NORTHWEST TERRITORIES POWER CORPORATION

Empowering Communities

OPERATIONS, MAINTENANCE AND SURVEILLANCE MANUAL

JACKFISH LAKE
GENERATING FACILITY, NWT
PLANT #120
YELLOWKNIFE, NORTHWEST TERRITORIES

April 2019

DOCUMENT MAINTENANCE AND CONTROL

This document will be reviewed annually by the Plant Operations Manager and updated as required. Changes in phone numbers, names of individuals, etc. that do not affect the intent of the plan are to be made as required.

DOCUMENT HISTORY				
Revision #	**Revised Section(s)**	**Description of Revision**	**Prepared by**	**Issue Date**
0	N/A	First Version	NTPC	Feb 2019
1	2.6.2	Information on disposal of plant sump water	NTPC	April 2019

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1 GENERAL

1.1 DESCRIPTION OF FACILITIES

Yellowknife is located on the west shore of Yellowknife Bay on the north arm of Great Slave Lake (Figure 1). The Jackfish Lake Generating Facility (the Jackfish Facility) is located at the north end of Yellowknife on the north shore of Jackfish Lake (formerly known as Stock Lake) and is surrounded by chain-link fencing (Figure 2).

The arrangement of buildings from east to west along the south side of the property is as follows: the office building, Cat Plant, EMD Plant, K-Plant (the three plants are joined by covered walkways), the warehouse, and the line shop. There is a water pump house located south of the K-Plant, a fuel pump house north of the K-Plant, and a storage shed northeast of the line shop. On the north side of the property from east to west sits the substation, the Ruston Plant, a drum storage berm, the tank farm, and five modular gen-sets with a fuel storage tank and control building (Figure 3).

The K-plant built in 1969 and extended in 1988 contains two Mirrlees KV-16 gen-sets rated at 5000 kilowatts (kW) each; only one is in service at this time. The EMD Plant (Photo 1) built in 1974 and extended in 1988 contains four EMD's (Electro-Motive Division of GM); two E-series gen-sets rated at 2500 kW each and two F-series gen-sets rated at 2850 kW each. The Cat plant built in 1993 contains two Caterpillar 3612 gen-sets rated at 2700 kW.

Figure 1: Regional Project Location

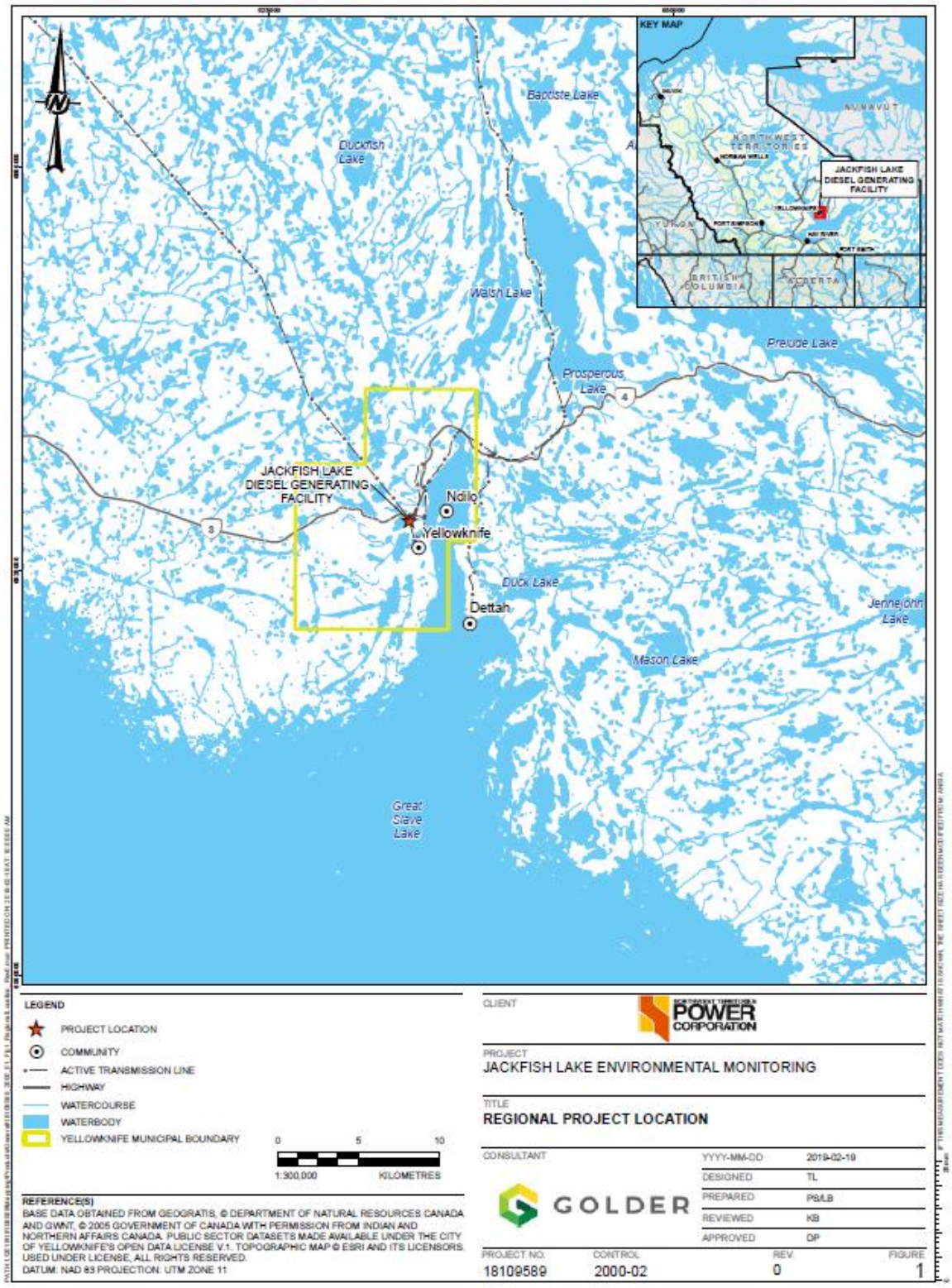

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Figure 2: Location of Jackfish Diesel Generating Facility

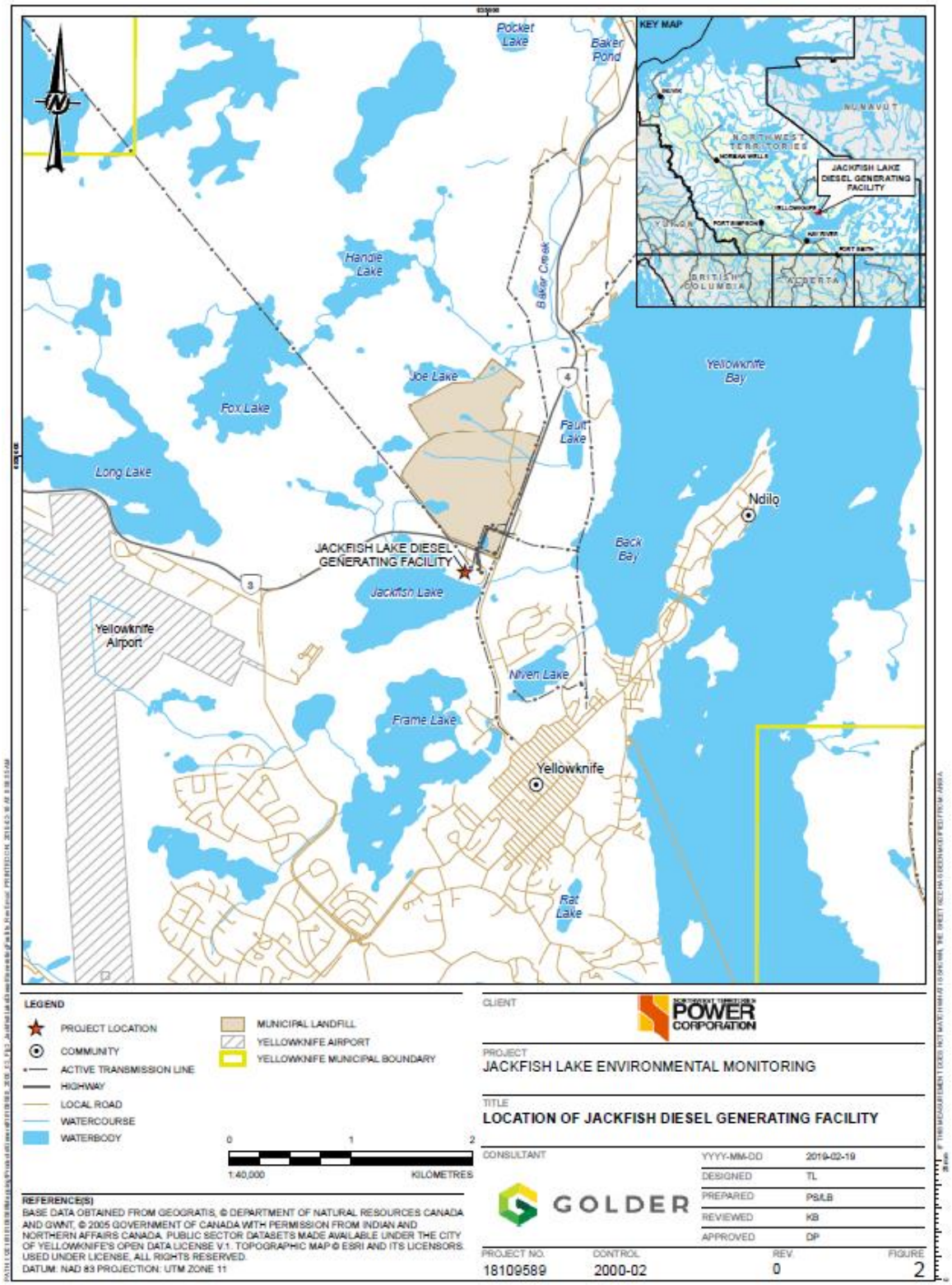

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Figure 3: Jackfish Diesel Generating Facility

Photo 1: EMD Plant

The Jackfish Facility is an important component of the North Slave Power System which is the sole supplier of electricity to the communities of Yellowknife, Behchokǫ̀, Ndilo, and Dettah (Figure 4).

