, a new trial using carcasses of domestic hens was repeated in January 2016 to re-examine potential carcass removal rates, as part of the monitoring program. This involved monitoring the persistence of 14 hen carcasses placed around six turbines, at daily intervals until all remains had disappeared. All carcasses had disappeared within a week of placement (Table 6).

Such a winter trial at SNWF was first conducted in February 2010 using 25 domestic duck carcasses placed around five turbines. The results of the 2010 trial were very similar to the 2016 trial so far as carcass persistence rate was concerned, despite the difference in the carcass species. The new trial also confirmed that carcasses were apparently removed quicker in winter than in autumn: see several trial results reported in previous autumn monitoring reports: http://www.aesgeoenergy.com/site/Studies.html.

Table 6. Removal rate of hen carcasses used in a trial of carcass persistence in winter 2015-2016. T42, T43 etc. gives the turbine under which carcasses were placed. All carcasses were put out on 21 January 2016.

Date	Day	T42	T43	T45	T28	T51	T53	Total	% present
21.1.2016	0	3	2	2	3	2	2	14	100
22.1.2016	1	2	1	1	3	0	2	9	64
23.1.2016	2	1	1	1	3	0	1	7	50
24.1.2016	3	0	0	0	1	0	0	1	14
25.1.2016	4	0	0	0	0	0	0	0	0

Away from the trial, during systematic searches under turbines (Table 1) there were two carcasses found which may be have been associated with a collision with the turbines in winter 2015/16: one Skylark (*Alauda arvensis*) and one Little Grebe (*Tachybaptus ruficollis)* were found intact (Figure 8 and Figure 9). Both species are of least concern according to the IUCN criteria. Conservation status of Little Grebe in Bulgaria is Vulnerable, but the species is migrating and identification of the geographic population of the dead bird found is problematic. The Skylark is not listed in Bulgarian Red Data Book

The other remains found include seven single unidentified feathers and one bunch of Grey Partridge (*Perdix perdix*) feathers. None of these remains indicated that they were the result of collision with turbines.

No body parts or intact remains of geese which could be considered as collision victims were detected after 480 cumulative searches of different turbines in the period 01 December 2015 – 30 March 2016 (Table 1). Therefore, no evidence for collision of any goose species,

including RBG, has been found in the winters 2010 - 2016 when geese were present and turbines were operating.

The TSS in the 2015/16 winter was activated in case of observed species which are listed as endangered and therefore need special attention, even if not exposed to direct risk of collision with the turbines. All of the turbine stops associated with the bird observations and the reasons why it they were enacted are given in the Table 7.

These stops of turbine activity were related to the unusual periodic and vagrant presence of Dalmatian Pelican and Demoiselle Crane (*Grus virgo*) (Table 7). No shutdowns were required for RBG as, unlike some occasions in previous winters, in the 2015/16 winter high goose activity did not coincide with poor visibility through fog or snowstorms.

Figure 8. *The carcass of Skylark (A. arvensis) found 18.12.2016.*

Figure 9. *The carcass of Little Grebe* (*Tachybaptus ruficollis) found 20.03.2016.*

Table 7. Number of turbine stops associated with minimizing collision risk of sensitive bird species during the winter 2015-2016 in SNWF. The Demoiselle Cranes were recorded (on 31st March 2016) out with the formal monitoring period but are shown here to illustrate the responsiveness of the TSS to such unusual events for potentially sensitive species.

Date	Stop	Start	Species	Species	Number of birds	WTG/ which turbines by groups	Ordered by	Remarks
6.01.2016	12:05	12:15	*Pelecanus crispus*	Dalmatian pelican	12	B	V. Vasilev	flying low near the wind farm, 150-200 m height, are not included in the wind farm counts
03.02.2016	13:40	13:48	*Pelecanus crispus*	Dalmatian pelican	5	B	S. Peev	flying at low altitude 50-100m, between the turbines
03.02.2016	13:44	13:53	*Pelecanus crispus*	Dalmatian pelican	5	D	S. Peev	flying in at low altitude 50-100m, between the turbines
31.03.2016	13:54	14:10	*Grus* virgo	Demoiselle crane	3	T-56, T-57,T-58	K. Bedev	flying in at low altitude 100-150m, between the turbines
31.03.2016	14:04	14:10	*Grus virgo*	Demoiselle crane	3	A	K.Bedev	flying in at low altitude 100-150m, between the turbines
31.03.2016	14:10	14:14	*Grus virgo*	Demoiselle crane	3	T-33, T-34, T-35	K. Bedev	flying in at low altitude 100-150m, between the turbines
31.03.2016	14:31	14:39	*Grus virgo*	Demoiselle crane	3	T-56, T-57,T-58	K. Bedev	flying in at low altitude 100-150m, between the turbines

Conclusions

As in other recent winters with relatively mild weather there were relatively few records of wintering geese using SNWF as a feeding ground, or overflying it to reach other agricultural fields from roost sites (apparently mostly roost sites on the Black Sea: see previous winter reports on how this behaviour may be a concern for RBG, independent of wind farms).

Observed numbers of geese of all three species as well as observed spatial distribution of flying and feeding geese did not indicate displacement of the observed species from the operational SNWF or its immediate environs.

Daily observations from December 2015 to March 2016 (inclusive) revealed that the recorded presence of geese in and around SNWF was compressed into a short time period with relatively few birds observed, compared to some winters in the recorded past (from research associated directly with SNWF – see previous SNWF winter reports on the AES website, and earlier surveys). SNWF apparently remains a feeding ground for RBG as well as GWFG, but it also remains as an unimportant area for both species, as indicated in pre-construction studies. It is still used, nevertheless, as a feeding area and is still used to access fields further inland (suggesting no gross displacement reaction from geese).

A new trial in January 2016 to estimate the disappearance rate of carcasses confirmed a previous trial in 2010 that agents of removal (e.g. scavengers) take away carcasses more quickly than in autumn. The 2016 and 2010 trials in winter were similar, nevertheless, and re-affirmed conclusions that inform calibration of frequent searches for collision victims under operational turbines during winter.

As in previous winters no remains of geese that could be attributed to collision with SNWF's turbines were found during many searches under operational turbines in the 2015/16 wintering period of geese. No geese have been found as collision casualties in any of the six winters when SNWF has been operational. Clearly, SNWF is not a source of collision mortality for wintering geese, even though they fly through or feed within SNWF (with varying regularity but sometimes frequently – as in previous winters).