

Site Plans and Constraints Maps

Best Practice #11

A successful and well-received wind development requires extensive research and careful planning. **Developers should create a site plan with sufficient detail to describe the nature and scope of the proposed project, the attributes of the specific location, as well as any potential issues or questions relating to the site chosen.** Important considerations in creating a site plan include using the latest information from a comprehensive environmental assessment, and making sure to address the potential environmental and community resources/concerns below, including any regulatory buffers surrounding them.¹ (See [Environmental Assessments](#) Best Practice.)

a. Wildlife, vegetation and critical habitat, including wetlands, floodplains and other sensitive and/or protected areas	b. Surface waters, drinking water supplies
c. Visual resources	d. Noise (identified by state and local standards)
e. Historic, cultural, and archeological resources	f. Roads, trails and recreational areas
g. Existing commercial uses of site (e.g. agriculture, commercial fishing, recreational boating, etc.)	h. Electric transmission lines; oil and gas wells; oil and gas transmission, gathering and service lines; sub-surface mining operations; and other infrastructure/facilities
i. Aviation and defense radar resources	j. Marine transportation resources (offshore)
k. Soil erosion and dust impacts	l. Safety issues
m. Community and residential area issues, including schools, hospitals, and churches	n. Areas of known geotechnical instability
o. Fire risks (e.g., grassland fires at site)	p. Other resources/concerns and land use constraints of local importance

Using the information gathered through the environmental assessment including both regulated and non-regulated environmental and cultural sensitivities, **developers should develop a constraints map to document and visually communicate all of the environmental concerns and restrictions that apply to an area, thereby illuminating the best location to site a wind development** (e.g., where there are few or no constraints). The constraints map should also reflect local zoning regulations, including setback requirements, land use restrictions, and infrastructure constraints.

Because impacts to some resources may occur at substantial distances from the project site, e.g. noise and visual impacts, the constraints map should include all important potentially affected resources near the project site; for visual resources, within the project viewshed, impacts may occur 15 miles (40 km) or more from the project site.

Challenges and Benefits

Like environmental assessments, successful site planning and constraints mapping requires gathering a large amount of information from many disparate sources. It may often be difficult to gather all necessary information in a timely manner. Starting the ef-

fort early in the planning process is important, as is frequent communication with regulators, and proactively seeking involvement from and consultation with local communities.

Identifying potential issues early in the planning process leads to better quality planning, and better public engagement – this normally translates into better results. A constraints map is a useful tool for graphically depicting the environmental and land use constraints that limit the desirable area for development at a site. The constraints map enables the developer to ascertain the number of turbines that can be located on the site. It also identifies features that may present challenges for siting ancillary facilities. The constraints map uses a base map that shows the wind resource and parcel information. Mandatory or other appropriate setbacks can be overlaid on the map.

A constraints map facilitates better tradeoff analysis when considering impacts to multiple resources. Effective early site planning can also identify poor sites for a wind development, as well as hidden project costs before a lot of resources and public goodwill is spent. The constraints map is a very effective communication tool for stakeholder engagement.

Who should implement this practice?

Developers should take the lead in conducting the actual assessment and gathering the necessary information to ensure comprehensiveness, but regulators and local communities should assist in providing the necessary and desired information.

Case Example | Ontario Power Authority Analysis of Future Wind Farm Development in Ontario

In 2006, the Ontario Power Authority (OPA) prepared an Integrated Power System Plan (IPSP) to guide the evolution of Ontario's power system and ensure that it will satisfy increased demand. Amongst numerous other objectives, the IPSP assembled data and characteristics of individual renewable energy supply options and defined the characteristics of future potential renewable energy projects. In this context, Helimax Energy Inc. (Hélimax) was commissioned by the OPA to identify the best locations for future wind power projects in the province.

The purpose of the study was to identify and prioritize sites for the development of large wind farms. The sites identified in the study were chosen based on a number of specific criteria. These criteria – the basis for the location, evaluation and ranking of sites – fell into two categories: constraints and factors. Constraints were used to zone out or discard areas considered unsuitable for wind development, while factors served to qualify and rank the remaining potential sites.

Hélimax's approach first consisted of combining wind speed data from the Ontario Wind Resource Atlas with a land-use and topographic analysis. By superimposing the results of the constraints analysis on the wind speed maps, it was possible to understand the geographical distribution of the resource and quantify the constrained potential within the province. The retained sites were then ranked based on a number of site-specific factors and a weighting mechanism was employed to reflect the relative importance of one factor versus another in project siting.

The constraints used were attributed values of either 1 or 0. For example, an airport is considered unsuitable for wind energy development and was assigned a value of zero and excluded from all further analysis. Areas that were considered developable were assigned a value of 1 and included in the analysis. In some cases certain constraints had associated buffers. The table below provides the constraints considered in this analysis and their associated buffer zones. These buffer zones are generally considered appropriate during the site selection process. For example, while the buffer zone of 550 m around houses is restrictive, especially in densely populated southern Ontario, it is a reasonable distance to ensure conformity with the Ministry of the Environment's noise specifications.