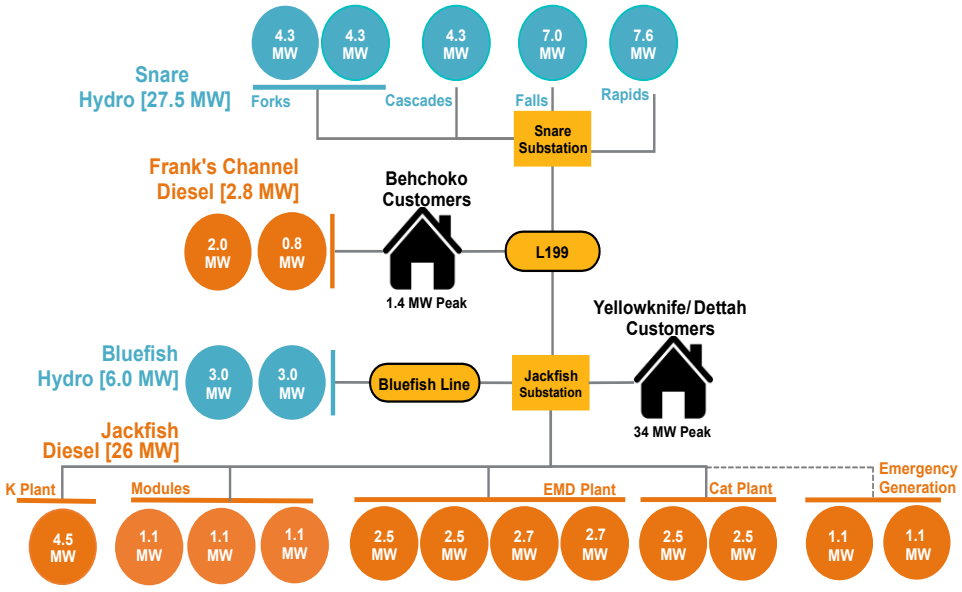


Figure 4: North Slave Power System Diagram

Historically, and recommended by the Northwest Territories (NWT) Public Utilities Board, the Jackfish Facility has been developed so the total installed diesel generating capacity can provide power to the communities in the event of a failure of the L199 transmission line from the Snare Hydro System (Table 1). The diesel generating capacity was sequentially increased until the construction of the 4300 kW Snare Cascades Hydro Plant in 1996 (Table 2). The closure of Con Mine in 2003 and Giant Mine in 2004 and resulting drop in the system load has made further expansion unlikely.

Table 1: North Slave System Generation Maximum Continuous Capacity

System	Plant and Unit	Continuous Capacity (kW)
Snare Hydro	Snare Rapids	7600
	Snare Falls	7000
	Snare Cascades	4300
	Snare Forks #1	4300
	Snare Forks #2	4300
	Total Snare Hydro	**27,500 kW**
Bluefish Hydro	Bluefish G1	3000
	Bluefish G2	3000
	Total Bluefish Hydro	**6,000 kW**
Jackfish Diesel	Mirrlees KV16 (G1)	4500
	Mirrlees KV16 (G4)	0
	EMD S20-645 (G2)	2500
	EMD S20-645 (G3)	2500
	EMD S20-645 (G5)	2700
	EMD S20-645 (G8)	2700
	CAT 3612 (G14)	2500
	CAT 3612 (G15)	2500
	Cummins (G20)	1100
	Cummins (G22)	1100
	Cummins (G25)	1100
	MTU (EM9)	1100
	MTU (EM10)	1100
	Total Jackfish Diesel	**25,400 kW**
Behchokǫ̀ Diesel	Behchokǫ̀ G5	2000
	Behchokǫ̀ G1	800
	Total Behchokǫ̀ Diesel	**2,800 kW**
	Yellowknife Peak Demand	34,000 kW
	Behchokǫ̀ Peak	1,400 kW

Note: EM9 and EM10 to be replaced by two Cummins units of the same capacity.

Table 2: Jackfish Diesel Generating Units in Service

UNIT	MANUFACTURER	MODEL	YEAR	Theoretical kW	Continuous Generation kW	Raw Water Cooling
G1	Mirrlees	KV16	1971	5000	4500	YES
G2	EMD	S20-645E4B	1974	2500	2500	YES
G3	EMD	S20-645-E4B	1974	2500	2500	YES
G5	EMD	S20-645-F4B	1993	2800	2700	YES
G8	EMD	S20-645-F4B	1988	2800	2700	YES
G14	CAT	3612	1993	2700	2500	YES
G15	CAT	3612	1997	2700	2500	YES
G20	Cummins	QSK50-G4	2017	1150	1100	NO
G22	Cummins	QSK50-G4	2017	1150	1100	NO
G23	Cummins	QSK50-G4	2017	1150	1100	NO
EM9	MTU	16V4000G03	2016	1150	1100	NO
EM10	MTU	16V4000	2015	1150	1100	NO

Note: EM9 and EM10 to be replaced in the future by two Cummins units of the same capacity.

2 OPERATION

2.1 OPERATING PRINCIPLES

The Jackfish Facility is a standby plant for the North Slave System. Hydroelectric power, while expensive in capital, is very economic to operate compared to diesel generation. Diesel generating units at Jackfish are therefore only utilized for the following conditions:

Instantaneous loss of hydro supply (Outage). This could be caused by a temporary issue such as lightning strike, failed insulator, or broken conductor on the transmission line, or a hydro unit(s) unplanned shutdown.

Shortage of hydro generating capacity. This occurs when the total system (customers) load exceeds the total available generating capacity of the hydro units. This generally occurs during the winter but may occur due to maintenance on the hydro components.

Diminished hydro supply. Due to low water inflows this may exist for a short duration due to a late spring runoff or for a longer term due to extended drought conditions in the Snare and/or Yellowknife River basins.

2.2 ACTUAL OPERATION

Actual system generation throughout various conditions is shown in Figure 4.

When Jackfish Facility needs to generate due to an instantaneous loss of hydro supply it is generally of short duration and is not significant on a monthly basis. The vast majority of electrical generation comes from Snare or Bluefish Hydro.

A shortage of hydro generating capacity can be seen in the winter months of the normal water year of 2015-2016 and a hydro unit overhaul in July of 2015 (Figure 5).

Diminished hydro supply can be seen in the drought period of 2014-2015 (Figure 5). Considerable diesel generation was required, particularly in the summer, to save water in the reservoirs required for the winter peak demand months.

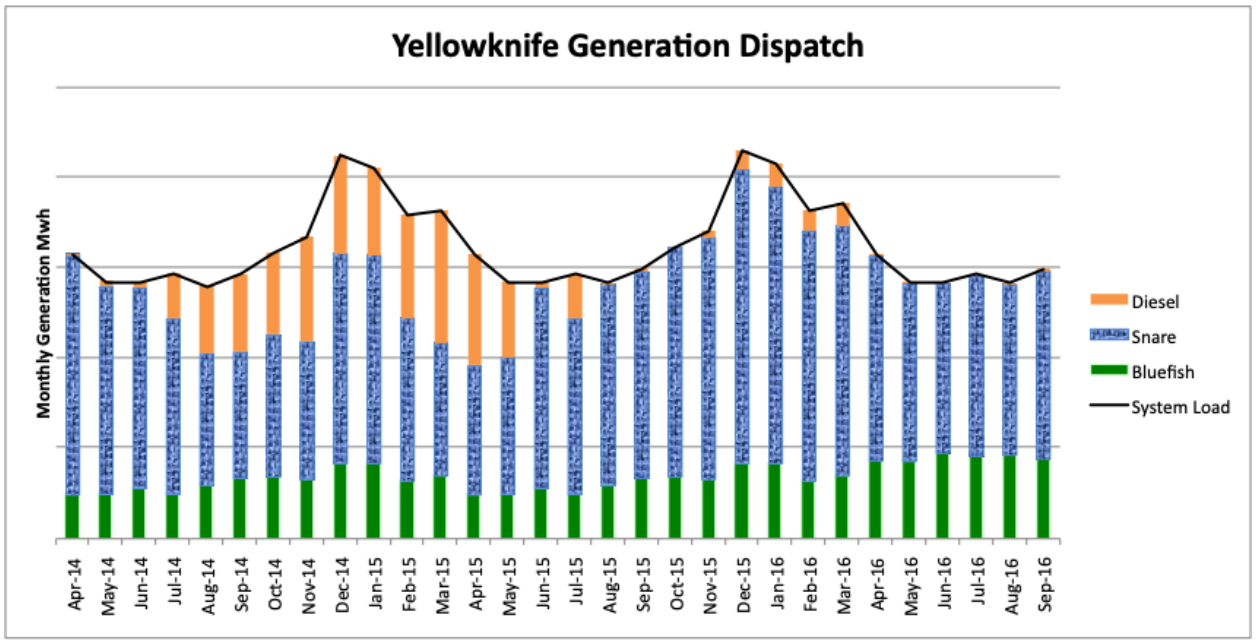


Figure 5: Yellowknife Generation Dispatch

2.3 DIESEL FORECASTING

Forecast Diesel Generation is the remainder of the Forecast System Load minus the Forecast Hydro Generation. This includes a shortage of capacity due to system load peaking in the winter and potential hydro from available reservoir storage and forecast inflows.

The forecasting process is a dynamic process that involves a series of forecasts, updates and adjustments during the year. The process uses some knowledge of hydrologic conditions and the manner in which runoff travels through the Snare River and Yellowknife River basins.

- STEP 1: The first forecast is based on an estimated annual runoff derived from the **April** snow surveys conducted on the Snare River and Yellowknife River basins.
- STEP 2: The next occasion to update the forecast occurs when the spring peak is observed at the Indin River gauge. This peak occurs, typically in **mid-June**, and is a good predictor of the eventual peak flow that will be observed at the Snare Ghost gauge, upstream of the Big Spruce Reservoir. This information is then used to forecast the spring peak flow at Snare Ghost. The resulting update forecast is then used to revise the reservoir-operating plan, the monthly water allocations and plant operations are adjusted accordingly.
- STEP 3: The next occasion to update the forecast occurs when the spring peak is observed at Snare Ghost gauge, normally during the period **mid– to late July**. The forecast is updated based on the observed peak and the recession (falling limb) of the annual hydrograph is adjusted to fit. The inflow hydrograph, water management plan and power plant operations are then updated.
- STEP 4: The fourth step involves monitoring the recession of the annual hydrograph, for the remainder of the year. The initial rate of recession until freeze up, typically in **mid-October**, varies somewhat from year to year. During this period, the performance of the forecast is reviewed and adjusted, normally at monthly intervals.

- STEP 5: After October 15, precipitation measured at Indin River, Snare Rapids and Yellowknife is normally in the form of snow and is a precursor of conditions in the coming year. Snow accumulations estimated for these stations give an indication of the future conditions and forewarning of possible problems.

2.4 OPERATIONAL RESPONSIBILITIES

Staffing levels at Jackfish Facility vary due to the rotation of staff to the Snare and Bluefish hydro plants and North Slave Communities. There are Mechanics, Electricians, and Millwrights as a resource for preventive maintenance, trouble shooting, and emergency repair. In general, there are eight Hydro Plant Operators skilled at operating the Jackfish Facility, although this number may fluctuate according to diesel demand. These operators also rotate through a days on / days off schedule to the Snare and Bluefish hydro systems. Their working hours at Jackfish Facility are scheduled depending on the current role of that plant to the system. An additional and critical role of the operators are supporting inspections for Health and Safety in addition to maintenance tasks identified by the central maintenance system.

