Vermont Agency of Transportation
Policy, Planning, and Intermodal Development Division

Feasibility Evaluation of Electric Vehicle Charging Stations, Electric Aircraft Charging Stations, and Renewable Energy Generating Plants at State-Owned Airports Pursuant to Act 108 of 2018

January 15, 2019

Submitted to
the Senate Committee on Economic Development, Housing, and General Affairs;
the Senate Committee on Natural Resources and Energy;
the Senate Committee on Transportation;
the House Committee on Commerce and Economic Development;
the House Committee on Energy and Technology; and
the House Committee on Transportation.

I. Background

A. Act 108 of 2018

In 2018 the Legislature enacted Act 108 (H.620)—an act relating to State-owned airports and economic development. Section 2 of Act 108 directs the Vermont Agency of Transportation (VTrans) to evaluate the feasibility of siting electric vehicle charging stations, electric aircraft charging stations, and renewable energy generating plants at each State-owned airport.

The full text of section 2 follows:

> Sec. 2. CHARGING STATIONS AND RENEWABLE ENERGY PLANTS AT STATE-OWNED AIRPORTS; FEASIBILITY EVALUATION
>
> (a) As used in this section:
>
> (1) "Renewable energy" shall have the same meaning as in 30 V.S.A.§ 8002.
>
> (2) "Renewable energy generating plant" means real and personal property, including any equipment, structure, or facility, used for or directly related to the generation of electricity from renewable energy.
>
> (b) On or before January 15, 2019, for each State-owned airport, the Agency of Transportation shall evaluate the feasibility of:
>
> (1) the installation of electric vehicle charging stations at the airport;
>
> (2) the installation of electric aircraft charging stations at the airport; and
>
> (3) the siting of one or more renewable energy generating plants at the airport.

B. State Airports

The State of Vermont owns and VTrans manages ten airports. Information about each of the State airports can be found on VTrans' Aviation website: https://vtrans.vermont.gov/aviation. The link to Airports and Travel contains an interactive map showing the locations of each State airport: https://vtrans.vermont.gov/aviation/airports.

The infrastructure and services at the ten State airports range from John J. Boylan Airport, a grass strip in Essex County, to Rutland-Southern Vermont Airport, which offers scheduled airline services through Cape Air and Jet Blue. For some State airports, VTrans contracts with a fixed-based operator (FBO) to handle day-to-day operations. Other airports are

managed by the Rail & Aviation Bureau of VTrans' Policy, Planning, and Intermodal Development Division. While title to the airports lies with the State of Vermont, use of the real estate is subject to grant assurances and other regulations of the Federal Aviation Administration (FAA).

C. Electric Vehicle Charging

For purposes of this feasibility evaluation, the term electric vehicle (EV) refers to both pure battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). EV charging stations are often referred to as electric vehicle supply equipment (EVSE).

Over 2,600 EVs were registered in Vermont as of July 2018, and that number has been increasing exponentially in recent years. (https://www.driveelectricvt.com/buying-guide/why-go-electric.) Millions of EVs have been sold across the U.S. and many millions more have been sold in other countries. However, market forces alone will not advance vehicle electrification fast enough to meet Vermont's climate and energy goals. The transportation sector is the largest source of greenhouse gas emissions in the State and across the nation, and vehicle electrification is a key strategy to mitigating these emissions. (https://publicservice.vermont.gov/publications-resources/publications/energy_plan/2015_plan; https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/The%20Vermont%20Tranportation%20Energy%20Profile_2017.pdf.) Policy support for EVs and EVSE will be necessary until market forces can take over.

Drive Electric Vermont's website shows 183 public charging stations in Vermont: https://www.driveelectricvt.com/charging-stations/public-charging-map. A significant barrier to electric vehicle adoption is an insufficient number of publicly available charging stations. Not all electric motorists can charge at home or at work, and even those who can need to be able to charge on long trips.

Electric vehicle charging equipment (often called electric vehicle supply equipment, or EVSE) comes in three forms. Level 1, Level 2, and DC fast charging, or DCFC: https://www.driveelectricvt.com/charging-stations/types-of-charging. Level 1 charging is slow and is generally not supported by public funds or built out by private companies. (An exception is that VTrans offers Level 1 charging without a fee at all new state park and ride facilities and all park and ride facilities that VTrans retrofits with new lighting.) Level 2 charging is appropriate for locations with longer EV dwell times, including people's homes, park and rides, or destinations like shopping centers or perhaps airports.

DCFC is important for highway corridor charging or other settings where a quick charge is important. However, DCFC requires 3-Phase power, and the equipment is costly to install and maintain. In addition, fast charging can be more difficult to link to time-of-use rates and may incur utility demand charges under current rate structures. Vermont needs to fill about seven gaps in its highway corridor DCFC network to bring fast charging within thirty miles

of most Vermonters. (https://vtrans.vermont.gov/sites/aot/files/planning/documents/DC%20Highway%20Corridor%20Report_112217_Final_FULLVERSION-web.pdf.) Publicly available DCFC stations will need to be upgraded over time with additional charging ports and faster charging times.

Appendix D of the nationwide VW settlement allocates an additional $2.7 billion dollars among the states based on the number of vehicles with fraudulent emission systems that VW sold in each of them. Vermont's share of Appendix D funds is $18.7 million dollars. Under the terms of the settlement, the states may allocate up to fifteen percent of their Appendix D funding to passenger vehicle EVSE. Vermont has decided to dedicate the full fifteen percent allowable ($2.8 million) to this purpose.

ANR has designated the funding for EVSE to the Agency of Commerce and Community Development, assisted by the interagency team. See https://accd.vermont.gov/community-development/funding-incentives/electric-vehicle-supply-equipment-evse-grant-program. ACCD plans to issue grants for EVSE in several rounds. The first round specifically included state airports as an eligible funding category for Level 2 and DCFC equipment.

First-round grants were capped at $400,000. Grant applications were due November 30, 2018. Forty-six applications were received with total funding requests exceeding $1,600,000. Proposed projects covered a range of funding categories, including private businesses and municipalities, and both Level 2 and DCFC. Project proposals also covered several Vermont counties. However, none of the proposals included a state airport.

D. Electric Aircraft Charging

A combination of Level 2 and DCFC would be appropriate for electric aircraft development. Level 2 would charge aircraft overnight without demand charges and could take advantage of time of use rates. DCFC would be needed for quick charges to keep experimental planes flying.