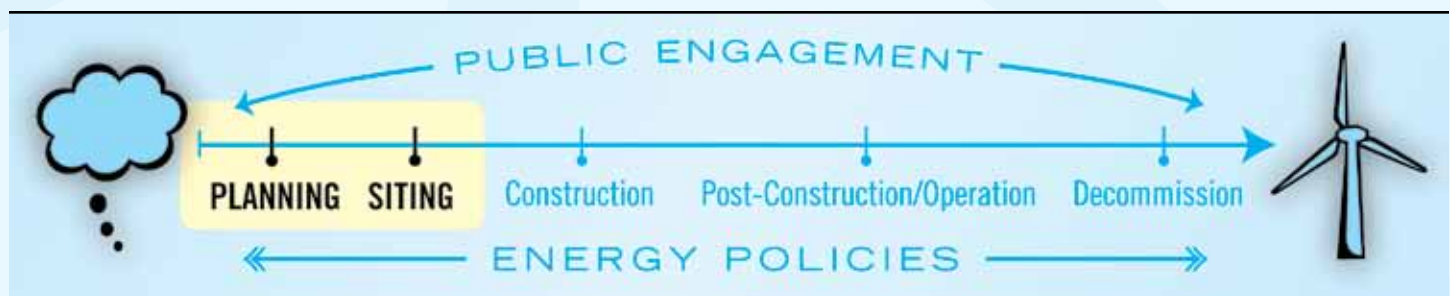
Constraints and Buffer Distances

Constraint	Action Taken
Wind speed less than 6.5 m/s at 80 m	Avoided (no buffer zone)
North of the 50th parallel	Avoided (no buffer zone)
Offshore Avoided (no buffer zone)	Avoided (no buffer zone)
Existing wind projects	Buffer zone applied (1500 m)
National park	Avoided (no buffer zone)
Provincial park	Avoided (no buffer zone)
Important Bird Area	Avoided (no buffer zone)
Hydrography (waterbody, wetland or watercourse)	Buffer zone applied (100 m)
Airport	Buffer zone applied (4000 m)
Railroad	Buffer zone applied (150 m)
Road	Buffer zone applied (150 m)
Building	Buffer zone applied (550 m)
Slope	Avoided (no buffer zone)

Source: http://amherstislandwindinfo.com/helimax_onshore_finalv2.pdf

When should this practice happen?

Site plans and constraints maps should be initiated during the planning phase and used during the siting phase.



Related Tools

Great Lakes Wind Collaborative Online Wind Atlas | <http://erie.glin.net/wind/> | This Great Lakes Wind Atlas serves as an online clearinghouse of ecological, geophysical and socio-economic geospatial datasets that can be used to identify environmental constraints and screen specific areas in the Great Lakes region in terms of their suitability for potential wind development.

AWEA Wind Energy Siting Handbook - Chapter 3: Critical Environmental Issues Analysis | http://www.awea.org/sitinghandbook/downloads/Chapter_3_Critical_Environmental_Issues_Analysis.pdf | This handbook informs wind energy developers and other interested parties about environmental siting issues relevant to land-based commercial-scale wind energy project development in the United States. Chapter 3 of the handbook provides an example of a constraints map. The handbook was designed to provide technical information and useful tools based on the industry's collective experience in siting wind energy projects and assessing potential impacts.

Ohio's Wind Turbine Placement Favorability Map Viewer | <http://www.ohiodnr.com/tabid/21234/Default.aspx> | Launched in November 2010 by the Ohio Department of Natural Resources (ODNR), Office of Coastal Management, this interactive map viewer showcases the resources that may play a role in where offshore wind turbines might be placed in Lake Erie. Map layers include bird habitat, fish habitat, commercial and sport fishery efforts, lakebed sediments, distance from shore, land transportation, harbor navigation, shipping and ferry routes, shipwrecks, restricted areas, industries and utilities.

Michigan Great Lakes Offshore Wind Council Mapping Recommendations | http://www.michiganglowcouncil.org/GLOW_Report_9-1-09_FINAL.pdf | The September 2009 Report of the Michigan Great Lakes Wind Council included an effort to determine the geographic areas that might accommodate future offshore wind power development in Michigan. Executive Order No. 2009-1 called on the council to recommend criteria to identify and map areas that should be categorically excluded from offshore wind development as well as those areas that are most favorable to such development. The council recommended a set of criteria to help guide future efforts to select and evaluate sites for wind energy development in Michigan's Great Lakes.

National Wind Coordinating Collaborative (NWCC) *Permitting of Wind Energy Facilities* handbook | <http://www.nationalwind.org/assets/publications/permitting2002.pdf> | This 2002 revision of the original 1998 handbook provides guidance to decision-makers and agency staff at all levels of government, wind developers, interested parties and the public in evaluating wind projects.

U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines and Eagle Conservation Plan Guidance | <http://www.fws.gov/windenergy/> | On February 18, 2011, the U.S. Fish and Wildlife Service two draft guidelines were published in the Federal Register: *Land-Based Wind Energy Guidelines* and *Eagle Conservation Plan Guidance*. As of press time of this document, both sets of guidelines were open for public comment. The documents are part of the agency's ongoing efforts to improve siting and permitting of renewable energy projects. Visit the web site above for updates.

Wind Energy: Guidelines for Siting and Operating Wind Turbines in the Great Lakes States | These yet unpublished guidelines by The Nature Conservancy provide information for siting wind developments and operating wind turbines throughout the Great Lakes Region. [Ewert, D.N., J.B. Cole, E. Grman. 2011. Wind energy: recommendations for siting and operating wind turbines in the Great Lakes states. Unpublished report, The Nature Conservancy]

¹ Best practices for addressing some of these specific impacts, such as noise, water quality and preventing hazardous spills are provided separately in this best practices toolkit.

