

Knockawarriga Windfarm

Site Visit 7th July 2010

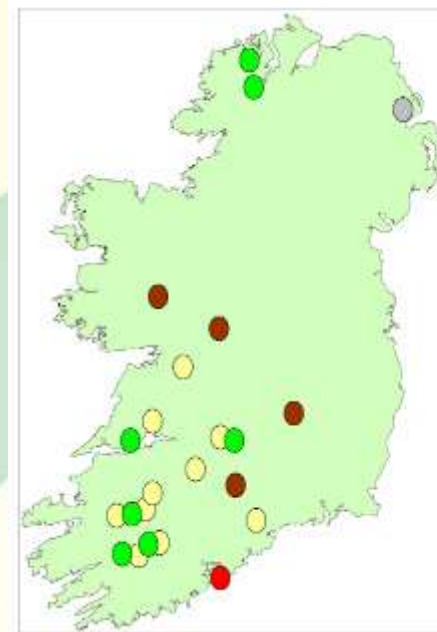


Overview

- Background to BGE/SWS
- Project background
- Environmental and Planning Considerations
- Operations
- Health & Safety

SWS/BGE

- SWS Energy
 - Developing wind projects since 2000 with portfolio of projects in planning, with planning, and operational in ROI and N Ireland
- Acquired by BGE in December 2009. 7 projects in commercial operation with net installed capacity of 218MW and a large portfolio of projects (>500MW) to be developed
- In house environment, grid, technical, legal, financial and operations teams which facilitate an integrated approach to project development



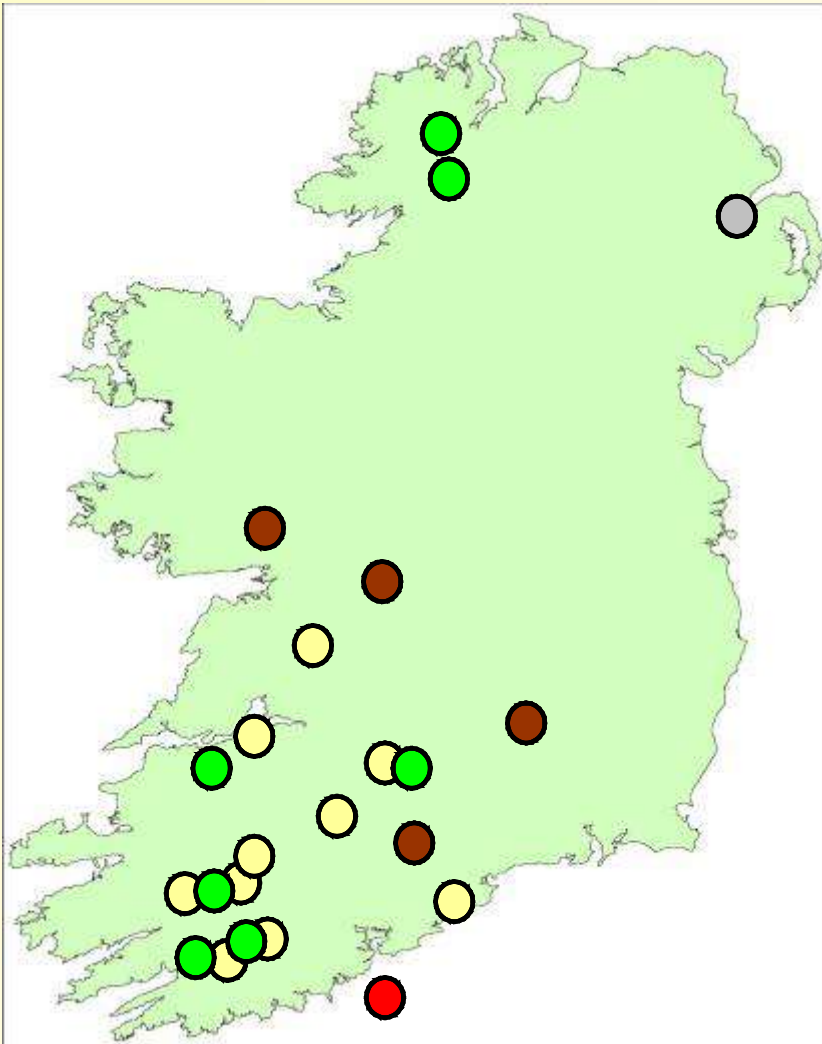
- 218MW Operating Wind Farms
- 558MW Development Wind Farms
- 400MW OCGT Development Sites
- 445MW CCGT COD July 2010
- Gas Storage Project



BGE Portfolio

BGE acquired SWS Wind Portfolio in December 2009

- 218MW Operating Wind Farms
- 558MW Development Wind Farms
- 400MW OCGT Development Sites
- 445MW CCGT COD July 2010
- Gas Storage Project