E. Solar PV

As a practical matter, for purposes of this feasibility evaluation, the terms renewable energy and renewable energy generating plant in Act 108 are limited to solar photovoltaic (PV) energy. Solar PV can be compatible with airport operations, and several State airports have suitable space available for the installation of solar PV facilities. The Rutland State Airport already hosts a solar PV array.

Wind energy would not be not appropriate at State airports because wind towers would represent an avigation hazard. Hydropower would not be practical because State airports do not feature riverine environments with enough potential hydraulic head to generate

electricity. State airports do not produce enough organic waste for anaerobic digesters (biogas plants) and would not be suitable for these kinds of facilities, which could compromise airport functions by attracting birds, creating fumes, taking up air space, and generating truck traffic. Wood heat is considered renewable but does not generate electricity and therefore falls beyond the scope of Act 108.

VTrans has previously looked for opportunities to develop solar PV at State airports and other VTrans properties and continues to do so. Through VTrans, the State of Vermont owns extensive lands and buildings that could support additional solar PV facilities. These locations include but are not limited to State airports and highway rights of way. Available right-of-way lands include linear holdings adjacent to highways, rest areas, welcome centers, staging areas for past construction projects, fill sites, quarries, park-and-ride facilities, and other lands that VTrans plans to retain but that VTrans does not anticipate using for transportation projects for years to come.

Using the State of Vermont's net-metering program, VTrans has entered into public-private partnerships to develop numerous solar PV facilities on its properties, including a state airport, a highway welcome center, and over a dozen district garages. VTrans commissioned a consultant to prepare a *Vermont Agency of Transportation Solar Plan* to help VTrans organize future solar PV projects. The *Solar Plan*, completed in 2016, is available at https://vtrans.vermont.gov/sites/aot/files/VTrans-SolarPlan-2016-12-08-FINAL.pdf. The state airport solar PV project is located in Rutland and has a 60kW capacity. VTrans' net-metering solar PV projects required significant administrative resources to develop and have generated modest revenues. Public policy to advance renewable energy in Vermont has been the primary driver for these projects.

Capacity limits on net-metering projects in the State of Vermont took effect in January 2017. (See Public Utility Commission (PUC) Rule 5.100, pertaining to the construction and operation of net-metering systems, available at http://puc.vermont.gov/about-us/statutes-and-rules/current-rules-and-general-orders.) As a result of these changes, VTrans can no longer avail itself of net metering.

VTrans would like to continue to host solar PV facilities to the extent doing so can be cost-effective. Solar PV development on VTrans lands would not only generate rental income for VTrans, but also advance the State of Vermont's climate and energy policies. However, VTrans does not want to enter the power-production business. In the absence of net-metering for its own facilities, VTrans is interested in leasing available and suitable properties to solar PV developers for long-term (20 years) solar PV production. VTrans would function as a lessor only and would not be an off taker of the solar PV electricity. Financing, construction, permitting, and maintenance would all be the responsibility of the lessee. VTrans will also consider making its lands available for energy storage for solar PV facilities.

With net metering no longer available, VTrans is currently developing a Request for Information to gauge the extent to which private energy developers may be interested in leasing lands controlled by VTrans, including State airports, to develop solar PV and on what terms. Private energy developers may be able to take advantage of net metering for third-party off-takers or may be able to profit from solar PV development on VTrans' lands without the benefit of net metering. Obstacles to solar PV projects on VTrans' lands include public opposition and permitting relating to large installations, lack of proximate phase 3 power for certain solar developments, and limited opportunities for net metering. Responses to the RFI may give VTrans a better idea of the feasibility of solar PV facilities at State airports.

II. Evaluation

A. Electric Vehicle Charging Stations

VTrans reviewed existing power transmission data to evaluate the potential for electric vehicle charging stations at state-owned airports. Data for the evaluation was obtained from digitized spatial layers hosted by the Vermont Center for Geographic Information and includes power transmission lines from the Vermont Electric Power Company (VELCO), Vermont Electric Cooperative (VEC), and Green Mountain Power (GMP). Some of the data, gathered through several years dating as far back as 2003, was incomplete and supplemented with known information about State airports from VTrans staff.

As summarized in Table 1 and displayed in the maps below, all of the State airports have at least 1-Phase power. Four of the airports (John H. Boylan, Edward F. Knapp, Northeast Kingdom International, and Rutland-Southern Vermont Regional) have 3-Phase power, while three additional airports have 3-Phase power in the vicinity (Hartness, Middlebury, William H. Morse).

For all State airports, costs for providing electric vehicle charging stations consists at 1-Phase levels consists of physical charging infrastructure and the associated software. The same holds true for 3-Phase vehicle charging stations at the four airports which currently have 3-Phase power. For the remaining airports, achieving 3-Phase electric vehicle charging stations will require the additional cost of extending 3-Phase transmission lines to the airports.

Table 1: Summary of Existing Power Distribution at Vermont State Airports

Airport	Existing Transmission Lines at or near Airports
John H. Boylan	3-Phase at the airport
Caledonia County	1-Phase at the airport (at least)
Franklin County	1-Phase at the airport (at least)
Hartness	1-Phase at the airport, 3-Phase further out
Edward F. Knapp	3-Phase at the airport
Middlebury	1-Phase at the airport, 3-Phase further out
Morrisville-Stowe	1-Phase at the airport (at least)
William H. Morse	1-Phase at the airport, 3-Phase further out
Northeast Kingdom International	1-Phase and 3-Phase at the airport
Rutland-Southern Vermont Regional	1-Phase and 3-Phase at the airport

