

## Jennings Substation - Narrative for Pre-application meeting

The District is proposing to construct a new substation within the City of Marysville to replace aging infrastructure, improve current capacity and reliability as well as provisioning the area for a future capacity increase when demand requires it. The substation is needed because of current and future developments anticipated in the City of Marysville and the inadequacy of the ageing adjacent Central Marysville substation to meet current and future needs.

Jennings substation is will be currently configured as a single bank, loop through station with a future provision to double bank the station when power demand in the area requires it.

- A “single bank” refers to a substation configuration which houses one power transformer.
- A “double bank” refers to a substation configuration which houses two power transformers.
- A “loop through” refers to a substation configuration in which two separate transmission lines are attached to the station. The “loop though” provides the substation the ability to be supplied with power from either transmission line. When one transmission line has an outage, the station may be fed from the other – thus increasing reliability of power in the area.

As configured Jennings substation is a unoccupied fenced 115V -12kV energized utility yard which contains electrical equipment; including transformers, switchgears, circuit switchers, bus, switches, reactors and various other ancillary electrical equipment. The equipment requires supports specifically designed to provide adequate electrical clearances for safety and maintainability as well bear the various loads of bus and electrical devices upon them and transitory loadings. In general, the height and spacing supports are configured to meet the NESC (national electric safety code) and various District standards which have been put into place to ensure safety and maintainability along with IEEE (Institute of Electrical and Electronics Engineers) standards. IEEE standards have long been utilized as a guide within the electrical portion of utilities for grounding, phase spacing, etc. Once those criteria are established the supports are engineered to meet various structural criteria; depending upon the particulars of the situation. ASCE published manual 113 – otherwise known as the substation structures design guide which provides guidance for loading the various supports for the unique circumstances encountered within a substation. Other criteria often include ASCE 7, the IBC, and other related codes. A self supporting piece of electrical equipment such as the transformer, circuit switcher or the electrical enclosures are designed by the manufacturer to meet the criteria established within IEEE 605, IEEE 693 – which specify loading requirements including seismic for electrical equipment as well as rigid- bus structures. The transmission poles and conductors will span into the substation in this instance – the poles are designed in accordance with the NESC loading requirements. Conductor drops will be attached from the conductors on the transmission poles to link to the substation. A photo is provided to illustrate this connection.

- A circuit switcher is an electrical device capable of breaking load.
- A switch is an electrical device capable of opening and providing a clearance once the load is broken.
- Bus refers to a conductor within the substation utilized to provide pathway to electricity throughout the substation.
- A switchgear is a metal clad electrical enclosure which contains distribution level voltage circuit breakers and the controls necessary for station operation.

- A reactor is a piece of electrical equipment sometimes installed to protect the transformer.

The various electrical equipment and supportive structures are typically installed upon concrete foundations, shafts and slabs as required. The foundations are designed to meet the criteria specified by the geotechnical engineer with regard to soil properties and the ACI, ASCE intermixed with the more electrical guides listed above.

It's been the experience of the District that most jurisdictions have adopted IBC 105.2.3 and do not require permits for the electrical equipment nor the foundations supporting the equipment. The substation security fence has often triggered a building permit as it exceeds the typical 6-ft limitation.

The layout of the substation requires a building platform adequate to meet the criteria listed above and to facilitate space to maintain said equipment while minimizing outages. Typical substation and utility civil engineering related construction practices include the removal of vegetation, organic soils and unsuitable soils in the area of the building platform supporting the substation and other items which may be identified within various reports by experts such as geotechnical engineers. Sub-surface of the station, underground conduits are installed to house control and power wires for the various electrical devices needed to operate the station devices, exiting the station are larger underground conduits which house the distribution circuits (feeders) utilized to provide power to the surrounding distribution infrastructure. These conduit installations range from typical depths of 2 to 8 feet below station final grade. A grounding system is installed in accordance with IEEE 80 which consists of various items including 4/0 copper conductors, grounding rods and, at times, grounding wells if analysis indicates they are needed. The 4/0 conductor is typically approximately 18-inches below the station finish grade, the grounding rods may be anywhere from 8-ft to 30-ft long depending upon the need, grounding wells range from 150-ft to 450-ft depending upon the need. At this time the grounding system has not been designed so the information above is provided to the city in reference only.

Once the below ground conduits and grounding system are installed – the District's practice is to install 8 – 12 inches of base course material above the native or sub-base material. Above the base course what is referred to as substation rock is installed. The substation rock is installed to establish an electrically isolative barrier in accordance with IEEE 80. The base course material is installed to help with the suitability of the substation rock drivability along with drainage related purposes. These layers are highly permeable and are described in detail within the stormwater notes provided to the City. Please refer to the stormwater notes with regard to the drainage design specific to the station.

The station requires access and thus driveways. The driveways are designed to facilitate the transportation and setting of the large electrical equipment such as the transformer and switchgear. Pavement driveways are common, a well graded graveled driveway can also be suitable. The turning radius of the vehicles and trailers are utilized to determine a feasible driveway profile.

The District landscapes and irrigates the landscaping as required by the jurisdiction – there are some security related concerns as to visibility due to a rise in theft of materials, specifically grounding materials and the concerns one would associate with energized removal of the grounding. These concerns may be raised during the permitting process, depending. Irrigation is typically established via purveyor provided water. These items are typically designed by a landscape architect under contract with the District. At present – there is no landscape architect, the District will procure one within the coming months.

The transformer contains about 8,500 of mineral oil. The District has an established SPCC plan; these plans are under the jurisdiction of the EPA and meet federal regulation 40 CFR. There is no oil stored on site – only what is within the electrical equipment needed for operation. This will be discussed in greater detail with the drainage report which will be provided to the City.

Public service access is unique as this is an electrical facility. Typical police/fire/aid department practices include contacting the electrical utility in order to ensure the area is made safe by electrically qualified personnel (wiremen/linemen, etc) prior to entry; same practice as when an electrical line is down. No knock box or means to access inside of the station is necessary; the electrically qualified personnel will provide safe access and escort public service within the station if necessary.

Some factors specific to the Jennings project:

- The groundwater level is relatively high at times of the year (refer to supplied geotechnical report). The District has oriented the station to minimize the the length and depth of the underground feeders leaving the station to avoid dewatering as much as is possible. The station final grade elevation is proposed to be approximately 3-ft above existing grade – both the provide separation between groundwater and bottom of infiltration facility and anticipate future development in the area possibly increasing the level of the groundwater. There exist stations within the Districts system which require consistent vigilance to ensure water from surrounding subsequent developments to not raise to an unsafe level within the station; simpler to anticipate and avoid that unsafe and undesirable situation.
- The existing masonry building and surrounding appatures will be removed and disposed of in order to provide thru-fare for the distribution and transmission in and out of the station, refer to site plan.
- The cell tower which is upon District property and currently in the transmission and distribution route will be relocated, this notice has already been provided to the cell company as their lease is up. Refer to site plan.
- Various cut sheets of typical electrical equipment are included in the transmittal of this narrative, these may be paired with the locations of existing substations with the City to garner an idea of the height of the equipment along with the visual appearance of the station.
- Locations of other stations with the City viewable from google include:

North Marysville Substation:

11705 Smokey Point Blvd Marysville, WA 98271

East Marysville Substation

48.05388063487191, -122.12214437301527

Edgecomb Substation:

16301 51st Ave NE, Marysville, WA 98271

Kellogg Marsh Substation:

6417 100th St NE, Marysville, WA 98270

Central Marysville Substation (likely removed after Jennings is complete)

4518 80th St NE, Marysville, WA 98270