Knockawarriga Project Details

- **Site Location**

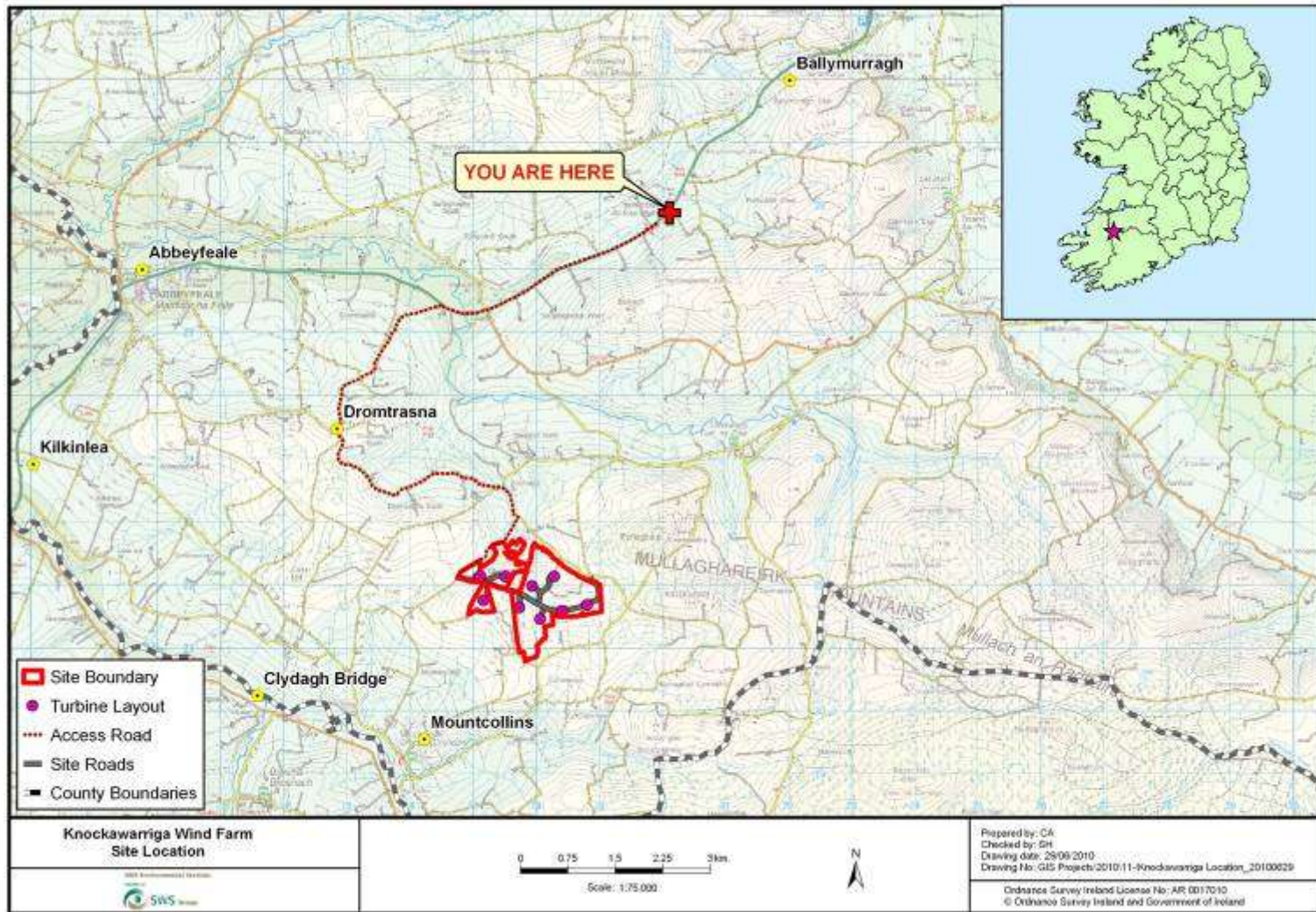
- Located in the townlands of Caherlevoy, Ballycommane & Glengort South, Co. Limerick
- 2.5km NE of Mountcollins
- 7km South East of Abbeyfeale

- **Windfarm Details**

- 9 Turbine Windfarm
- 2.5 MW Turbine, Total Output of 22.5MW
- First SWS Project to use Nordex N90 Turbines
- Hub Height 80m, Rotor Diameter 90m, Blade Tip Height 120m