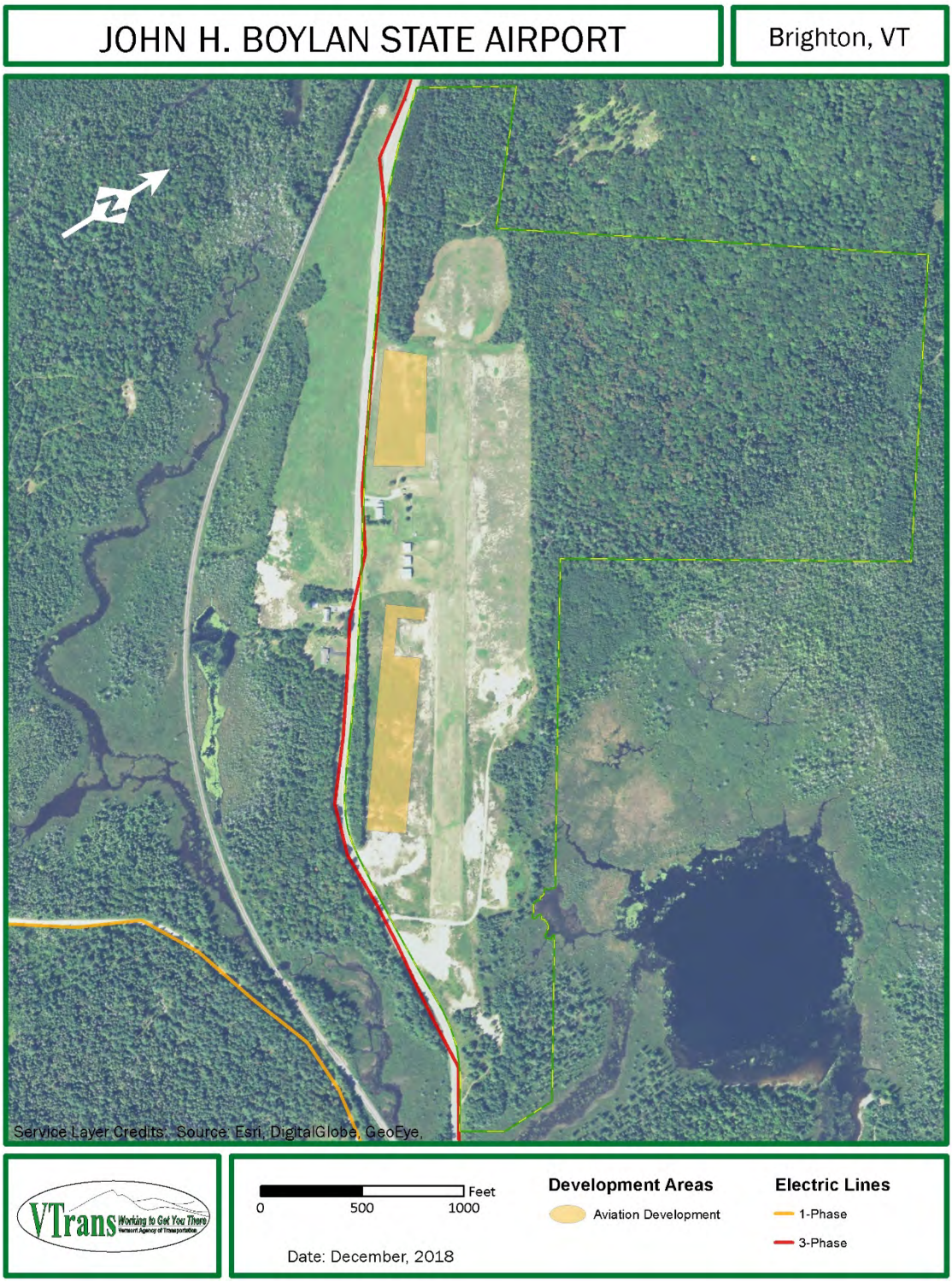
B. Electric Aircraft Charging Stations

Similar to electric vehicle charging stations, the costs associated with electric aircraft charging stations are largely dependent on the availability of power transmission lines at or in the vicinity of State airports. However, unlike electric vehicle charging (which would optimally be located at airport parking lots) charging infrastructure for electric aircraft will need to extended well onto airport property in order to access aircraft areas. Available on-airport property is thus an additional consideration. All of the airports (as seen in the maps below) have ‘airport development’ areas available, with some airports also including ‘mixed-use aviation’ development areas. Conceivably these could be used for electric aircraft charging stations.

C. Renewable Energy Generation Plants

Solar PV is not considered an aviation development use, unless the power generated is used to support airport operations. As such, it is unclear whether the FAA would permit Solar PV for general use, as opposed to airport uses.

If permitted in mixed-use aviation development areas, solar PVs could be located at all but three of the State airports (John H. Boylan, Caledonia County, and Morrisville-Stowe), which do not have any mixed-use aviation development areas.


JOHN H. BOYLAN STATE AIRPORT
Brighton, VT
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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye,
VTrans Working to Get You There
Vermont Agency of Transportation
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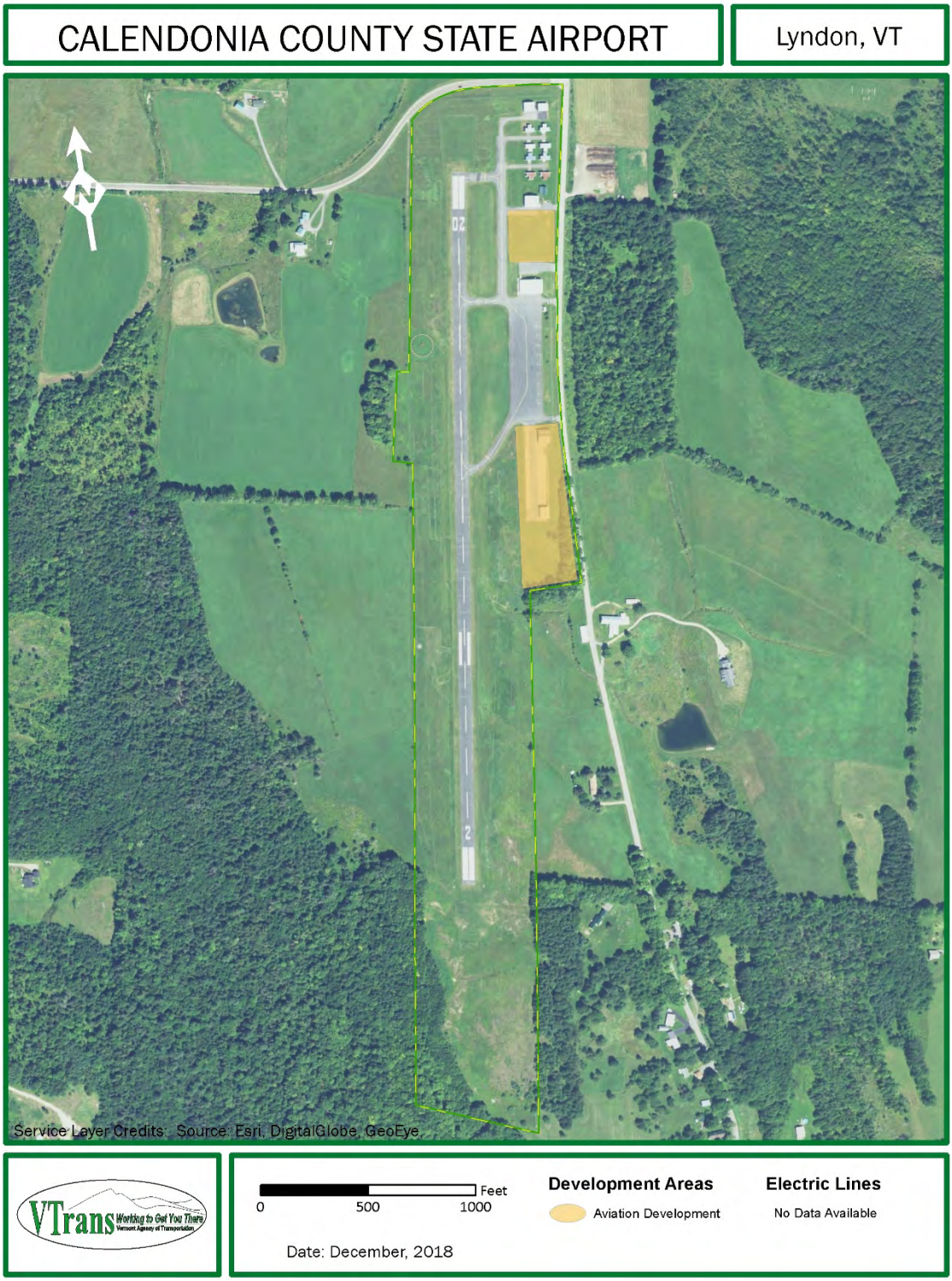
Feet
Date: December, 2018
Development Areas
Aviation Development
Electric Lines
1-Phase
3-Phase


