JOB DEMANDS ANALYSIS

Company: City of Burnaby **Location:** Works Yard

Job Title: Labourer – Water Works Construction **Classification:** Regular Duty

Purpose of Activities

The Labourer is responsible for water main and hydrant installation and repair; service connection, transfers and repairs and ensuring the work site is kept clean and hazard free.

Tools and Equipment

The Labourer will use the following tools and equipment to perform his duties:

1. One-ton Gruman van
2. Hand tools – shovels,(square and round mouth), pry bars, pipe wrenches, wrenches, brooms, bench vise, hand saw, rakes, pipe cutters, hammers, buckets, sledge hammer
3. Power tools – jackhammer (41-kg), pumps (two man lift), electric grinder, power saw, cad welder
4. Valve keys, tapping machine (30-kg)
5. PVC, plastic and or Asbestos Clay, cast iron pipe (15 – 61 cm, six-24 inch), Elbows, T's, fittings, gaskets, hydrants (two man or machine lift)
6. Bags of powered cements (23-kg)
7. Step and extension ladders

Usual Methods

Expose Service by Hand

1. Drive to the work area in the morning.
2. Exit the vehicle, check the work order and set up the barricades and signs to close the street if necessary.
3. Gather the required tools for the job from the back of the truck.
4. Check for pre-marked services on the ground (paint).
5. Use a shovel, bar or jackhammer to dig the earth away to expose the service. Throw the dirt and debris out of the ditch onto the street or curb. Note: Water services located approximately one metre or less from the surface are usually dug by hand by the Labourer.
6. Once the service has been exposed and debris cleared away, climb out of the ditch and gather the required tools, equipment and parts to make the installation or repair.
7. Carry the tools, equipment and parts to the ditch from the truck. Lower the tools, equipment and parts into the ditch by hand or rope.
8. Climb into the ditch.

9. Perform installation or repair task on the service using hand and/or power tools. Depending on the type of installation or repair, the water line may be live and under pressure or it may have been turned off and drained.
10. Lift and carry tools, equipment and excess parts out of the ditch to the surface.
11. Climb out of the ditch after the installation or repair.
12. Use a shovel to backfill the ditch.
13. Clean the area of excess dirt and debris.
14. Load the truck with tools, equipment and parts.
15. Remove barricades and signs from the roadway if required.
16. Drive or walk to the next work area.
17. Repeat steps 2-16.

Expose Service by Backhoe

1. Drive to the work area in the morning.
2. Exit the vehicle, check the work order and set up the barricades and signs to close the street if necessary.
3. Gather the required tools for the job from the back of the truck.
4. Check for pre-marked services on the ground (paint).
5. Assist the Backhoe Operator as required with hand signals and verbal communication to expose the service.
6. Using a shovel or broom the Labourer keeps the edges of the ditch clear of dirt and debris.
7. Once the service has been exposed, the Labourer will climb into the ditch (ladder) and expose the immediate area that requires the installation or repair.
8. Climb out of the ditch
9. Carry the tools, equipment and parts to the ditch from the truck. Lower the tools, equipment and parts into the ditch by hand, rope or Backhoe.
10. Climb into the ditch.
11. Perform installation or repair task on the service using hand and/or power tools. Depending on the type of installation or repair, the water line may be live and under pressure or it may have been turned off and drained.
12. Water main installation requires the Labourer to use a bar to push the male end of the pipe into the female end to complete the connection.
13. Lift and carry tools, equipment and excess parts out of the ditch to the surface.
14. Climb out of the ditch after the installation or repair.
15. The Backhoe Operator will use the Backhoe to backfill the ditch.
16. Clean the area of excess dirt and debris with a shovel or broom.
17. Load the truck with tools, equipment and parts.
18. Remove barricades and signs from the roadway if required.
19. Drive or walk to the next work area.
20. Repeat steps 2-19.