Site Location Map

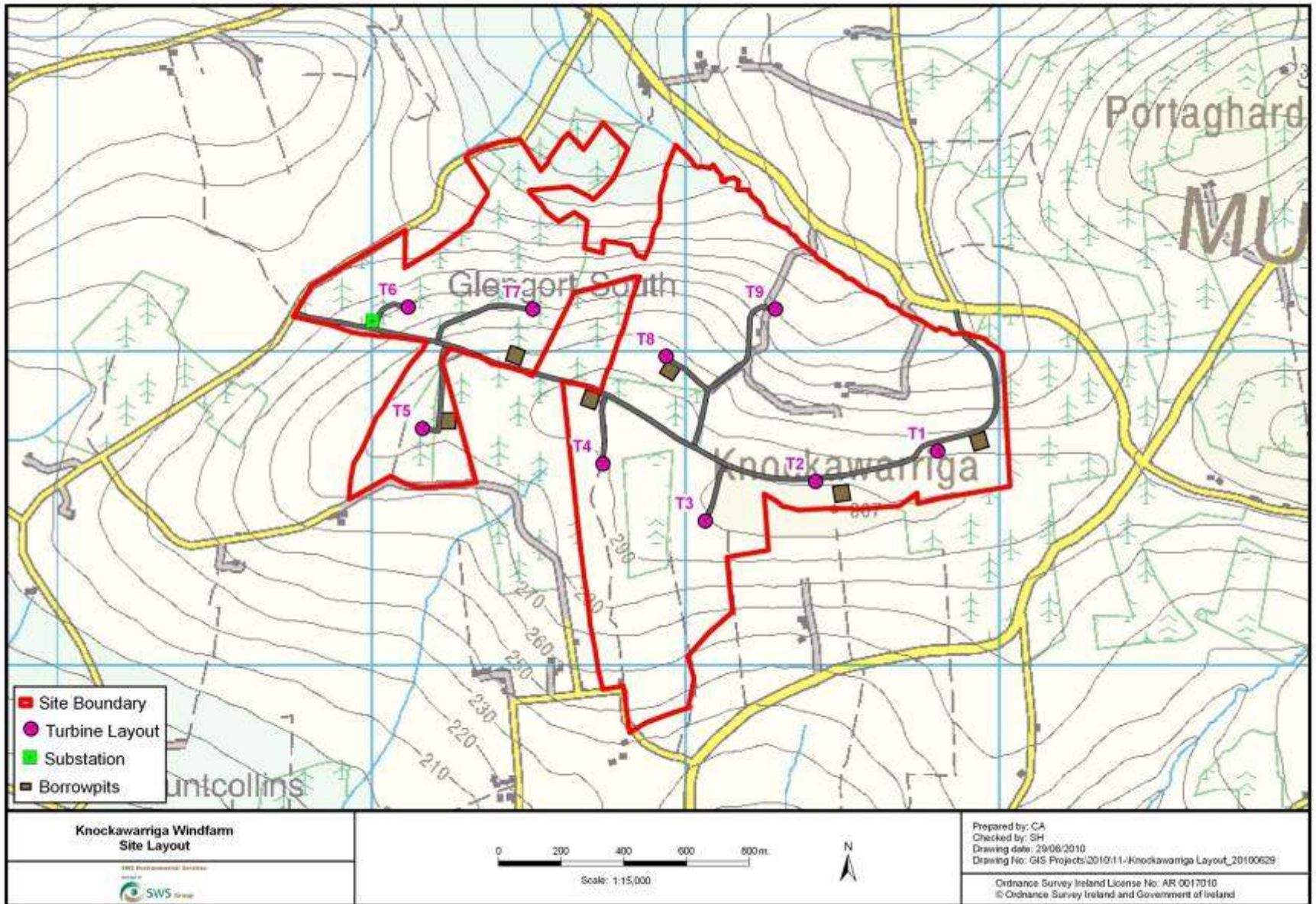


Planning Background

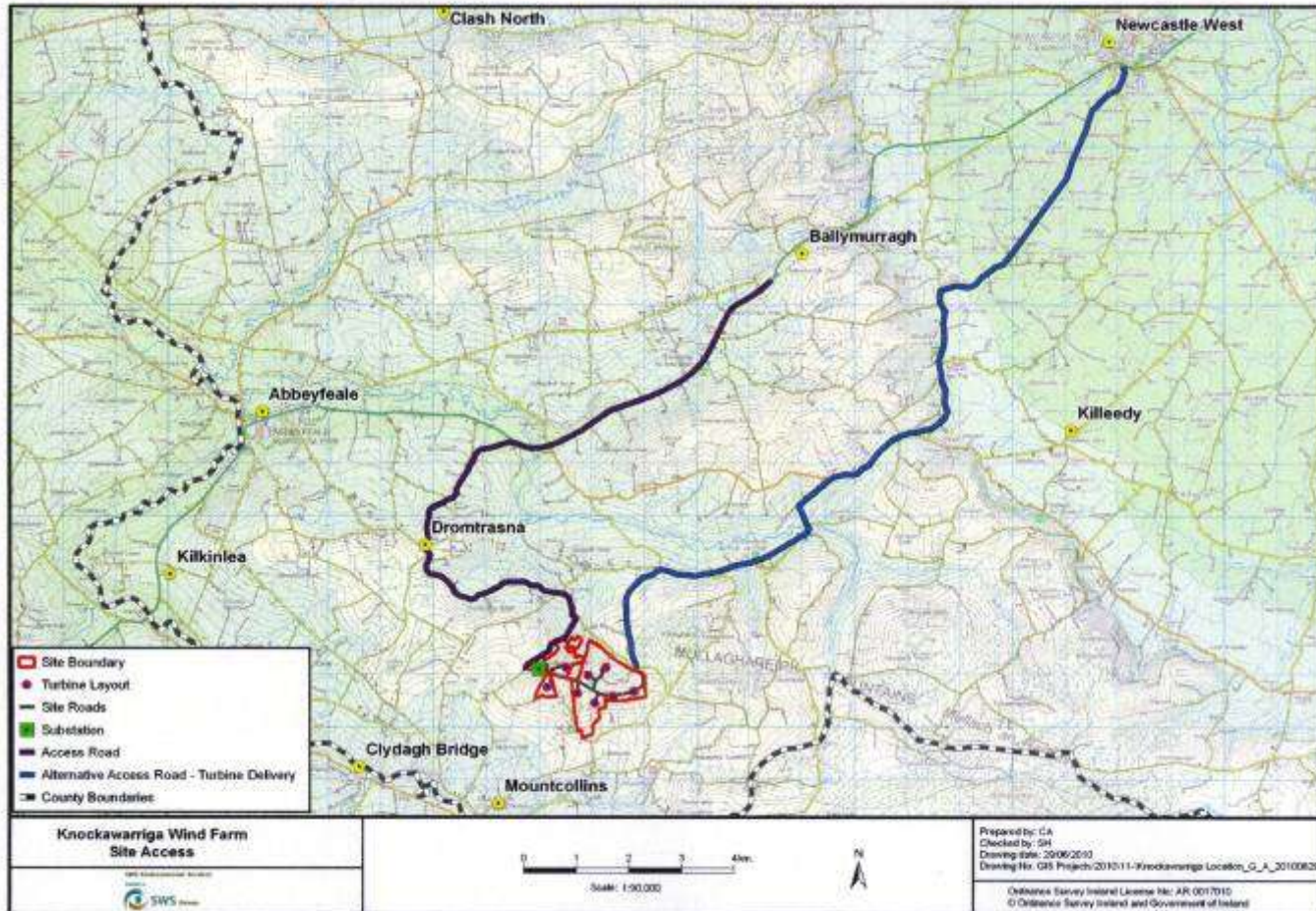
- EIS & Planning Application for 67m HH Submitted: December 2002, Granted April 2003
- Hub Height Increase (80m) Submitted: May 2004, Granted August 2004
- Alternative Access & Internal Roads: Granted November 2006
- Borrow Pits: Granted November 2006
- Permanent Meteorological Mast: Granted February 2008