CALENDONIA COUNTY STATE AIRPORT
Lyndon, VT
N
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20
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye
VTrans
Working to Get You There
Vermont Agency of Transportation
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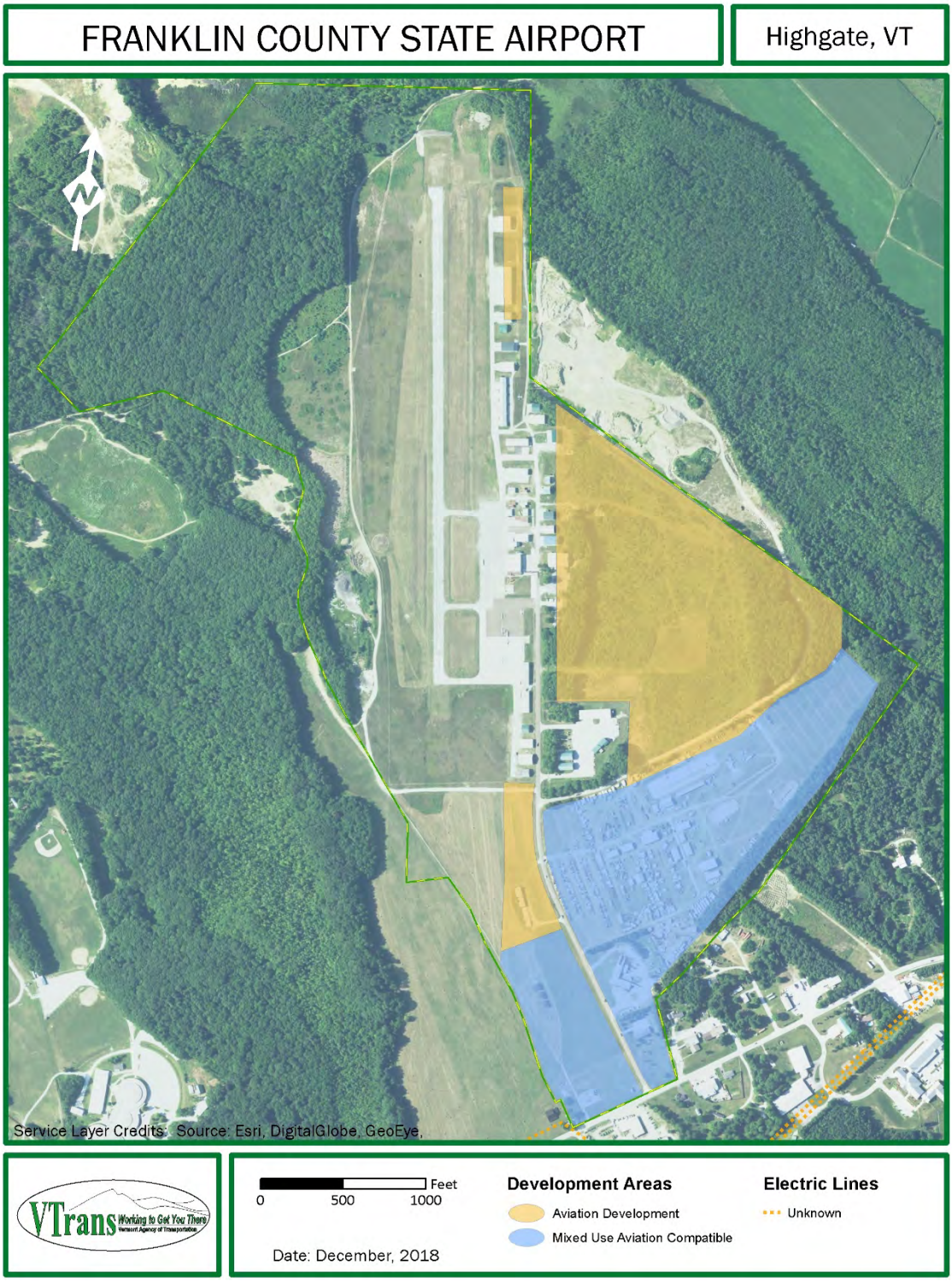
Feet
Development Areas
Aviation Development
Electric Lines
No Data Available
Date: December, 2018