There are five System Operators that monitor the North Slave System via SCADA (System Control and Data Acquisition) over a 24/7 shift in addition to 26 other communities.

2.4.1 Plant Operators

Reporting Structure
The Hydro Plant Operators report to the Plant Operations Manager in Yellowknife who reports directly to the Hydro Divisional Director. For technical assistance, there is the Mechanical Services Manager, Electrical Services Manager and System Control Manager in Yellowknife who may provide input and support staff.

Duties of Plant Operators
At a minimum, the Plant Operator does a visual inspection of the entire facility at least once a day. This includes a walk around of each unit, a check of sumps, raw water pumps, tank farm and modules. When Diesel Units are being operated the Plant Operator's duties increase to observing and recording generating data, temperatures and pressures on the units and auxiliary equipment. The Plant Operator also performs or assists in maintenance.

2.4.2 System Operators

Reporting Structure
The System Operators report to the System Control Manager in Yellowknife who reports directly to the Hydro Divisional Director. For technical assistance, there is the Mechanical Services Manager, Electrical Services Manager, Transmission and Distribution Manager, and Plant Operations Manager in Yellowknife that may provide input and support staff.

Duties of System Operators

The System Operator monitors and controls the various components of the North Slave System to ensure safe, efficient, and reliable power generation. The System Operator directs the dispatch of diesel generating units, based on short- and long-term operating schedules. This may be performed by the Plant Operator or remotely through SCADA. Some high-level monitoring of information and alarms of the Jackfish Facility and units are also performed with SCADA.

2.5 DIESEL GENERATING UNIT COOLING SYSTEMS

The three main plants use Jackfish Lake water (raw water) to circulate cooling between the internal plant heat exchangers and back out to Jackfish Lake (Table 3, Figure 6). Jacket Water is the term used for the internal "closed loop" system for engine cooling which contains a corrosion inhibitor called Powercool 3000 (mixture of 95% water to 5% powercool). The five modular gen-sets use antifreeze for cooling and are not connected to Jackfish Lake for cooling requirements. All pumps are 3-phase, 600 volts. Maximum flow rate is 7,619 imperial gallons per minute, or 34.6 m^3 per minute and 49,882 m^3 per day.

Table 3: Jackfish Facility Raw Water Pumps

K-Plant Vertical 2 Stage Pumps				
PUMP	**HP**	**RPM**	**GPM US**	**GPM IMP**
W1-1	50	1800	1500	1245
W1-2	20	1800	910	755
W4-1	50	1800	1500	1245
W4-2	20	1800	910	755
EMD Plant Horizontal Double Suction Pumps				
PUMP	**HP**	**RPM**	**GPM US**	**GPM IMP**
W2-1	30	1800	840	697
W2-2	30	1800	840	697
W2-3	30	1200	560	465
Cat Plant Vertical Single Stage Pumps				
PUMP	**HP**	**RPM**	**GPM US**	**GPM IMP**
1	15	1750	1060	880
2	7.5	1750	530	440
3	7.5	1750	530	440

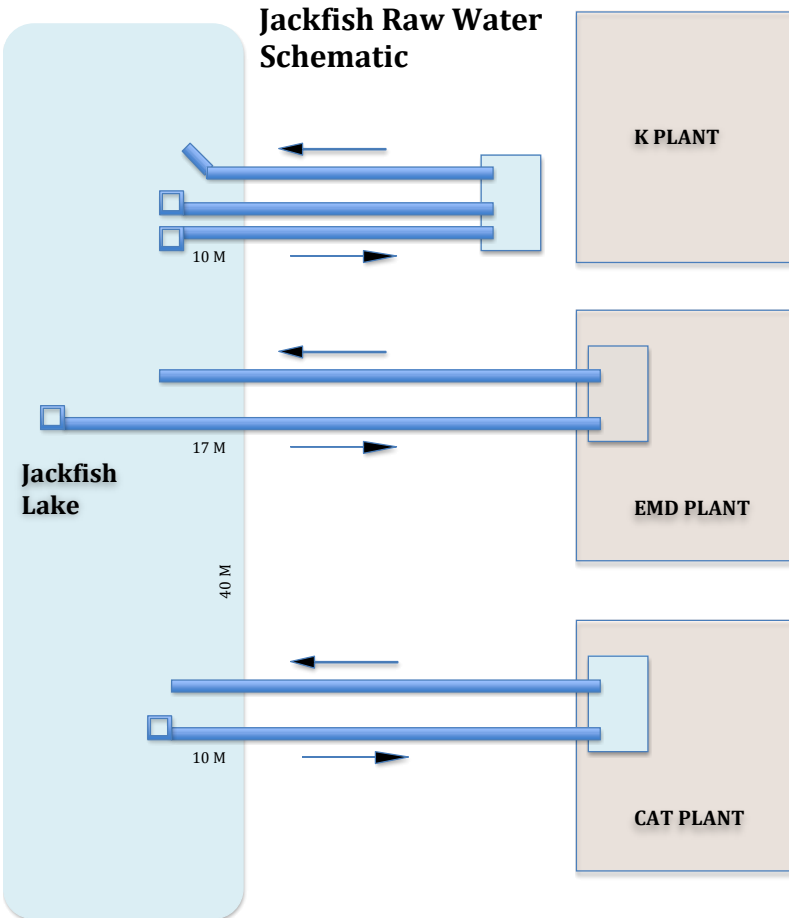


Figure 6: Jackfish Raw Water Schematic

2.5.1 K-Plant Raw Water System

2.5.1.1 Description

The K-Plant raw water system consists of two screened unpressurized intake pipes that allow water from Jackfish Lake to flow into a large covered well enclosed in a pumphouse building (Figure 7, Photo 2). Water can be pumped from the well by any combination of four vertical 2-stage pumps, 2-50 horsepower (HP) and 2-20HP, to the K-Plant powerhouse. In the Powerhouse the raw water flows through sheet and tube heat exchangers for distinct (isolated) Jacket Water, Oil, Fuel, and Turbocharger Air systems. The raw water returns to Jackfish Lake via a common gravity pipe.

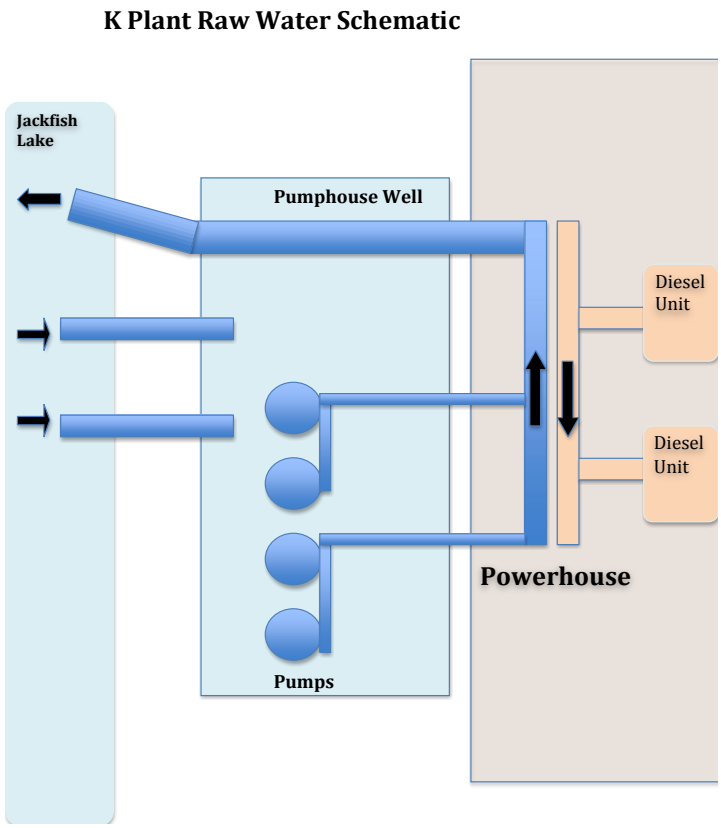


Figure 7: K-Plant Raw Water Schematic

Photo 2: K-Plant Raw Water Pumphouse

2.5.1.2 Normal Operation

The K-Plant raw water system was designed and constructed to supply cooling water to 2 KV-16 Major Generating units. In recent years one unit has been taken out of service so the system is currently overbuilt. Two pumps are normally running continuously to keep the supply and return pipes from freezing in the winter. In summer one pump is running continuously to allow for prompt unit startup in outage conditions. Jacket Water, Oil, and Fuel are not pumped through the heat exchangers (Photo 3) unless the corresponding pumps are manually turned on, generally upon unit startup.

Photo 3: K-Plant Sheet and Tube Oil Heat Exchanger

2.5.2 EMD Plant Raw Water System

2.5.2.1 Description

Unlike the K-Plant the EMD Plant raw water system draws water directly from the lake via a screened and valved, 12-inch intake pipe (Figure 8). From the intake pipe three 30-HP horizontal pumps are installed in parallel to a 12-inch outlet manifold (Photo 4). This system is located in a dry sump below the powerhouse floor. The outlet manifold rises and extends the length of the powerhouse where it is circulated through the main heat exchangers of each of the four generating units. The EMDs are self-contained beyond this heat exchanger so there are no additional heat exchangers on the raw water system. The raw water returns to Jackfish Lake via a common gravity pipe.

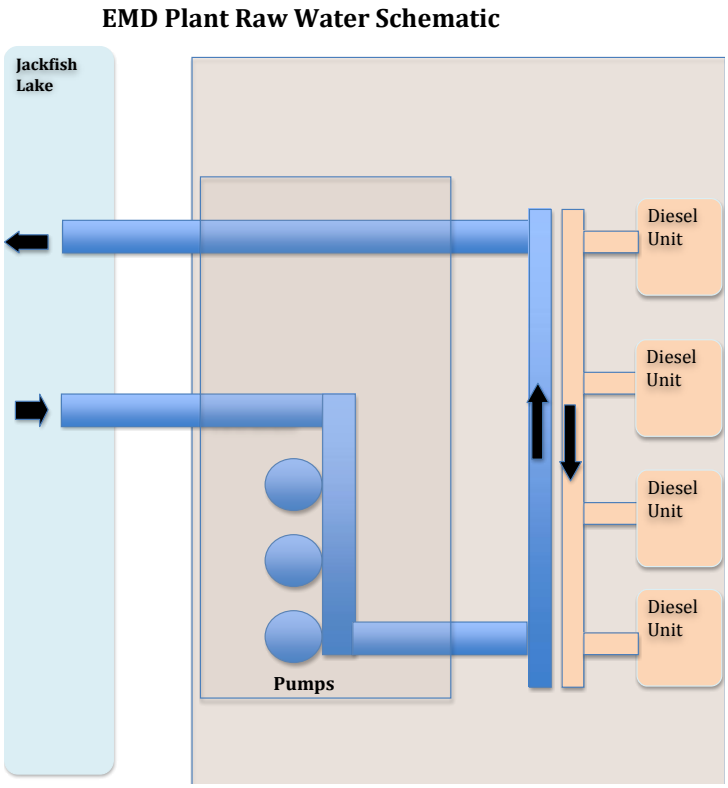


Figure 8: EMD Plant Raw Water Schematic

Photo 4: EMD Plant Raw Water Pumps

2.5.2.2 Normal Operation

For the EMD Plant two raw water pumps are normally running continuously in order to keep the supply and return pipes from freezing in the winter. In summer one pump is running continuously to allow for prompt unit startup in outage conditions. A second pump is started if additional cooling is needed. The third pump is for maintenance of the other pumps.