- Construction Commenced: October 2006
- Generation: April 2008





Site Access Roads



Wind Energy Development

- The 5 main stages of wind energy development include:
 - Site Selection & Feasibility Stage
 - Assessment Stage
 - Consents, Contracts & Construction Stage
 - Operation Stage
 - Decommissioning Stage or Repowering
- To ensure responsible & sustainable design, SWS/BGE take a proactive approach to each of these development stages, by conducting detailed:
 - Technical Assessments
 - Environmental & Planning Assessments
 - Consultations
- Development is carried out in accordance with:
 - ✘ The relevant County Development Plan
 - ✘ IWEA/SEI '*Best Practice Guidelines for the Irish Wind Energy Industry*', April 2008
 - ✘ The Department of the Environment, Heritage & Local Government (DEHLG) '*Wind Energy Planning Guidelines*', 2006

Wind Energy Development

- The 3 main considerations associated with wind energy development include:
 - Wind Resource
 - Planning & Environmental
 - Grid Connection
- Wind Resource- Met Mast Data for Knockawarriga
 - Avg wind speed 7.9m/s @ 50m
 - Avg wind speed 8.2m/s @ 75m
- Class II Site - Medium Wind Speed

Planning & Environmental Constraints

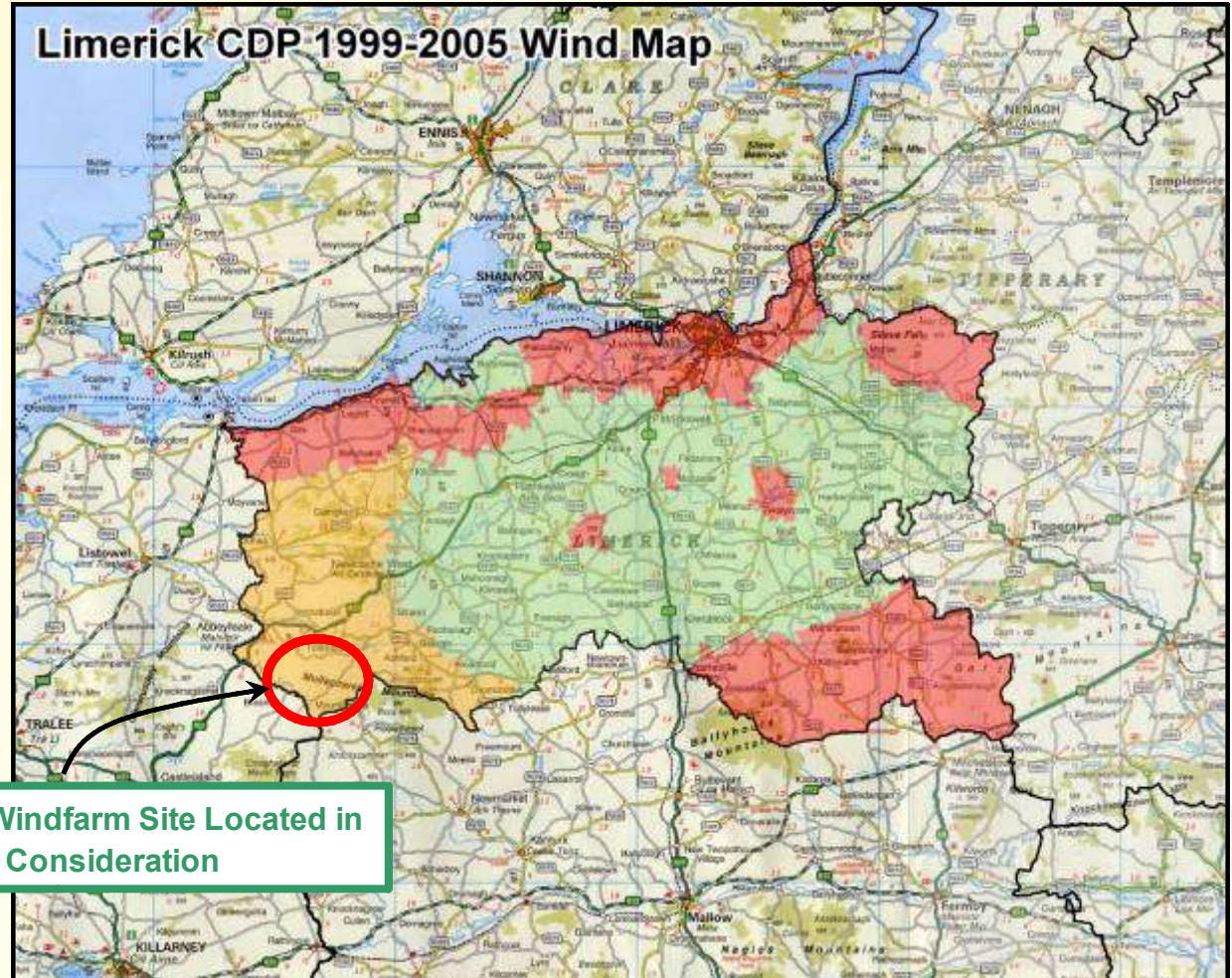
- **Clearly defined planning philosophy:**



- Feasibility assessment - Planning & environmental constraints, wind speed, grid connection,
- Limerick County Development Plan 1999-2005 was consulted during the site selection process.
- This document stated that *“using renewable energy is at the core of sustainable development”*.
- The Planning Authority stated that it would take a positive approach to renewable resource development *“subject to the development not detracting from Limerick’s other environmental resources which can be assessed in economic, scenic, natural, historic and recreational terms”*
- The Knockawarriga site was not within a sensitive area or an area of high visual amenity, with no designated views or prospects within 4km of the site.
- At time of EIS Mullaghareirks- not designated as SPA but area was known to be of importance to Hen Harrier- DOEHLG consulted- they stated no records of hen harriers nesting within the site.