FRANKLIN COUNTY STATE AIRPORT
Highgate, VT
N
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye,
VTrans Working to Get You There
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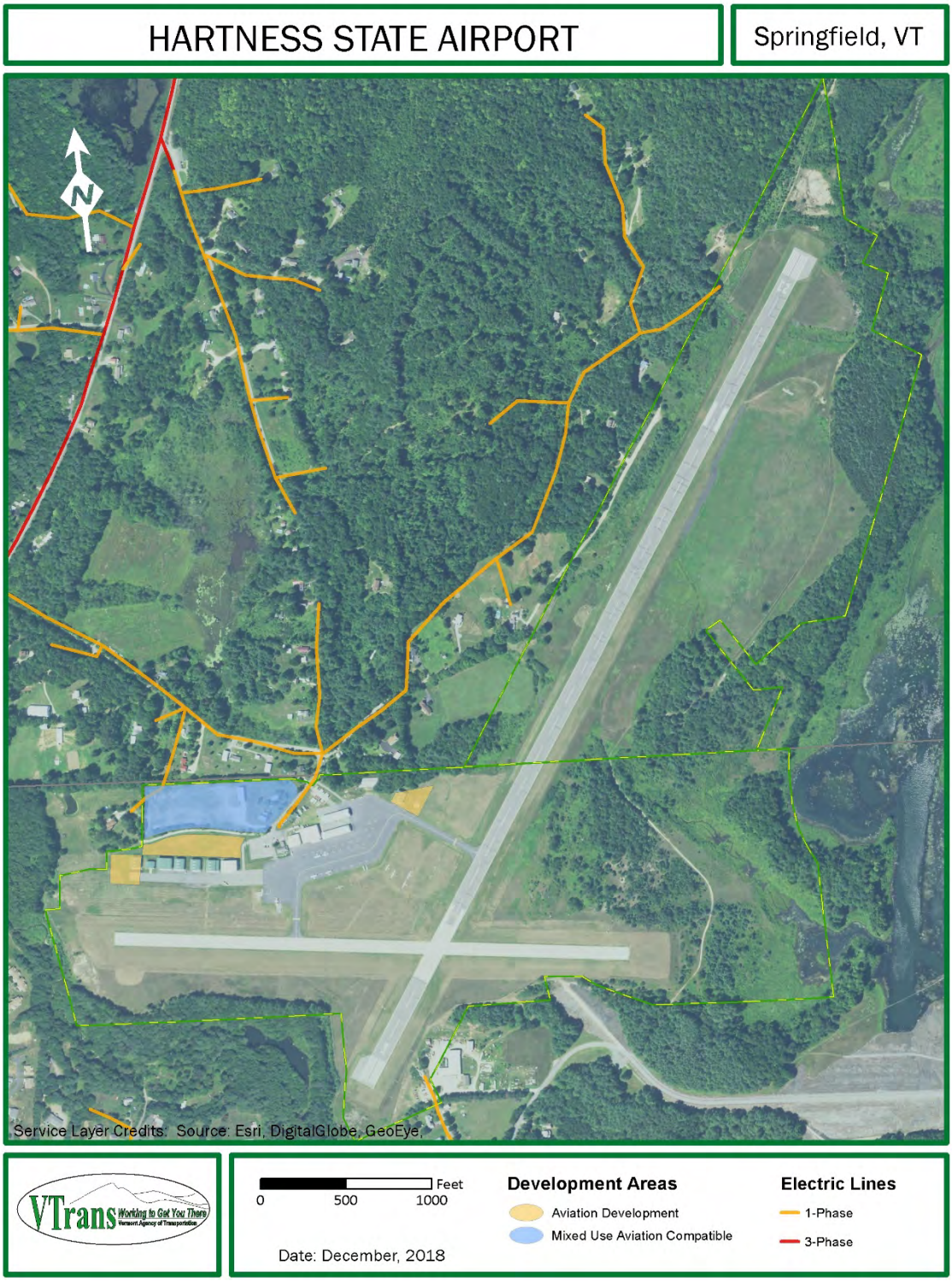
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
Unknown


HARTNESS STATE AIRPORT
Springfield, VT
N
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye,
VTrans Working to Get You There Vermont Agency of Transportation
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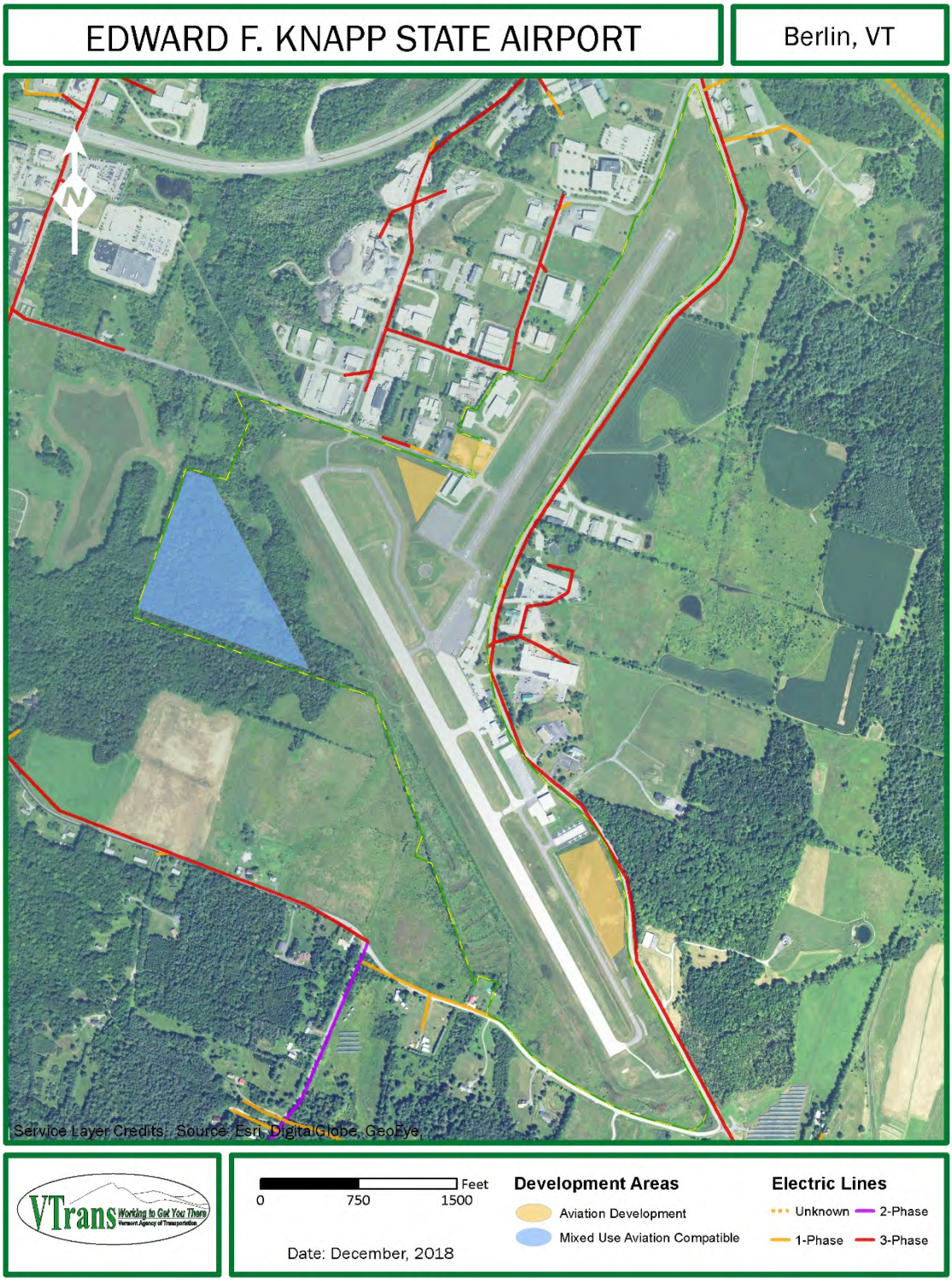
Feet
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
1-Phase
3-Phase
Date: December, 2018


