Selection and Evaluation of the Site

This section emphasizes the requirements for evaluating and selecting a suitable site for the Data center, whether the location is a new site that involves the construction of a new data center or reviewing the location of an existing building that will function as a data center, or the ranking of an already existing and operational data centers when considering closure or consolidation.

- The location of the datacenter should be unobtrusive so as not to attract any unnecessary attention and the site should not be located directly above water pipelines or any drainage piping as it has the risk of water leakage.
- The location where possible earthquakes and low level vibrations (less than rector scale 2) are likely to happen should be avoided and the Data center should not be located in or near an area with an active volcanoes.
- The Datacenter should not be placed near an urban development or protected natural areas where there are high chances to get wildfire. The history of location must be verified and certified by local district offices.
- The site location should be checked for the risk of a flood of a river or possible break of a lake and the site should not be located near/in an area where there is high possibility of intolerable levels of wind such as storms, tornadoes, hurricanes, cyclones and heavy rainfall.
- The quality and the stability of the soil should be tested and certified and any possibility of land sliding should be verified by local district offices.
- The site should be checked for acceptable levels of noise including the noise levels that will be produced by equipment.
- The equipment like generators, cooling towers should have silencers and sound attenuated enclosures. Outdoor equipment should incorporate sound barriers within the architectural screening.
- The impact of lightning must be verified, and the recommended flash rate of 10 or less is preferred and areas with a flash rate of 0.6 or less are to be considered as lightning free.
- Air quality of the site should be checked for the datacenter; fresh air intake for external mechanical components like cooling towers and heat exchangers and anything may be emitted from the site. Clean air quality is recommended so that emission of gases particle do not cause a problem. If there are existing quality problems, this should get verified by the air quality control and other local environmental authorities and compliance should be adhered to.
- The Location must be far away from any other location where protests and or riots are likely to take place.
- The Vibration and Electromagnetic Interference at the site should be tested if the location of datacenter is in proximity to railroad and the necessary mitigation should be taken if the vibration is not at or on the recommended level.
- The datacenter should not be placed above the train tunnel since train movements create above the recommended level vibration and Electromagnetic Interference

Below table should be referred to before the selection of the Datacenter location

Airports	8km
Auto body or other paint shops	1.6km
Canals	3.2km
Chemical plants and storage	8 Km
Conventional power plants (ex. coal, natural gas)	8Km
Embassies and political group properties	5km
Foundries and heavy industry operations	5km
Gas station and distributors	1.6km
Grain elevators	8km
Harbors and ports	3.2km
High voltage power transmission line	1.6km
Nuclear power plant	80km
Landfills and waste storage facilities	3.2km
Landing and takeoff flight paths for any airport	1.6km
Military installations and munitions storage	13km
Municipal water and sewage treatment plants	3.2km
Overflow areas for reservoirs and man-made lakes	1.6km
Quarries	3.2km
Radio/television transmitters/stations	5km
Railroads	1.6km
Research laboratories	5km
Self-storage facilities	1.6km
Stockyards and livestock feedlots	3.2km
Transportation corridors where hazardous material c ould be transported	1.6km
Water storage towers	1.6km
Weather or other radar installations	5km
Lakes, dams, reservoir	3.2km

Site Access

The data center site should not be close enough to the road or adjacent to the road which could result in vehicular contact with the building fabric or any building component of the datacenter which could cause potential fire. In case of proximity, proper protection of the building should be put in place.

The Site should be within a recommended distance between 3.2 km to 16km to a freeway or major arterial road. The site should have two or more accessible roads from the nearest major arterial road with each road having a minimum 4.3m length clearance for vehicles throughout.
If the datacenter is on a campus, then the campus should have redundant access roads with security checkpoints at all access points.

The datacenter should not be located near any buildings and facilities that have a risk of fire and it should
not be located near a large campus or manufacturing plant which may cause traffic.
The datacenter should not be placed near some properties as mentioned below, which could potentially affect datacenter operations;

- Military
- Embassy/consulate
- Police
- Fire station
- Hospital
- Chemical plant
- Political target
- Research lab
- Publishing house/foreign press
- Adjacent vacant lots may cause future issues because of:
- Possible future development and disruption during construction
- Unknown tenant(s)

Distance between Primary and disaster recovery datacenter will be determined using primary site and whether the backup site must have synchronous or asynchronous replication with the primary datacenter. However, there should be a minimum of 50 KM between the primary and disaster recovery site.

Site Security

The site should not be placed in the area where high crime rate is registered; site perimeter security analysis should be done depending on risk and threat analysis as per the factor based on the users' needs. This would include building type, site location and neighborhood.

All emergency services are located within a reasonable distance such as Police stations, Fire Station and
Hospital as below table,

Fire Station	10km
Police Station	8km
Hospital	16km

Water and Sanitary sewer

Datacenter should have adequate sanitary waste capacity from the site to the municipal sanitary waste sewer system. A private sanitary waste system should be required in regions where no national sanitary waste sewer system is available.
Sanitary systems or storm drainage systems (depending on local requirements) should be sized for expected water usage by cooling systems, including cooling tower blow down or filtration systems, which could be greater than 750 liters/min (200 gpm).

Holding tanks, traps and such requirements should be planned for during site design. A private sanitary waste system is recommended for critical facilities that require on-site operations personnel 24/7 to maintain uninterrupted services. This will help mitigate having to vacate the facility in the event the WASAC sanitary waste sewer system fails.