<u>Administrative Issues</u>

The Labourer works from Monday to Friday 0700 to 1530 with a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. There are seven crews in the City of Burnaby made up of three Labourer's and a Foreman. Services less than one metre below grade are usually exposed by hand (shovel, bar and/or jack hammer). In this instance the Labourer will spend his day digging to expose the service, repairing or installing the service, and back filling the service up to all day. When

using Backhoe, the Waterworks Construction Crew will lay approximately 122 metres (400 feet) of water line for main installation per day.

Activity Demand Variables

These variables are tasks that must be carried out by the employee and are implicitly or explicitly required as objectives of the job.

- Shovel or dig around pipe and/or utilities (gas, water, sewer, electric) in the ditch
- Shovel by hand to one metre deep by one metre wide to expose service
- Climb up and down a ladder into the ditch that can range from one to seven metres deep
- Climb in or out of the ditch without a ladder
- Shovel and/or sweep debris from edge of ditch when working near a Backhoe
- Raise and lower tools and equipment by hand or rope into a ditch that can range form one to seven metres deep
- Lift and carry tools, equipment and parts (elbows, T's, fittings, etc.) from the truck to the ditch (usually get truck as close as possible to the ditch or work area)
- Work in a confined area when installing or repairing water service
- Repair or install pipe/service on a live water line
- Kneel, crouch, bend, stoop in a ditch while installing or repairing water line, hydrant, etc.
- Push and/or pull tools and equipment in or out of the ditch
- Two ten minute rest periods (one in the morning and one in the afternoon) and a 30 minute lunch break
- Work in all weather conditions including prolonged periods of rain or heat

Worker Decision Variables

These variables are the sub-routines and cognitive/physical decisions made by the worker in carrying out the objectives of the job.

- Choose posture when able to perform tasks (lifting, shoveling, pushing, pulling)
- Ask for assistance when required and others are around

Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the labouring duties of this position.
2. People with shoulder injuries such as rotator cuff tendonitis, bursitis and instability may have difficulty with dynamic and static loading and reaching activities required to install and repair water/service lines and components.
3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the repeated jarring and the static grip forces required to shovel, dig and power tool use including the jackhammer.
4. People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use hand and power tools (compression and vibration).
5. People who do not work well in confined areas will not do well with this position.
6. People with injuries to the lower extremities will have difficulty walking and standing on uneven ground and climbing in and out of the ditch as well as producing enough force to shovel or pick the ground to expose a service.

Prepared By: Jeffrey J. McGinn, Kinesiologist May 27, 1999

Summary of Stresses

Metabolic Stresses

The aerobic energy systems will be the major source of energy requirement while performing the duties and responsibilities of the Labourer - Waterworks. This energy system will be utilized during the installation and repair of the water service lines. The anaerobic energy systems may be required to supply energy for brief intense periods of work, which may include heavy or sustained lifting or carrying; or towards the end of the day when the aerobic energy system has been depleted. In this last instance the anaerobic energy system becomes the primary energy source

Structural Stresses

Spine –Significant loading of the spinal structures are likely in this position. Prolonged loaded and unloaded forward flexion, extension, lateral flexion and rotation of the spine are all movements required by the Labourer. Forward flexed postures require no activity from the torso musculature, but increase asymmetrical disc compression and passive stretch on the posterior spinal ligaments and disc fibres. This can contribute to disc integrity problems as well as contributing to deconditioning of the torso support musculature. Lateral flexion and/or rotation with or without forward flexion (loaded or unloaded) will significantly increase the shear forces encountered by the discs, fibres and spinal ligaments. The Labourer will handle loads from less than one to 41 kilograms in extreme positions.