EDWARD F. KNAPP STATE AIRPORT
Berlin, VT
N
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye
VTrans Working to Get You There
Vermont Agency of Transportation
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750
1500
Feet
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
Unknown
2-Phase
1-Phase
3-Phase


MIDDLEBURY STATE AIRPORT
Middlebury, VT
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VTrans
Working to Get You There
Vermont Agency of Transportation
Feet
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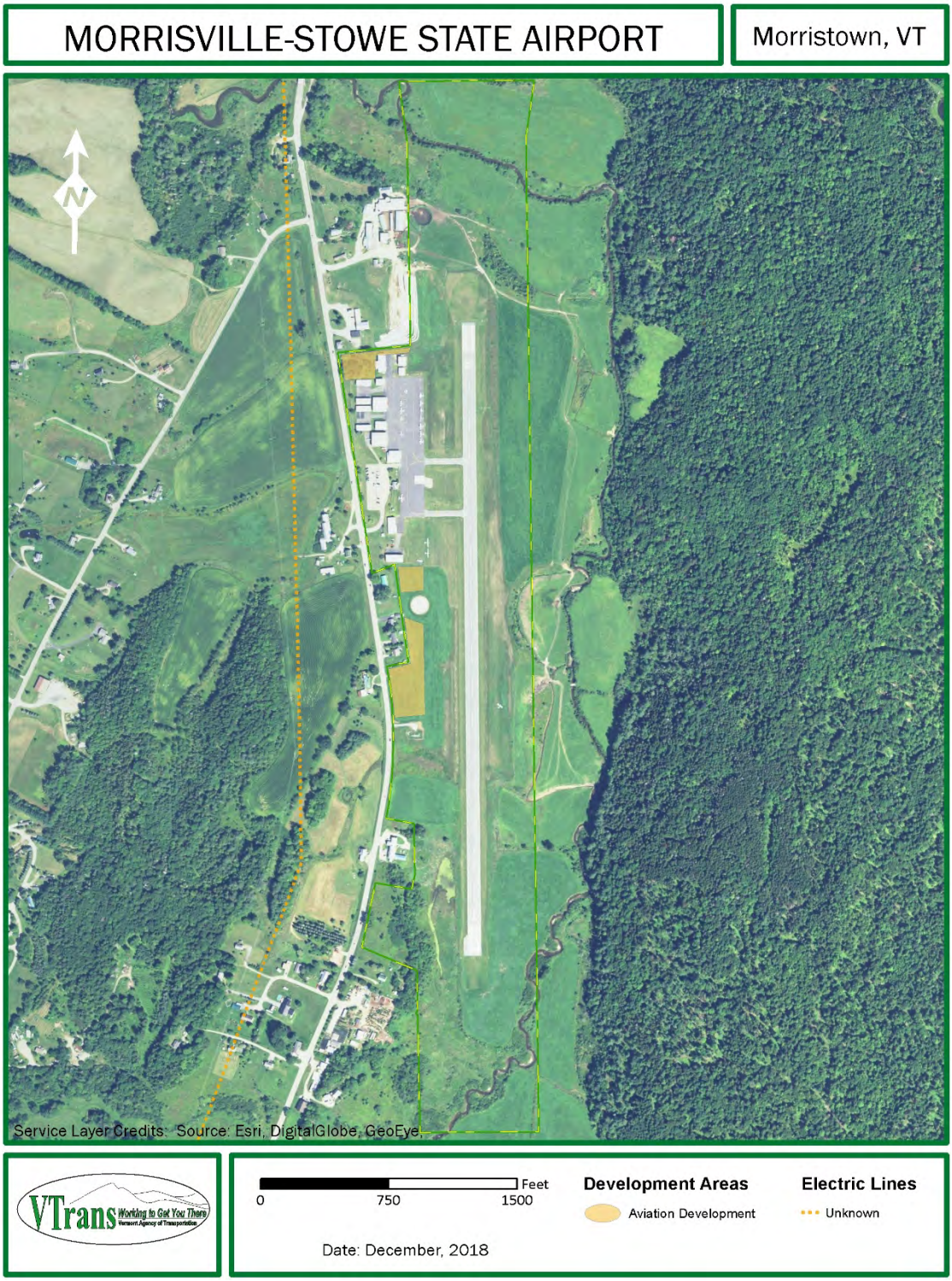
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
1-Phase
3-Phase