2.5.3 CAT Plant Raw Water System

2.5.3.1 Description

The CAT Plant has a well system similar to the K-Plant but has the well located inside the powerhouse (Figure 9). The well has a screened 12- inch pipe from Jackfish Lake to the well that can be isolated. There are two 7.5HP and one 15HP single stage horizontal pumps connected to a 12-inch supply manifold (Photo 5). The supply manifold extends across the plant where the two units connect with the respective Jacket Water, Oil, Fuel and Turbocharger heat exchangers. Jacket Water, Oil, and Fuel are not pumped through the heat exchangers unless the corresponding pumps are automatically turned on by the PLC for each unit.

The raw water returns to Jackfish Lake via a 10-inch common gravity pipe.

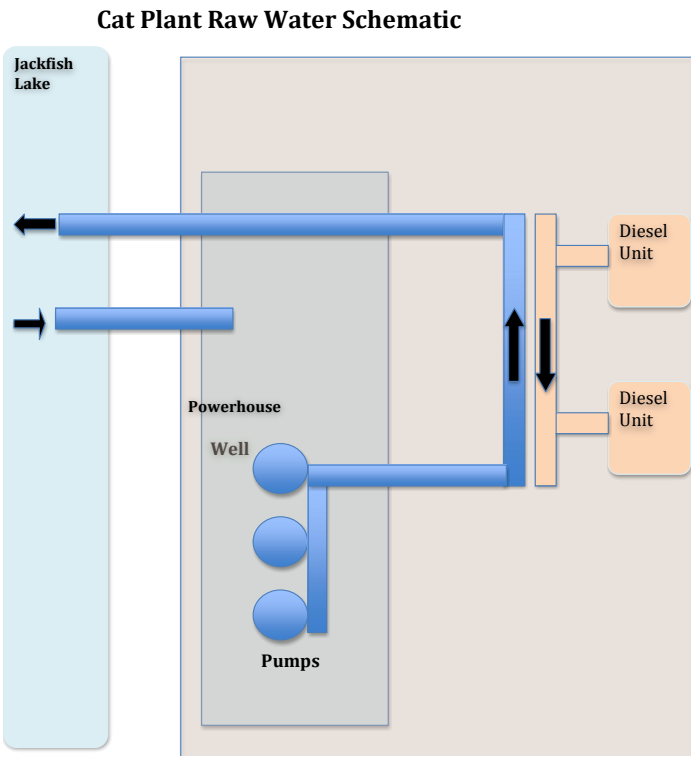


Figure 9: Cat Plant Raw Water Schematic

Photo 5: CAT Plant Raw Water Pumps

2.5.3.2 Normal Operation

The CAT Plant has one raw water pump continuously running to keep the supply and return pipes from freezing in the winter. In summer one pump is running continuously to allow for prompt unit startup in outage conditions. The second pump is automatically started if needed for cooling purposes when both units are running. The third pump is for maintenance of the other pumps

2.6 OTHER SYSTEMS

2.6.1 Heat Recovery System

There are Plate Type Heat Exchangers that capture waste heat off the Jacket Water of the KV-16 Unit 1, EMD Units 5 and 8, and CAT Unit 15 (Photo 6). This system is used as needed to heat the other Diesel Plants as well as the Administration Building and Warehouse.

Photo 6: K-Plant Plate Heat Exchanger

2.6.2 Sumps

The K-Plant drains to a sump that has a level alarm and is manually pumped out through an oil/water separator if needed.

The EMD Plant has a lower sump within the raw water pump sump that has a level alarm with an oil/water separator installed in the discharge line (Photo 7). Discharge to a surface container is manual only.

Photo 7: EMD Plant Sump

The CAT Plant drains through an oil/water separator to a water sump that is pumped out through a manual operation.

The sumps within the plants are visually monitored for level as part of standard inspections. When they reach a level that requires discharge they are pumped out through an oil/water separator into a Vacuum Truck and taken to the City of Yellowknife Water Treatment Plant.

No sump water is discharged into the environment.

3 MAINTENANCE

3.1 MAINTENANCE RESPONSIBILITIES

The Electrical Services Manager and Mechanical Service Manager are responsible for the planning and implementation of maintenance. Maintenance of the diesel generating units is planned in coordination with plant and system operation, These Managers report to the Hydro Operations Director. The Plant Operators, Electricians, Mechanics, Millwrights and contractors, depending on the work to be done, perform the maintenance on these facilities. The Maintenance staff are knowledgeable in all facets of power generation, and beyond servicing the Jackfish Facility, supply crucial support to Snare Hydro, Bluefish Hydro, and isolated North Slave communities of Behchokǫ̀, Whatì, Gamètì, and Lutsel K'e. Staff also maintain vehicles, heavy equipment, and the Transmission and Distribution system.

3.2 MAINTENANCE PROGRAMS

The diesel generating units have extensive maintenance programs for both electrical and mechanical components predominantly based on engine hours using a Computerized Maintenance Management System. The Mirrlees, EMD and Caterpillar engines have both common and unique specialized tools, overhaul schedules, and required skillsets. In addition, there are regular inspections and maintenance performed on plant auxiliaries, heating systems including waste heat, structures, and the many critical substations throughout the system.

4 SURVEILLANCE

4.1 PLANT CHECKS

When the Jackfish Facility and respective plants are in standby operation mode there is a daily visual check by a Plant Operator throughout the plants and grounds for proper operation and abnormalities (Appendix A). Any incidents are documented in the Incident Report (Appendix B).

4.2 HOURLY READINGS

When a diesel unit is in operation, logs sheets are completed hourly by the plant operator (Appendix C). They are specific to a particular unit and, among other details, record the temperature and pressure of the Raw Water System as well as the Jacket Water, Fuel, Oil, and Turbocharger cooling systems (Photo 8). Discrepancies observed are noted and may result in communication to maintenance department or the unit being taken through a controlled shutdown and replaced with alternative generation.

Photo 8: Raw Water Pressure and Temperature Gauges

4.3 WILDLIFE

The Jackfish Facility is surrounded by municipal and industrial developments. As illustrated in Figure 2, the Jackfish Facility is bound by the Yellowknife municipal landfill, Giant Mine, Highway 3, Highway 4, the Yellowknife Airport, the Niven Lake housing development, and Yellowknife city centre. As such, the potential for impacts to wildlife is limited. Continual operation of the Jackfish Facility for over 40 years have confirmed this.

Species at Risk

Species at risk that may interact with the Jackfish Facility (i.e., species with overlapping range that may venture into city limits) include bank swallow, barn swallow, Harris' sparrow, horned grebe, olive-sided flycatcher, rusty blackbird and short-eared owl. No mammal, plant, fish or insect species are anticipated. The most likely impact to these species at risk will be disturbance of nests if they attempt to nest on Jackfish Facility structures. These species are small enough that mortality through electrocution (caused by simultaneous contact with charged and grounded electrical current) is not anticipated.

Potential Wildlife Impacts

Potential impacts to wildlife and wildlife habitat from developments include:

- direct habitat loss
- indirect habitat loss
- wildlife mortality or injury

Direct habitat loss refers to the disturbance and immediate loss of wildlife habitat within the Project physical footprint, for example from new infrastructure. As the Jackfish Facility is contained within a fence and is surrounded by other infrastructure and disturbances, further direct habitat loss due to Jackfish Facility operations is not anticipated.

Indirect habitat loss describes changes to wildlife movement and behavior due to Project activities (such as the noise from landing aircraft, operation of drilling equipment, odours or human presence). Indirect habitat loss can occur even where vegetation and other habitat features remain intact. These changes are typically negative, causing wildlife avoidance, but can also be positive for some species that are attracted to camps. As the Jackfish Facility is contained within a fence, and as it is surrounded by other infrastructure and disturbances, and most activity is contained within a fence or enclosed buildings, further indirect habitat loss is not anticipated.

Wildlife mortality or injury can result from accidents caused during deterrent or removal of problem wildlife to protect worker safety. Considering the physical hazards, possible presence of food attractants, and electrical infrastructure at Jackfish Facility, wildlife injury or mortality is possible and has occurred. This category includes disturbance or destruction of nests, which may occur when birds nest on structures within the Jackfish Facility.

The anticipated impacts to wildlife, and the associated mitigation implemented for each is outlined in Table 4.

Table 4: Mitigation for Anticipated Impacts to Wildlife

Potential Impact	Mitigation	Monitoring
Contamination of terrestrial environment from spills	Spill Contingency Plan outlines mitigation and procedures to reduce risk of spills, and actions to follow in the event of a spill	Daily Safety Inspection (Appendix A) Prevent and respond to all spills as per the Spill Contingency Plan
Attractants from office waste	Food scraps and other household waste from the Administration Building are stored	Daily Safety Inspection

	inside and in wildlife-proof containers when outside	Feeding of wildlife is prohibited Implement the Waste Management Plan
Electrocution of birds from sub-station	Sonic bird scare devices (Phoenix Wailer MkIII, supplemented by Bird-X UltrasonX and Bird-X Super BirdXPeller Pro) Spikes? Other physical deterrents or barriers?	Daily Safety Inspection Isolate electrical hazards where possible
Greenhouse gas and particulate emissions	Diesel generation is an expensive alternative to hydro, and engaged only when there is instantaneous loss of hydro power, shortage of hydro generating capacity, or diminished hydro supply.	Diesel use is documented
Physical hazards	Chain-link fence surrounds the Sub Station Gated entrance to the facilities	Daily Safety Inspection

5 REPORTING

5.1 MONTHLY READINGS AND ANNUAL REPORTING

Every month the hour meters are read and recorded for each raw water pump. The number of hours operated multiplied by the flow capacity of the pump results in the amount of water pumped through the raw water system. The water usage for the pumps and cooling systems is reported to the Mackenzie Valley Land and Water Board in quarterly reports and an annual report all of which are available on the online registry (https://mvlwb.com/registry).

5.2 WILDLIFE REPORTING

Results from the daily check of plant and grounds will be documented…
Wildlife incidents refer to a range of possible occurrences at the Project, including:

- human-wildlife interactions that present a risk to either people or animals
- wildlife-caused damage to property or delay in operations
- wildlife deterrent actions
- wildlife injury or mortality
- wildlife found dead, even if from natural causes
- birds nesting on Project infrastructure or equipment

All incidents will be documented using the Incident Report form (Appendix X), and will be reported immediately to the Government of the Northwest Territories Department of Environment and Natural Resources at 867-873-7181.