Limerick Draft CDP 1999-2005 Wind Energy Development Map

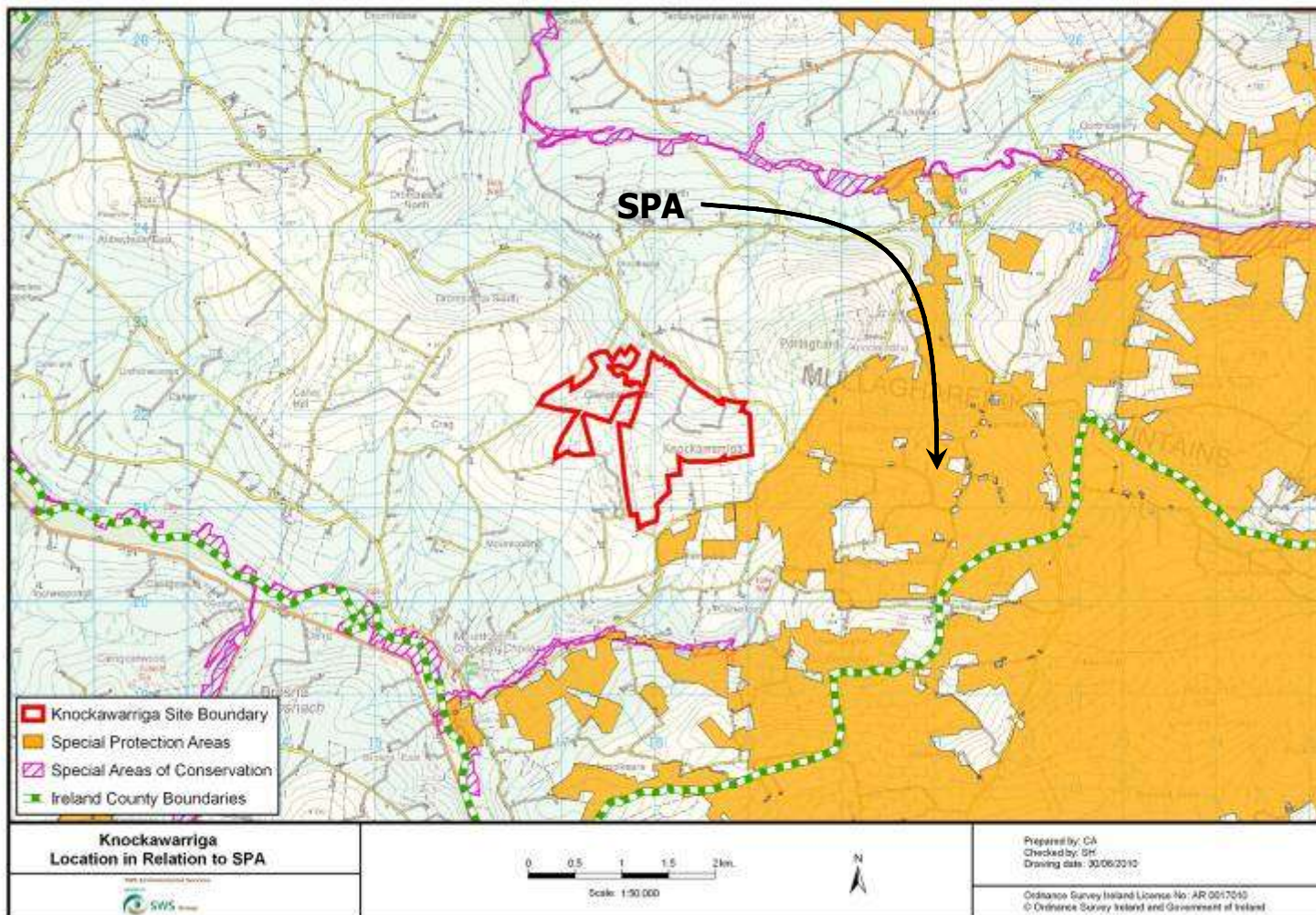
-  Areas unsuitable for wind energy development
-  Preferred Areas
-  Areas open for consideration



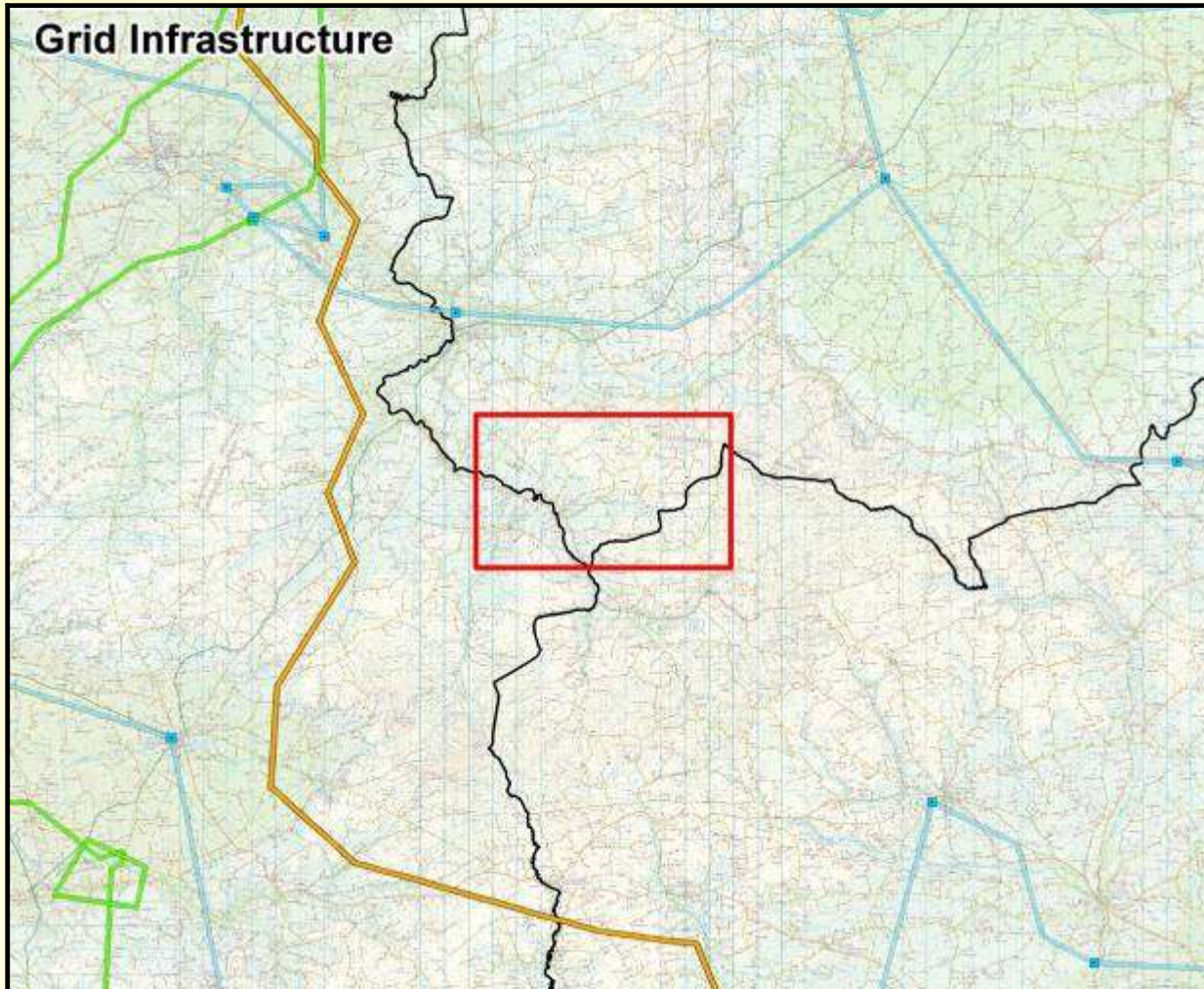
**Knockawarriga Windfarm Site Located in
an area Open for Consideration**