MORRISVILLE-STOWE STATE AIRPORT
Morristown, VT
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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye
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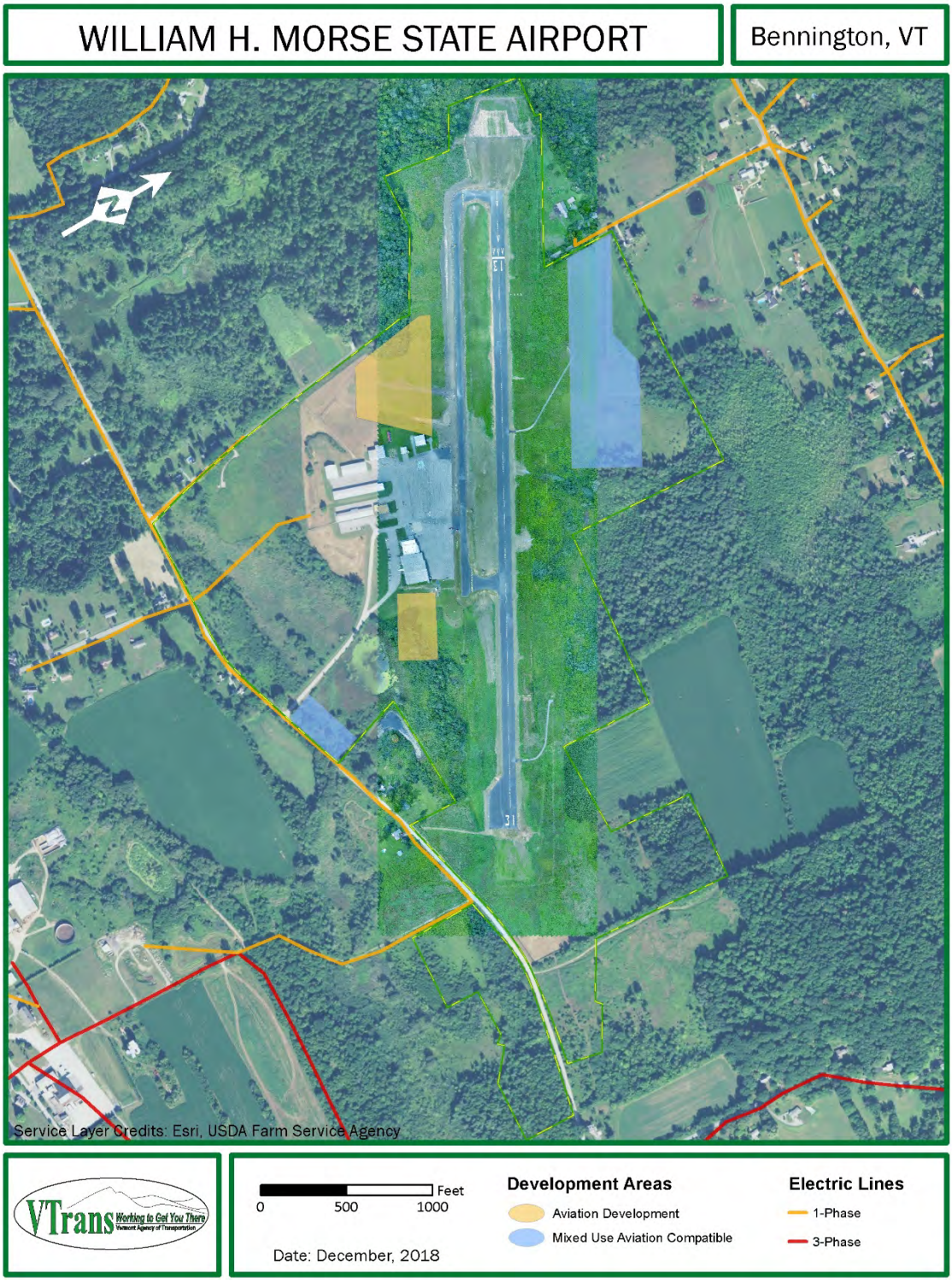
Development Areas
Aviation Development
Electric Lines
Unknown
Date: December, 2018


WILLIAM H. MORSE STATE AIRPORT
Bennington, VT
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Service Layer Credits: Esri, USDA Farm Service Agency
VTrans
Working to Get You There
Vermont Agency of Transportation
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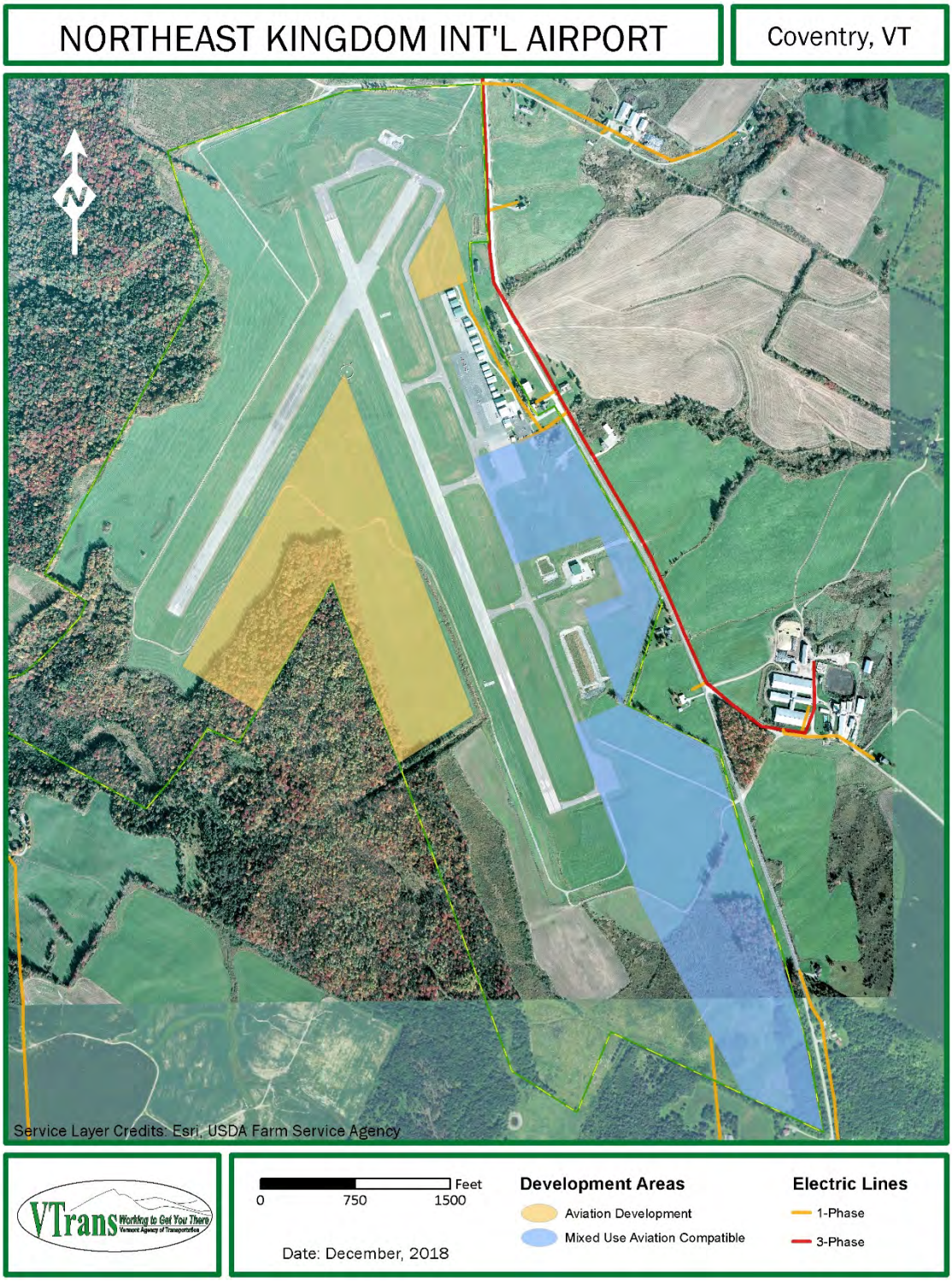
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
1-Phase
3-Phase