6 CONTACT NUMBERS

Plant Operator/ System Operator shall report to:	
Manager, Plant Operations- Robert Sunderland	867-669-3338 (O)
	(H)
	867-445-1841 (cell)
Manager, Electrical Services- Robert Burgin	867-669-3308 (O)
	867-766-3328 (H)
	867-444-8424 (cell)
Manager, Mechanical Services- Sergio Catlyn	867-669-3326 (O)
	867-766-3541 (H)
	867-445-3389 (cell)
Director, Hydro Division- Colin Steed	867-669-3326 (O)
	867-920-4574 (H)
	867-446-4712 (cell)
Manager, System Control	867-669-3347 (O)

	(H)
	867-445-6515 (cell)
Director shall report to:	
President & CEO	867-874-5245 (O)
	(H)
	780-719-0612 (cell)
Manager, Corp. Health, Safety & Envi. – Ed Smith	867-874-5327 (O)
	867-874-2491 (H)
	867-875-7737 (cell)
Local Agencies (Yellowknife):	
Fire or Emergency	867-873-2222
Ambulance	867-873-2222
Hospital	867-669-4111
RCMP	867-669-1111
City of Yellowknife	867-920-5600

Appendix A Safety Inspection Form

Inspection Details	
Location:	Plant:
Inspected by:	Date:

#	Inspection Item	Y	N	NA	Notes
1.0	**Housekeeping**				
1.1	Are all buildings clean & organized inside?				
1.2	Are all walkways and doorways clear and free of debris?				
1.3	Is the yard clean & organized with no vegetation control required?				
1.4	Is the transformer storage platform solid and well-organized?				
1.5	Is the pole storage rack solid and well-organized?				
1.6	Are garbage cans fire resistant with self-closing lids? Emptied at the end of each day?				
1.7	Are all spills and leaks cleaned up?				
1.8	Are floors clean and tidy and free of slippery substances (e.g., water, oil, grease)?				
1.9	Are floors level and well maintained with no projecting surfaces and no tripping hazards?				
1.10	Are windows clean, both inside and outside, and kept obstruction free?				
2.0	**Storage**				
2.1	Are tools and materials properly stored in racks, shelves, and bins wherever possible?				
2.2	Are commonly used and heavy items stored between mid-thigh and shoulder height?				
2.3	Are floors around racks, shelves, pallets, etc. clear?				
2.4	Are racks, shelves, pallets, etc. kept in good condition?				
2.5	Are storage areas safe from falling objects?				

#	Inspection Item	Y	N	NA	Notes
2.6	Are storage racks, shelves, etc. free of sharp edges?				
2.7	Is there a safe means of accessing high shelves?				
3.0	**Tools & Equipment**				
3.1	Are tools & equipment maintained in good condition, clean, suitable for intended use?				
3.2	Are all necessary machine guards in place?				
3.3	Are spill pads, drip trays, and crankcase vent containers emptied or replaced as required?				
3.4	Are batteries free of leaks with terminals clean and protective covers in place?				
3.5	Are line & electrical tools available, properly stored, certified, and in good condition?				
3.6	Is rigging & lifting equipment available, properly stored, certified, in good condition?				
3.7	Are compressed gas cylinders undamaged, stored upright, and secured?				
3.8	Are pipes leak-free, colour coded, and properly painted?				
4.0	**Personal Protective Equipment (PPE)**				
4.1	Is all PPE available onsite (hard hats, safety glasses, rubber gloves, earing protection)?				
4.2	Is all PPE properly stored?				
4.3	Is all PPE clean?				
4.4	Is all PPE in good condition?				
4.5	Is all PPE correctly used?				
5.0	**Emergency Equipment**				
5.1	Is the Emergency Response Plan available onsite and current?				
5.2	Is the Spill Response Plan available onsite and current?				
5.3	Is the Hazardous Waste Management Plan available onsite and current?				

#	Inspection Item	Y	N	NA	Notes
5.4	Are the NWT Safety Act & NWT Occupational Health & Safety Regulations available onsite?				
5.5	Are emergency phone numbers posted and up-to-date?				
5.6	Are emergency lights functional for a 30 second test?				
5.7	Are eyewash stations available and functional with the solution changed every 6 months?				
5.8	Are fire extinguishers available, charged, and inspected monthly?				
5.9	Are fire extinguishers secured on the wall and not free standing?				
5.10	Is access to fire extinguishers free and unobstructed?				
5.11	Are 1st aid kits available, inspected monthly fully stocked? Outdated items replaced?				
5.12	Are exits clearly marked with functional exit signs?				
5.13	Are exits functional and free from obstructions?				
6.0	**Chemicals**				
6.1	Are Safety Data Sheets (SDS) available and up-to-date within the last 3 years?				
6.2	Are all chemicals properly labelled and stored in proper containers (as per WHMIS)?				
6.3	Are all flammable products stored in proper containers and kept in a flammable cabinet?				
6.4	Are unused or unnecessary substances disposed of in a safe manner?				
6.5	Are all chemical containers and drums leak free?				
7.0	**Building**				
7.1	Are buildings in good condition on the inside with no repairs required?				
7.2	Are buildings in good condition on the outside with no repairs required?				
7.3	Are floors level and well maintained with no projecting surfaces and no tripping hazards?				

#	Inspection Item	Y	N	NA	Notes
7.4	Are windows clean, both inside and outside, and kept obstruction free?				
7.5	Is ventilation equipment clean, obstruction free, well maintained, and fully functional?				
7.6	Is the air temperature comfortable?				
7.7	Are all inside & outside lights functional?				
7.8	Do existing lights provide adequate lighting?				
7.9	Are all necessary warning signs in place with no new or additional signs required?				
7.10	Are all signs and notices in good condition?				
7.11	Are employee facilities (e.g., washrooms, lockers, crew trailers) clean, tidy, maintained, and adequate?				
8.0	**Security**				
8.1	Are all fences in good condition with barbwire intact?				
8.2	Are all gates and doors kept locked when unattended?				
8.3	Are all doors and locks in working order?				
9.0	**Electrical**				
9.1	Are ground connections present and in good working condition?				
9.2	Are electrical boxes & breakers properly covered?				
9.3	Are all electrical plugs and switches in good condition?				
9.4	Are all electrical cords in good condition?				
9.5	Are all power tools in good condition?				
9.6	Is all temporary wiring properly routed?				

#	Inspection Item	Y	N	NA	Notes
10.0	**Work Protection**				
10.1	Are sufficient Work Protection tags and forms available onsite?				
10.2	Is the Work Protection Log book available and up-to-date?				
10.3	Are all Single Line Diagrams posted and up-to-date?				
11.0	**Hazardous Waste Storage Area**				
11.1	Are all wastes properly separated to ensure no mixing of wastes?				
11.2	Are all waste storage containers in good condition with lids securely in place, no leaks?				
11.3	Are all waste containers labelled clearly and accurately?				
11.4	Are spill response materials available onsite (e.g., spill kits, sorbents, hand tools, PPE)?				
11.5	Are all sources of ignition kept away from the waste storage area?				
11.6	Is a fire extinguisher kept close to the waste storage area? Inspected monthly and charged?				
11.7	Does the storage area have proper drainage to prevent leaks or spills from leaving the site?				
11.8	Is the *Waste Accumulation Log* up-to-date?				
11.9	Is the *Waste Storage Inventory Log* up-to-date?				

Provide completed form to manager.

Corrective Actions (to be assigned by manager and followed up until completed)		
Manager:	Signature:	Date:

#	Corrective Action	CMMS #	Resp. Party	Due Date	Completed
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
12					
13					

Appendix B Incident Report Form

Sections A-E to be completed by worker.

Section A – Incident Details			
Date & time of incident:	Date: Time:	Date & time reported:	Date: Time:
Reported by:	Name: Position:	Reported to Manager:	Name: Position:
Incident location:			
Incident description (attach sketch if necessary):			

Section B – Type of Incident		
☐ Injury/Illness ☐ Rules/Procedures	☐ Property Damage ☐ Environmental	☐ Production Loss ☐ Near Miss

Section C – Injury			
Injured party:	Name: Position:	Phone: Email:	☐ NTPC employee ☐ Contractor ☐ Member of the public
Address:			First aid provided: ☐Y ☐N Medical treatment provided: ☐Y ☐N
Description of injury:			

Section D – Property/Environmental Damage	
Description of damage:	

Section E – Incident Ranking (Reasonable Potential for Harm)		
☐ Low (potential First Aid Injury, minor property/environmental damage or production loss)	☐ Medium (potential Medical Treatment Injury, medium property/environmental damage or production loss)	☐ High (potential Serious Injury or Fatality, major property/environmental damage or production loss)

Send completed form to your manager and to the HSE Director by email or fax (1-888-458-4627).

Sections F- I to be completed by manager.

Section F – Incident Ranking (Reasonable Potential for Harm)		
☐ Low (potential First Aid Injury, minor property/environmental damage or production loss)	☐ Medium (potential Medical Treatment Injury, medium property/environmental damage or production loss)	☐ High (potential Serious Injury or Fatality, major property/environmental damage or production loss)

Section G – Immediate Actions Taken

Hierarchy of Controls: 1) Elimination 2) Substitution 3) Engineering 4) Administration 5) PPE

Action	Responsible Party	Date Completed

Section H – Further Corrective Actions

	Action	Responsible Party	Due Date	* Date Completed
1				
2				
3				
4				
5				
6				

Section I – Management Review

Name:	Position:	Review date:
Comments:		