ENVIRONMENTAL DESIGNATIONS

- Site located adjacent to Stacks to Mullaghareirks and Mount Eagle SPA, designated for Hen Harrier in 2007



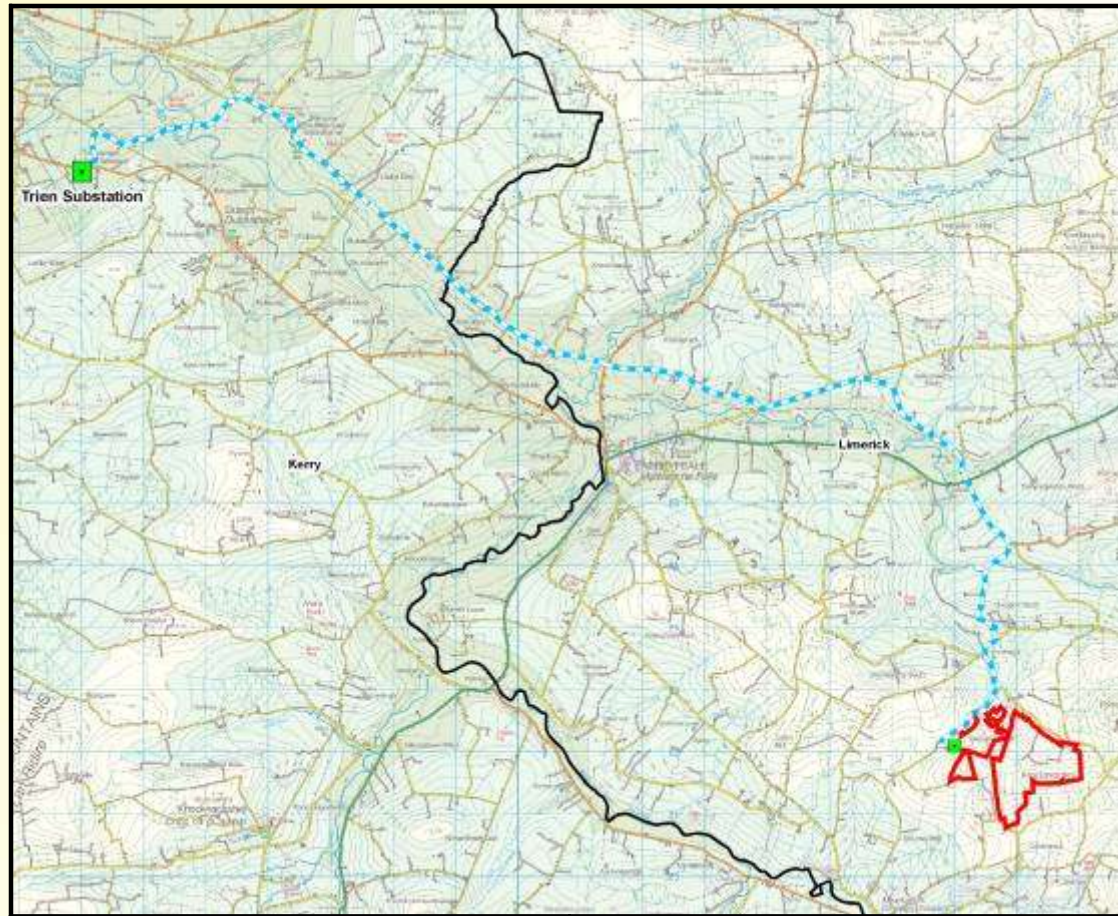
GRID INFRASTRUCTURE



Blue- 38kV
Green- 110kV
Orange- 220kV

Feasibility assessment- looked at the network connections available

UNDERGROUND GRID CONNECTION ROUTE



27km - Longest build of underground 38kV cable by any wind farm developer

Planning Conditions (Environment)

As part of the grant of planning permissions we worked proactively with the planning Authority & stakeholders in implementing the following onsite;

Pre-construction bird survey to be carried out – No Nests onsite, 1 breeding pair within 1km of the site boundary & a further 2 within 5km.