NORTHEAST KINGDOM INT'L AIRPORT
Coventry, VT
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Service Layer Credits: Esri, USDA Farm Service Agency
VTrans Working to Get You There
Vermont Agency of Transportation
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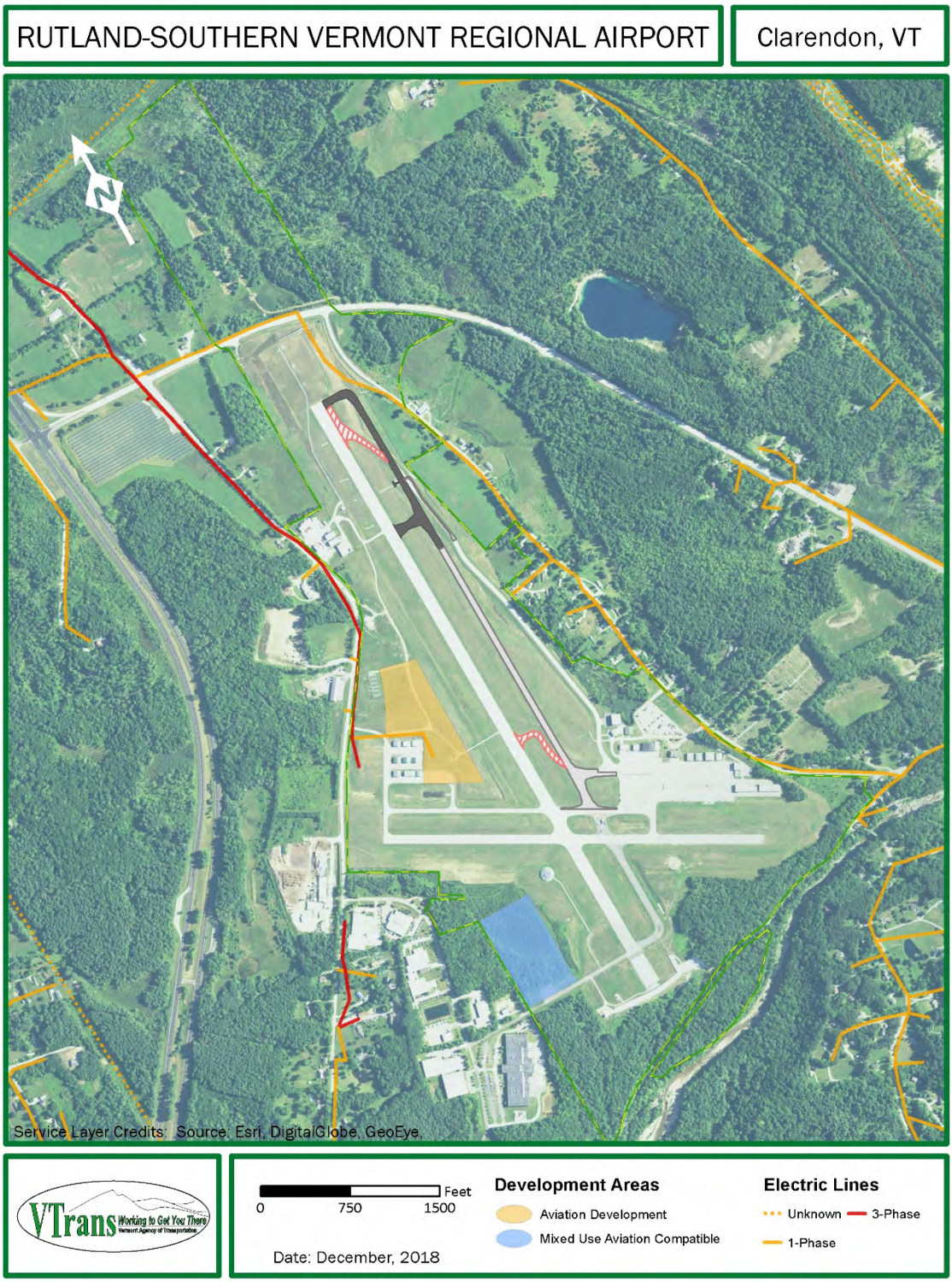
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
1-Phase
3-Phase


RUTLAND-SOUTHERN VERMONT REGIONAL AIRPORT
Clarendon, VT
N
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye
VTrans
Working to Get You There
Vermont Agency of Transportation
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Feet
Date: December, 2018
Development Areas
Aviation Development
Mixed Use Aviation Compatible
Electric Lines
Unknown
3-Phase
1-Phase

Date sources:

- Transmission Lines: UtilityTransmit_ELTRN, Edition: 2003, Updated: 6/11/2003; VELCO, Title: UtilityTransmit_VELCOTRANS, Edition: 2003, Updated 3/14/2003; from U.S. Geological, Title: UtilityTransmit_DLGMTT, Edition: USGS RF 100,000-scale, Updated: 1/1/1985. Hosted by VCGI.

- Vermont Electric Cooperative line data: UtilityTransmit_VECDISTLINES, Edition: 2016A, Updated 4/29/2016. Hosted by VCGI.

- Green Mountain Power line data: UtilityTransmit_GMPPOLES, Edition: 2017A, Updated: 3/20/2017. Hosted by VCGI.