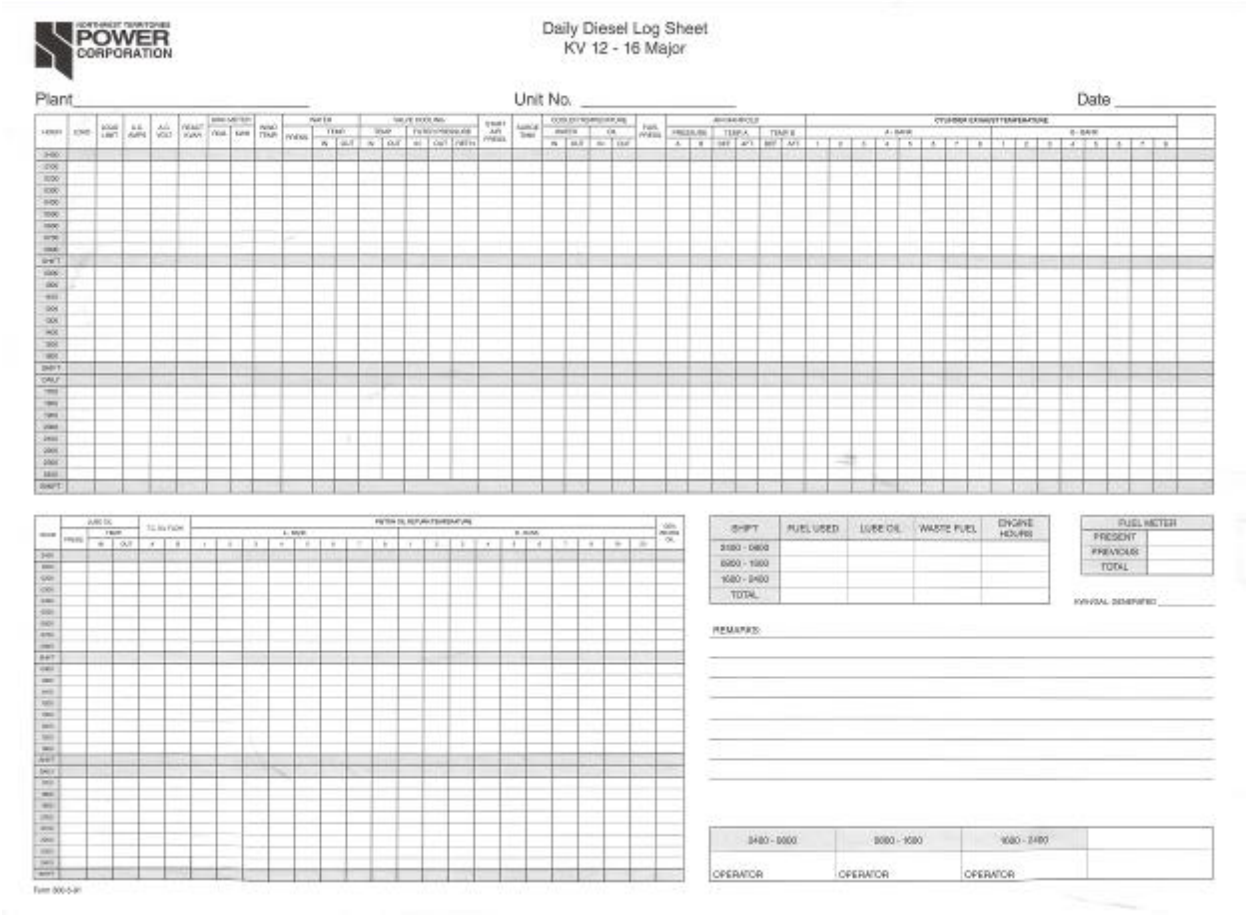
Section J – Health & Safety Department Review

Name:	Position:	Review date:
Comments:		

* Inform HSE Director of corrective action completion dates.

Appendix C Log Sheets

KV-16 Daily Log Sheet



POWER CORPORATION

Daily Diesel Log Sheet
KV 12 - 16 Major

Plant _____ Unit No. _____ Date _____

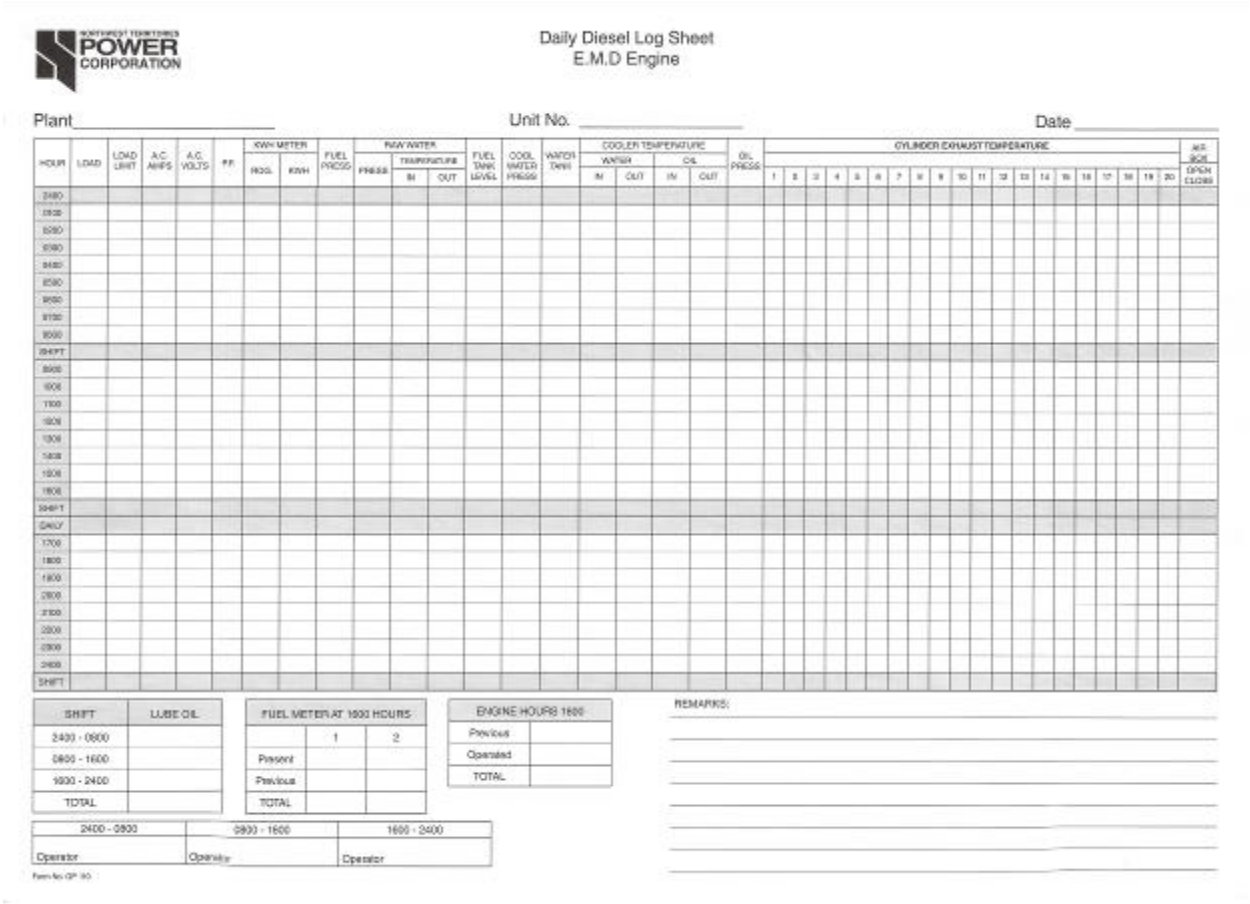
SHIFT	FUEL USED	LUBE OIL	WASTE FUEL	ENGINE HOURS
0000 - 0800				
0800 - 1600				
1600 - 2400				
TOTAL				

FUEL METER	
PRESENT	
PREVIOUS	
TOTAL	

REMARKS:

2400 - 0800	0800 - 1600	1600 - 2400	
OPERATOR	OPERATOR	OPERATOR	

EMD Daily Log sheet



NORTHWEST TERRITORIES POWER CORPORATION

Daily Diesel Log Sheet
E.M.D Engine

Plant_____ Unit No. _____ Date _____

HOUR	LOAD	LOAD LIMIT	A.C. AMPS	A.C. VOLTS	P.F.	KWH METER		FUEL PRESS	RAW WATER		FUEL TANK LEVEL	COOL WATER PRESS	WATER TANK	COOLER TEMPERATURE				OIL PRESS	CYLINDER EXHAUST TEMPERATURE																AIR BOX
						REG.	KWH		PRESS	TEMPERATURE IN	TEMPERATURE OUT			WATER IN	WATER OUT	OIL IN	OIL OUT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	OPEN CLOSED
2400																																			
0100																																			
0200																																			
0300																																			
0400																																			
0500																																			
0600																																			
0700																																			
SHIFT																																			
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1900																																			
2000																																			
2100																																			
2200																																			
2300																																			
2400																																			
SHIFT																																			

SHIFT	LUBE OIL
2400 - 0800	
0800 - 1600	
1600 - 2400	
TOTAL	

FUEL METER AT 1600 HOURS	1	2
Present		
Previous		
TOTAL		

ENGINE HOURS 1600	
Previous	
Operated	
TOTAL	

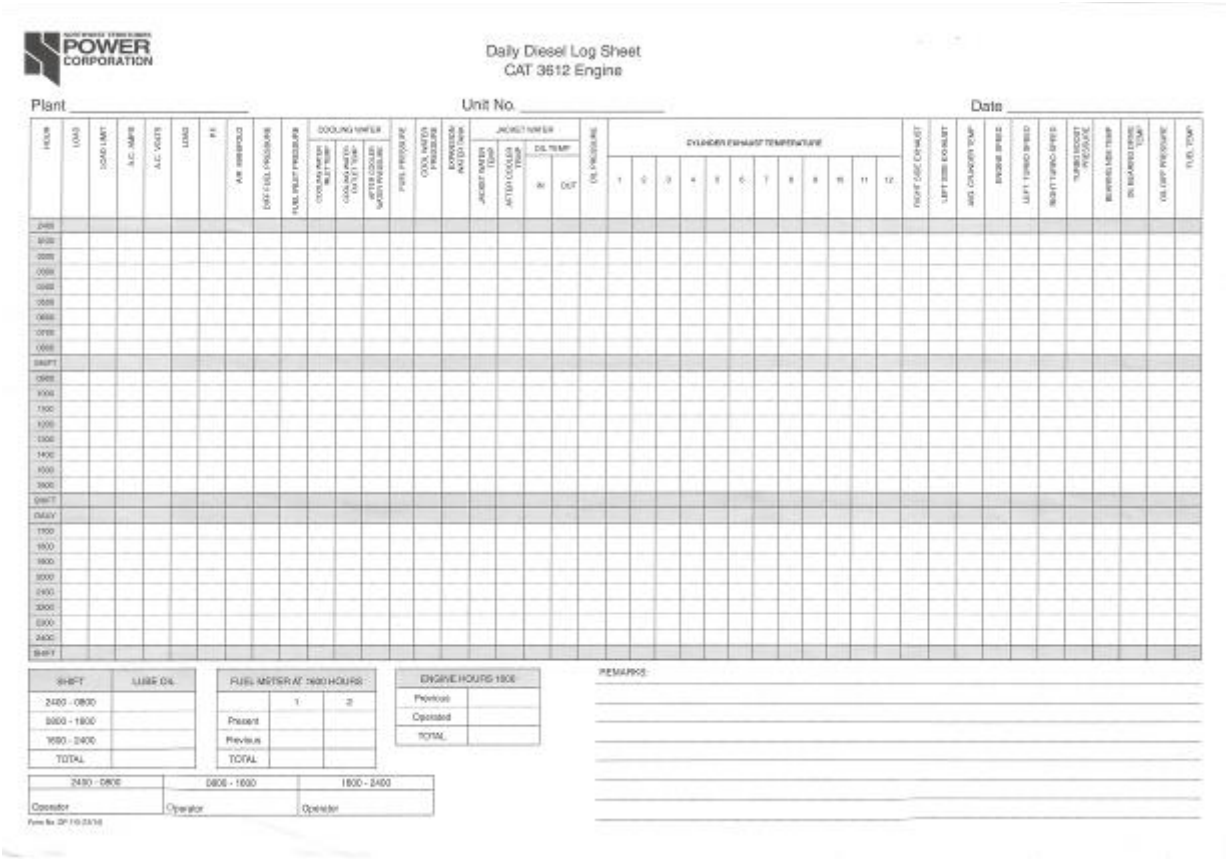
REMARKS:

2400 - 0800	0800 - 1600	1600 - 2400
Operator	Operator	Operator

Form No. OP 90

NORTHWEST TERRITORIES POWER CORPORATION
Empowering Communities

CAT Daily Log Sheet



POWER CORPORATION

Daily Diesel Log Sheet
CAT 3612 Engine

Plant _____ Unit No. _____ Date _____

HOUR	LOAD	LOAD LIMIT	A.C. AMPS	A.C. VOLTS	LOAD	PF	AIR INLET PRESS	DIFF FUEL PRESSURE	FUEL RELIEF PRESSURE	COOLING WATER: CONTROL PUMP OUTLET PRESS	COOLING WATER: CONTROL PUMP OUTLET TEMP	COOLING WATER: AFTER COOLER WATER PRESSURE	FWPL PRESSURE	COOL WATER PRESSURE	EXPANSION WATER TANK	JACKET WATER: JACKET WATER TEMP	JACKET WATER: AFTER COOLER TEMP	OIL TEMP: IN	OIL TEMP: OUT	OIL PRESSURE	CYLINDER EXHAUST TEMPERATURE: 1	2	3	4	5	6	7	8	9	11	12	RIGHT SIDE EXHAUST	LEFT SIDE EXHAUST	AIR CHARGER TEMP	ENGINE SPEED	LEFT TURBO SPEED	RIGHT TURBO SPEED	TURBO BOOST PRESSURE	BEARING MAIN TEMP	OIL BEARING STRIP TEMP	OIL DIFF PRESSURE	FUEL TEMP
2400																																							
0100																																							
0200																																							
0300																																							
0400																																							
0500																																							
0600																																							
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2400																																							
SHIFT																																							

SHIFT	LUBE OIL
2400 - 0800	
0800 - 1600	
1600 - 2400	
TOTAL	

FUEL METER AT 2400 HOURS	1	2
Present		
Previous		
TOTAL		

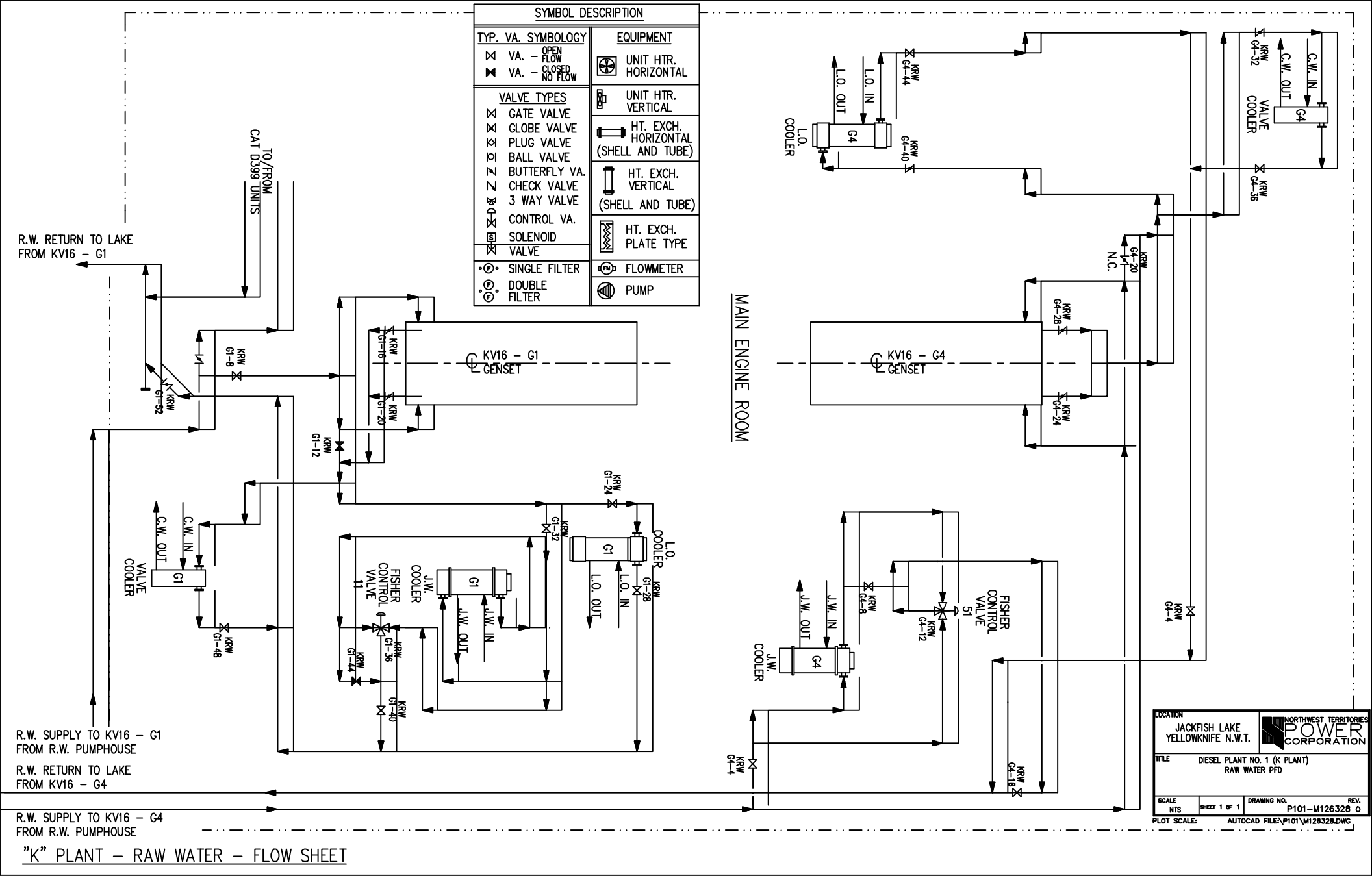
ENGINE HOURS 1800	
Previous	
Operated	
TOTAL	

REMARKS

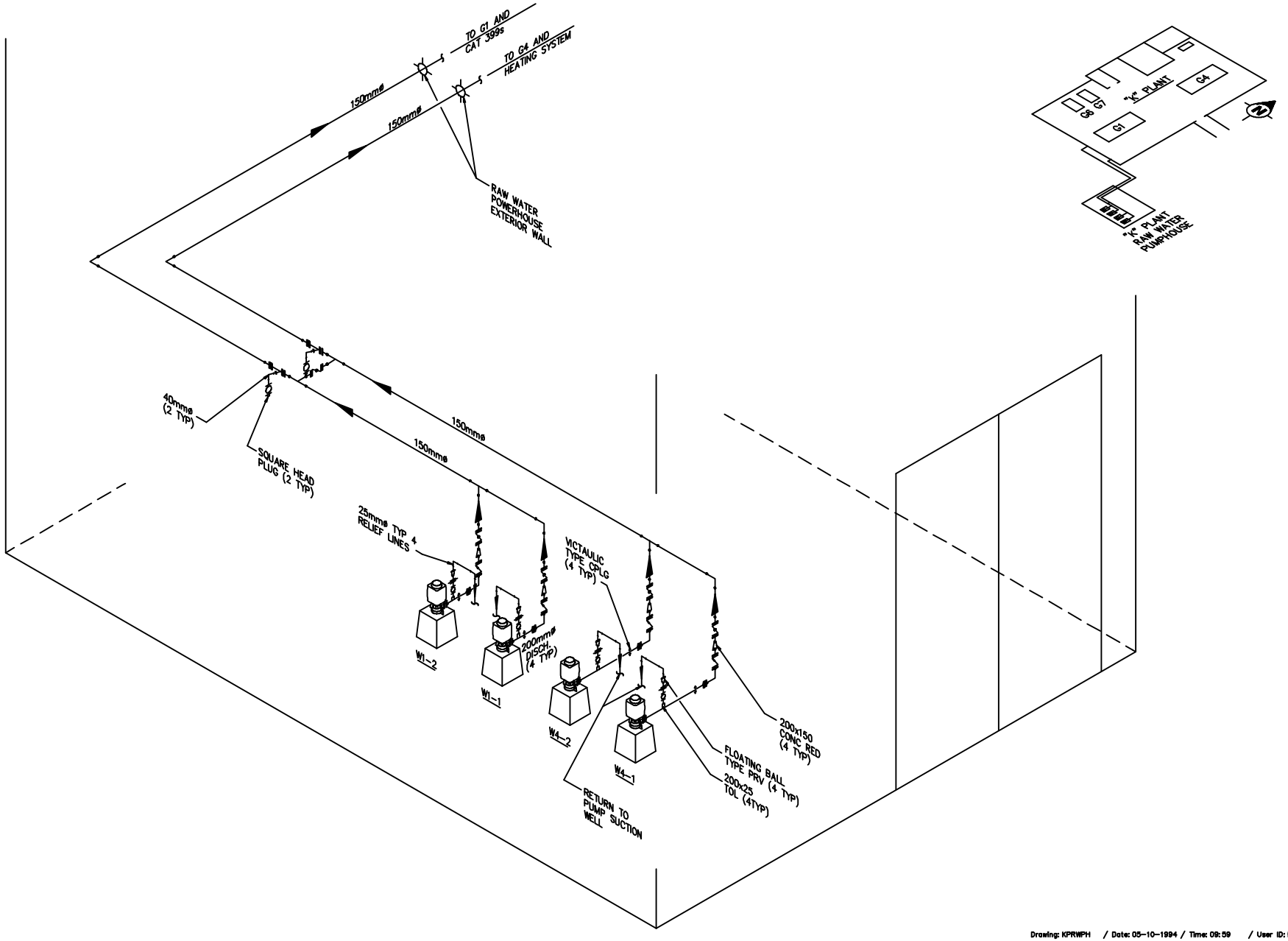
2400 - 0800	0800 - 1600	1600 - 2400
Operator	Operator	Operator

NORTHWEST TERRITORIES POWER CORPORATION
Empowering Communities

Appendix D Cooling System Drawings



"K" PLANT – RAW WATER – FLOW SHEET



Drawing: KPRWPH / Date: 05-10-1994 / Time: 09:59 / User ID: RL

DRAWING NO.	TITLE	0	ORIGINAL																
REFERENCE DRAWINGS		REVISION LETTER	REVISION	WORK ORDER	NAME	DATE	CHECKED BY	DESIGNED BY	CIVIL	MECH	ELEC	T & D	P & C	STATUS OF DRAWING	DATE	SCALE	SHEET	OF	DRAWING NO.	REV.
				525/94	RLAYCOCK	MAY.8/94			APPROVED FOR CONSTRUCTION BY							NTS	1		P101-M126325	0