- No construction was carried out during the bird breeding season
- Site Management Plan prior to construction works agreed with NPWS & Limerick Co Co.
- Shadow flicker monitoring programme to be implemented post construction



Construction

- Construction works:
 - Commenced in October 2006
 - Completed in June 2008
- Condition 17 - Cessation during the hen harrier breeding season (April to late June)
- Construction Management Plan
 - Daily Checks & Weekly Water Quality Audits
 - Onsite supervision by Ecologist & Environmental Engineer
- Site Drainage Management in consultation with Fisheries
- Borrow Pit Reinstatement
- Roads/Road Embankment Management
- Hen Harrier Breeding Site- close liaison with NPWS- 400m buffer zone.

Borrow Pits



Road Embankments

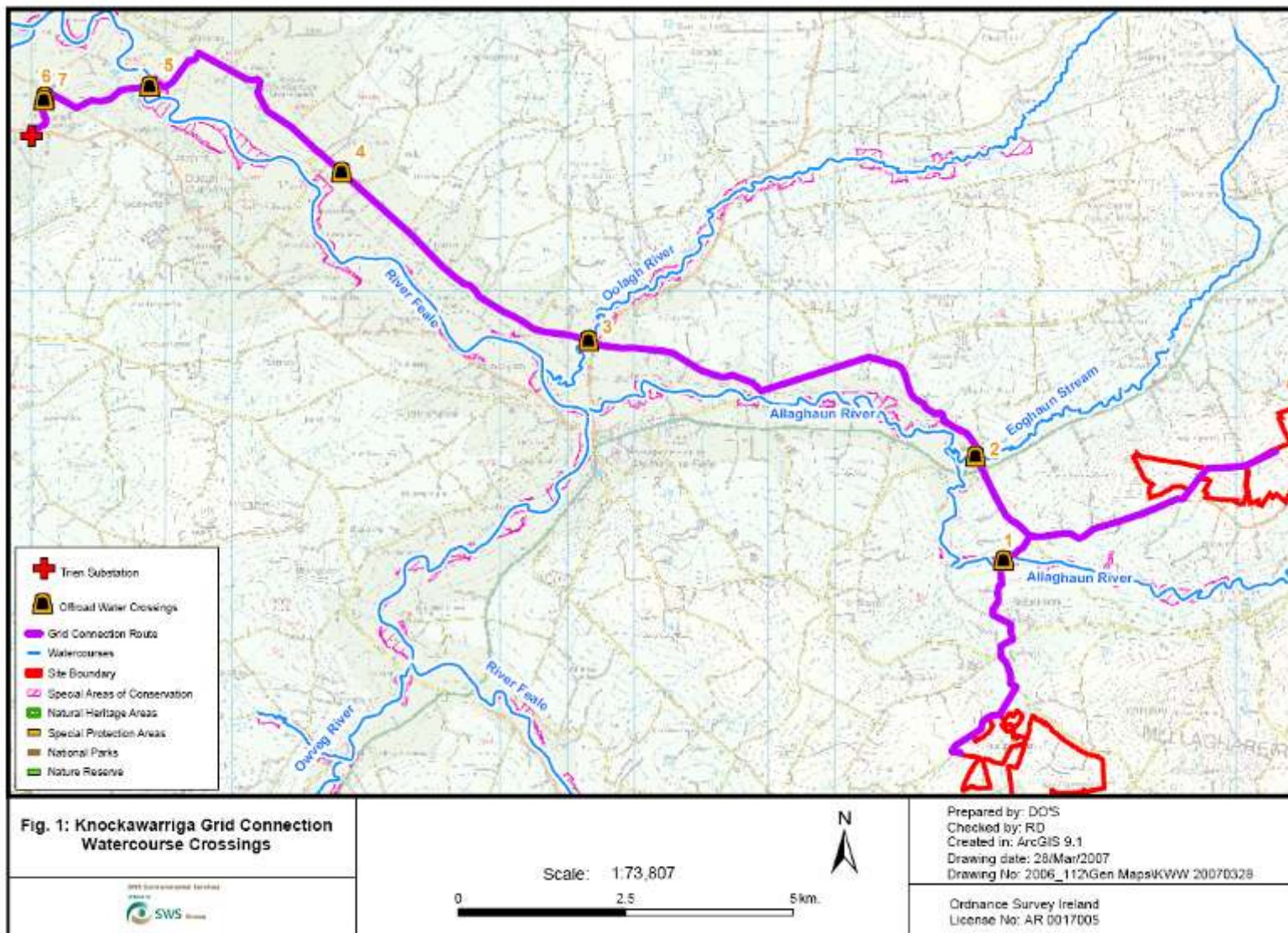


An example of an on-site road-side drain with grading and leveling of the adjacent sloping embankment visible

Construction- Grid connection

- GRID CONNECTION ROUTE
 - 27 km under ground route, 23km on public road & 4km cross country
 - 7 Stream Crossings
 - Consultation with NPWS and Fisheries
 - Directional Drilling in accordance with NPWS/Fisheries Advice

GRID CONNECTION WATER CROSSING POINTS



First drill pipe being positioned



Location of the four drill pipes under the northern bank of the river (marked in yellow on the bank)



Drill pipes exiting the ground
on the northern bank



Ground cabling works
awaiting connection with
pipes from under river





Cable pipe connected to drill pipe on northern bank. Drill pipe will reverse back under river and pull the cable with it

The River Feale following Directional Drilling (11th Oct 2007)