Data centers should have access to large volumes of water for other uses. Some uses of water that may be required are as follows:

Domestic water (e.g., drinking water, restrooms, kitchens) Irrigation (e.g., lawn watering)
Fire suppression (e.g., sprinkler systems)
HVAC (e.g., cooling towers, air humidification)

Provide adequate water delivery to the site to meet the requirements of the data center. For Tier 3 or TIER 4 data centers, the ability of the water supply pumping station (s) to deliver water when there is a major power outage must be documented or mitigated.

The water should be tested for contaminants and particulates and water filtration systems might be required as per the testing report.

If ground water is to be utilized, make sure that there is adequate ground water delivery on the site to meet the requirements of the data center. It is necessary to first determine the volume and quality of water that will be consumed for all purposes (data center cooling, building plumbing and occupant use, lawn irrigation, etc.).

A hydrogeological risk assessment should be carried out. The assessment should be conducted by a licensed hydrology engineering firm. An environmental impact study might be required. A hydrogeological report can include information on:

- Groundwater
- Infiltration
- Soil moisture
- Surface water flow
- Precipitation and evaporation
- Uncertainty analysis
- Water quality
- Remote sensing
- Integrating measurement and modeling
- Prediction

The available on-site water (Ground water) should be tested for contaminants and particulates. Water filtration systems may be required for some or all the various water uses listed above.

Utility Services

Utility services are essential for any datacenter to run its regular operations without any interruption. It is recommended that a Datacenter site be in an area where it can acquire the necessary skilled personnel to perform maintenance and repair of IT Equipment and Facility equipment, it would be difficult to get support if the site is located far from the necessary support.

Natural Gas and Other fuels

Fuels (e.g., natural gas, propane, and diesel) may be used to support primary or back-up systems of a data center. On-site fuel (e.g., propane, diesel) storage tanks should be located outdoors on the ground or buried below ground.

If natural gas is selected to support the heating systems, cooling systems, or backup electricity generation that the site requires, provide properly sized natural gas feed from the local utilities.

Data center should have a proper arrangement to have full capacity natural gas delivery to the site for the duration of any prolonged power outage or disaster situation.

Redundant gas feeds from redundant gas sources is the most desirable although rarely available method for natural gas delivery to a site. Natural gas in combination with diesel fuel may also be considered if dual-fuel generators are incorporated into the design. Dual-fuel generators start on diesel but can run on either diesel or natural gas. For sites with natural gas generators sized 25 kW or less, on-site storage of natural gas should be considered.

The data center site should be carefully planned to support on-site fuel storage when it is required. On- site fuel storage should be located on the data center site and in a secure and aesthetically pleasing manner. Fuel should be stored as far away from the data center as practical. Blast containment (proximity to a building or actual structure) should always be planned for in the site. Special containment or controls are usually required in case of any fuel leaks.
Controls for fuel transfer should be in a secure location, above worst-case flood levels, and protected from other natural disasters.

Other fuel or energy sources (e.g., wind, solar) may be used to support the site. Consider their continuous availability to determine if they can be primary or secondary energy sources. If other energy sources are used, their requisite equipment and system infrastructure (wind generator, photovoltaic panels) will require additional space and may affect building and structural requirements.

Careful consideration should be given to the visual intrusion on neighbors and any effects on the surrounding environment. Zoning, codes, and other governmental/municipal restrictions may not allow for alternate fuel/energy sources.

Regulations

Determine if local air quality regulations exist such as generator emission restrictions. These regulations may restrict the acceptable hours of operating backup generators.
Concerns that data centers may have for local authorities are the emissions of oxides of nitrogen (Nox), carbon monoxide (CO) and particulate matter (PM-10).

Determine if there are any local, regional, or International regulations that identify acceptable levels of noise from equipment operating within the data center facility that cannot be exceeded at or beyond the property line.

Determine if there are any local regulations that will restrict the height or proximity to other facilities for
Communication towers; water tanks; cooling towers; and other tall structures.
Determine if there are any federal or local requirements to hide these structures from public view.
Determine if there are any local regulations that will require double-walled tanks or restrict the size or proximity to other facilities for fuel tanks.
Determine if there are local regulations that will allow above ground fuel tanks only. Evaluate security of the fuel tanks.
Emission levels need to meet state and local emission requirements. Generator hours may be limited by local codes because of air quality emission control or noise abatement.

Determine if there are any road restrictions (permanent or seasonal) on the size of vehicular traffic or time of day restrictions for truck traffic.

Determine how the Rwanda Housing authority determines the required number of parking stalls for a new facility. Negotiations with the Rwanda housing Authority may be necessary to try to reduce the number of required stalls if the Rwanda Housing Authority treats the data center as a typical commercial office space.
Consideration should be given to disaster recovery scenarios, which may require additional parking for the respective personnel.

Determine the required setbacks from the property line for the building, parking, or perimeter security. Verify with the Rwanda Housing Authority that the target location does not have sight line restrictions that must be mitigated or that they can be done so economically.

An environmental assessment could include an environmental impact study if wetlands are impacted or if the site has any contaminants present. An environmental impact study may be required by Rwanda Environmental Management Authority. Ensure enough time prior to proceeding with the detailed design phase to allow completing the study and attend Rwanda Environmental Management Authority meetings as required to obtain approval.

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