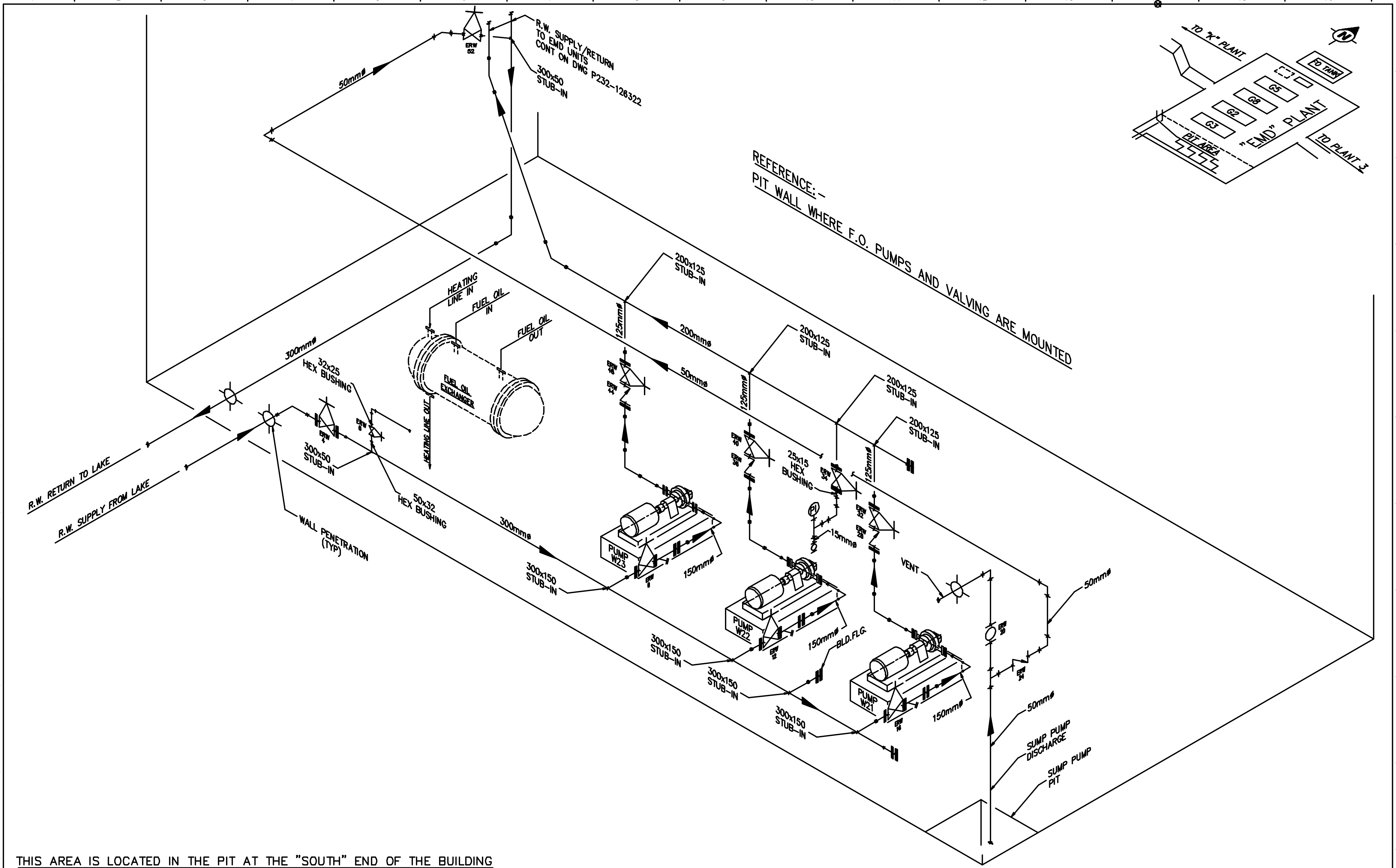
LOCATION
JACKFISH LAKE
YELLOWKNIFE N.W.T.

NORTHWEST TERRITORIES POWER CORPORATION

PLANT 01

TITLE
"K" PLANT
RAW WATER SYSTEM
RAW WATER PUMP HOUSE
SYSTEM ISOMETRIC

AUTOCAD FILE: \P101\M126325.DWG PLOT SCALE: 1:1



THIS AREA IS LOCATED IN THE PIT AT THE "SOUTH" END OF THE BUILDING

DRAWING NO.	TITLE	REVISION LETTER	REVISION	WORK ORDER	NAME (DRAWN BY)	DATE (DRAWN BY)	CHECKED BY	DESIGNED BY	CIVIL	MECH	ELEC	T & D	P & C	STATUS OF DRAWING	DATE
		B	VALVE NUMBERS REVISED		R.L.	12/00								AS BUILT 2000	12/00
P232 – 126322	R.W. DISCH. TO EMD UNITS	A	AS BUILT AS PER FIELD INFO PROVIDED	901-6310	F.L.	04/97	S.E.S.								
		0	ORIGINAL	525-94	R.LAYCOCK	MAY.31/94									

REFERENCE DRAWINGS — APPROVED FOR CONSTRUCTION BY

LOCATION: JACKFISH LAKE YELLOWKNIFE N.W.T.

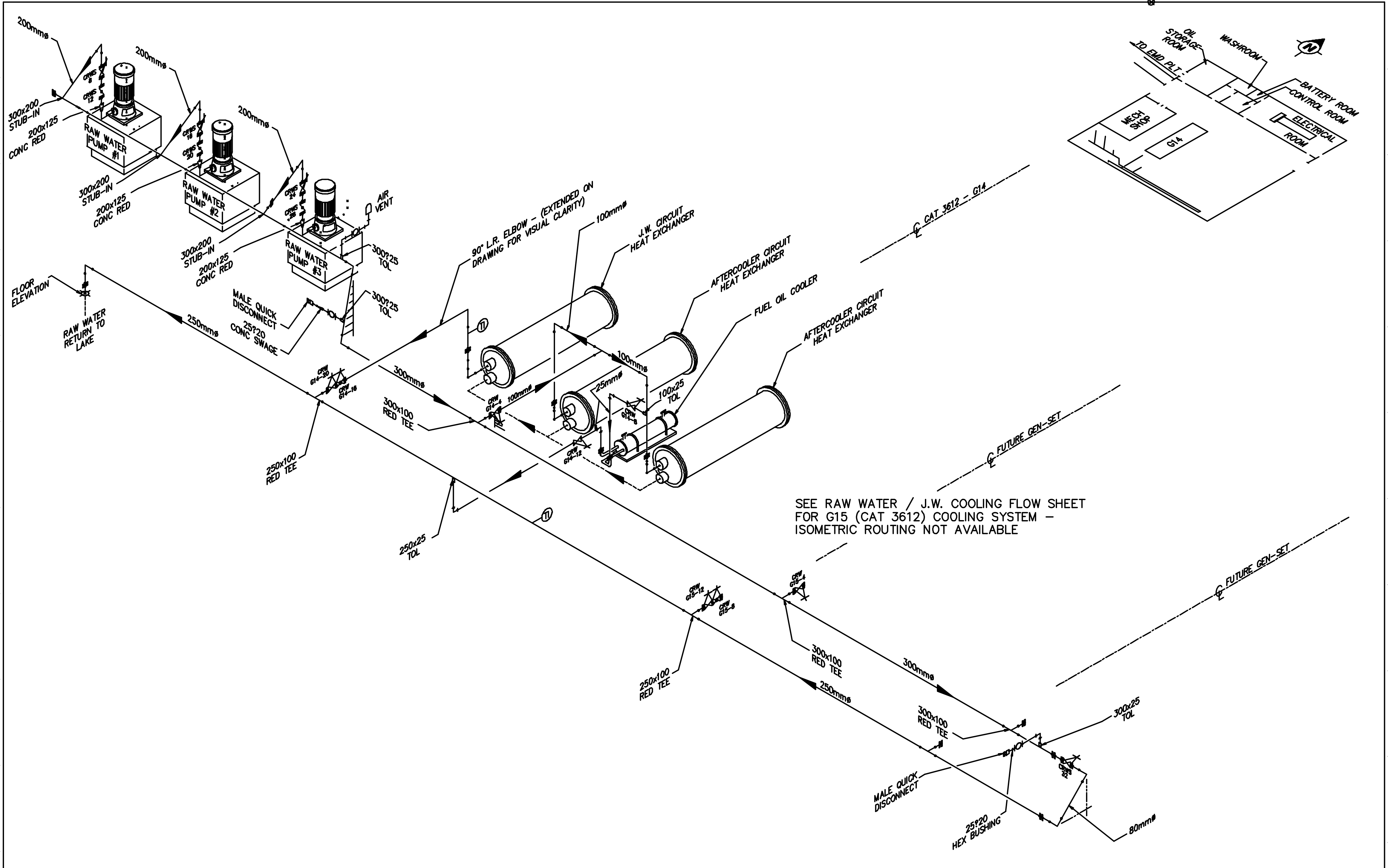
PLANT:

NORTHWEST TERRITORIES POWER CORPORATION

TITLE: 1974 DIESEL PLANT (EMD)
RAW WATER SYSTEM
PUMP SUCTION AND DISCHARGE PIPE ROUTING
SYSTEM ISOMETRIC

SCALE: NTS | SHEET 1 OF 1 | DRAWING NO. P232 – 126323 | REV. B

AUTOCAD FILE: P232/126323 PLOT SCALE: 1:1



		B	VALVE NUMBERS REVISED		R.L.	12/00				AS BUILT 2000	12/00
		A	AS BUILT AS PER FIELD INFO PROVIDED	901-6310	F.L.	04/97	S.E.S.				
DRAWING NO.	TITLE	0	ORIGINAL	525-94	R.LAYCOCK	JUNE.20/94					
REFERENCE DRAWINGS		REVISION LETTER	REVISION	WORK ORDER	NAME	DATE	CHECKED BY	DESIGNED BY	CIVIL / MECH / ELEC / T & D / P & C — APPROVED FOR CONSTRUCTION BY	STATUS OF DRAWING	DATE

LOCATION	JACKFISH LAKE YELLOWKNIFE N.W.T.
	NORTHWEST TERRITORIES POWER CORPORATION
PLANT	
TITLE	DIESEL PLANT #3 RAW WATER SYSTEM PUMPING AND DISTRIBUTION ROUTING SYSTEM ISOMETRIC
SCALE	NTS
SHEET	1 OF 1
DRAWING NO.	P231 – 126323
REV.	B

AUTOCAD FILE: P231/126323 PLOT SCALE: 1:1