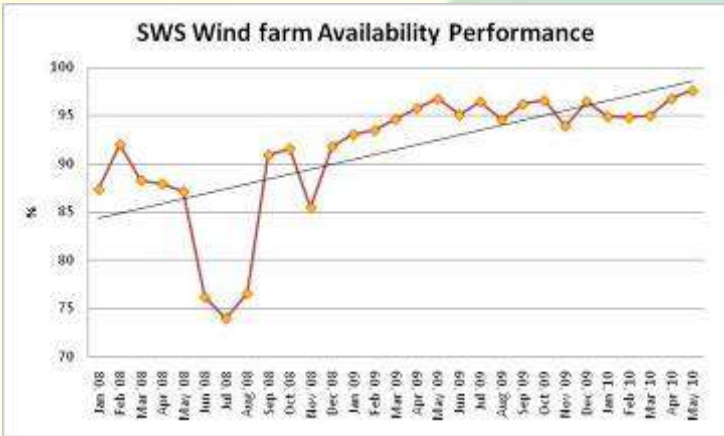
Our Philosophy - Operational Excellence - DMAIC

Report/Abbreviation	Root Cause	Corrective Action	Action by	Close by	Comment
Service	6 month service	2. PTO's remain in the weather conditions a low	JA	31.01.10	
Service	Low oil level across all turbines	Review: Root cause investigated by service in year in 4 no. Turbines in direct action	DI	31.01.10	
Grid	1. Grid code breach 2. Constraints to abnormal load output	2. To be discussed with Grid Co	AC	30.01.10	
Hydraulic system	Low hydraulic oil level	Have released - CIM Update form	JA	14.01.10	

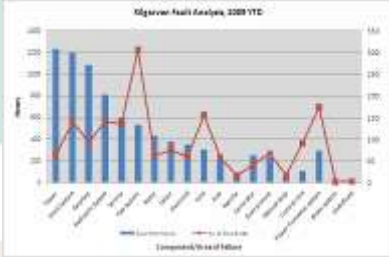
Define:
Step change in availability performance

Date	Time	Location	Asset	Asset ID	Supervisor	Shift	Time
Tue 7 Apr 09	11:11	Wigmore	T1	FC10000	SCADA Filter Availability	4	0:00
Tue 7 Apr 09	11:11	Wigmore	T1	FC10000	SCADA Filter Availability	4	0:00
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Control:
Weekly meetings/remote monitoring



Measure:
Downtime per fault - SCADA error logs



Improve:
Actions tracker, CIM cases, QPR's, Data sharing & OEM score cards

Analyse:
Pareto & Root Cause Analysis

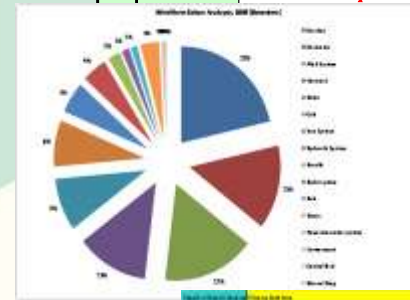
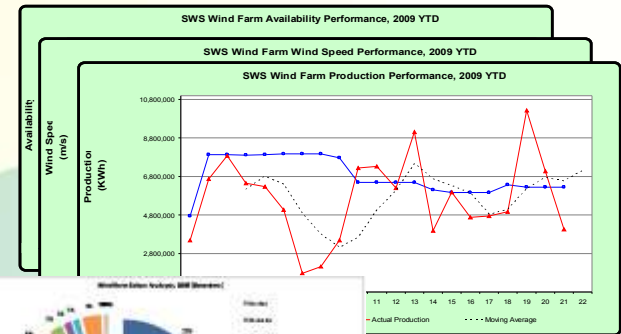
Asset	Asset ID	Asset Name	Asset Type	Asset Status	Asset Location	Asset Age	Asset Value	Asset Cost	Asset Depreciation	Asset Maintenance	Asset Repairs	Asset Downtime	Asset Availability	Asset Efficiency	Asset Reliability	Asset Safety	Asset Security	Asset Compliance	Asset Environmental	Asset Social	Asset Governance
Wigmore	T1	FC10000	SCADA Filter Availability	4	0:00																

Operations

Output: 68.1 GWh

Load factor: 36.7%

*Load factor = capacity factor = ratio of actual output of a power plant over a period of time versus its output if it had operated at full **nameplate capacity** the entire time



Issue	Impact	Resolution
Issue 1	Impact 1	Resolution 1
Issue 2	Impact 2	Resolution 2
Issue 3	Impact 3	Resolution 3
Issue 4	Impact 4	Resolution 4
Issue 5	Impact 5	Resolution 5
Issue 6	Impact 6	Resolution 6
Issue 7	Impact 7	Resolution 7
Issue 8	Impact 8	Resolution 8
Issue 9	Impact 9	Resolution 9
Issue 10	Impact 10	Resolution 10

Category	Value	Unit
Production	68.1	GWh
Capacity	185.5	MW
Load Factor	36.7%	%
Availability	99.5	%
Wind Speed	7.5	m/s
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Capacity	185.5	MW
Load Factor	36.7%	%
Availability	99.5	%
Wind Speed	7.5	m/s

Health & Safety

Safety Signs

- Make sure you understand and comply with all safety signs:
- All Prohibition, Information, Warning and Mandatory signs



First Aid

First Aid Kits are available at the following locations:

- On-site and Off-site Control Buildings,
- Turbine Nacelles,
- SWS Energy staff vehicles,

'Don't do'

'Safe condition'

'Hazard'

'Must do'

Welfare facilities

- A toilet, hand-washing facilities area are located in the On-site Control Building. A drinking water dispenser is also provided.
- The On-site Control Building can quickly become untidy and cluttered – you are requested to ensure that you leave the building in a clean and tidy condition.

Hazards related to this site:

- Unstable ground underfoot
- While driving on site please turn on Lights and Hazard lights.
- Beware of farm animals and/or wild animals while driving or walking on site please inform SWS of any loose farm animals
- No entry to wind Turbines unless Nordex or SWS are informed.
- Areas of no entry are any electrical dangers around substation.
- Walking beside machinery in operation remember if you can't see the driver then the driver can't see you.
- Risk of open manholes.
- Do not stray away from the person who is accompanying you on site.