Neck, Shoulders and Upper Extremity– the Labourer will often perform prolonged and repeated static and dynamic movements. These static and dynamic movements through the shoulder and upper extremity require the rotator cuff muscle groups, upper trapezius and scalene muscles of the neck to maintain a significant load. Static loading of the of the forearm flexors, extensors, supinator, pronator teres and the pronator quadratus during tool use (shovel, hand and power tools, etc) will increase the risk of injury to these areas. Power and air tool use (saws, jackhammers, etc) will also increase the vibration, jarring and compressive forces from the grip to the elbow and shoulder that may lead to over use tendon or nerve injuries.

Hips and Lower Extremities – Standing and walking on concrete, asphalt, mud and dirt for the entire shift increase the compressive forces through the ankles, knee, hips and spine. The awkward positions required to access pipe and component parts do not allow the Labourer to perform the required work from a stable base of support. This in turn will increase the risk of injury for all of the other structures.

INTERVENTIONS

Recommendations that could be implemented to increase productivity and lessen the risk of injury are listed below:

1. Encourage the Labourer to maintain an increased level of fitness away from work that will focus on cardiovascular endurance, muscular strength, muscular endurance and flexibility.

2. Provide kneepads for the Labourer for any work where kneeling is required, specifically in an open excavation.

3. Provide regular education in effective use of the body and neutral joint positions for this type of work. This education component should go way beyond the standard back care and lifting techniques (bend knees, keep the back straight, etc.)

4. Encourage the Labourer to ask for assistance (co-worker or backhoe) when handling heavy and/or oversized parts or pieces

5. Exposing a service by hand (one metre deep by one metre wide by one metre long) could be performed more efficiently and with less risk of injury to the Labourer if a Backhoe or a HydroVac Truck was used.

Referral: Lana Ho		Organization: City of Burnaby							Title: Labourer
Dept.: Engineering		Division: Waterworks							Contact: Grant Tesar
				FREQUENCY*					Date: April 30, 1999
	PHYSICAL DEMANDS	REQD	SIDE	Sel 1	Low 2	Mod 3	High 4	Max. Weight (kg)	Usual Weight (kg)	COMMENTS
STRENGTH	Lifting - Floor to Knuckle	X	E			X		41	<1-8	pipe fittings, tools, equipment, lumber
	Lifting - Knuckle to Waist	X	E				X	41	<1-8	pipe fittings, tools, equipment, lumber
	Lifting - Waist to Shoulder	X	E			X		41	<1-8	pipe fittings, tools, equipment, lumber
	Lifting - Over Head	X	E		X			30	<1-8	pipe fittings, tools, equipment, lumber
	Carrying - With Handles	X	E				X	41	<1-8	pipe fittings, tools, equipment, lumber to 100 m
	Carrying - Without Handles	X	E			X		41	<1-8	pipe fittings, tools, equipment, lumber to 100 m
	Pushing - Upper Extremity	X	E			X		41	<1-8	shovel, pry bar, fit pipe together, tool use
	Pushing - Hip/Leg Assist	X	E			X		41	<1-8	shovel, pry bar, fit pipe together, tool use
	Pulling - Upper Extremity	X	E			X		41	<1-8	shovel, pry bar, fit pipe together, tool use
	Pulling - Hip/Leg Assist	X	E			X		41	<1-8	shovel, pry bar, fit pipe together, tool use
	Reach - Shoulder or Above	X	E			X		30	<1-8	from ditch to grade for tools, equip., pipe
	Reach - Sho. or Above extnd	X	E		X			30	<1-8	from ditch to grade for tools, equip., pipe
	Reach - Below Shoulder	X	E				X	41	<1-8	lift, carry, tool use, install/connect fittings
	Reach - Bel. Shoulder extnd	X	E		X			41	<1-8	lift carry tools, equip., pipe, lumber
	Handling	X	E				X	41	<1-8	tools, shovel, equip., pipe, fittings
	Gripping	X	E				X	50	<1-8	tools, shovel, equip., pipe, fittings
	Fine Finger Movements	X	D			X		max.	low	connect, install fittings, tapping machine
ENRG	Aerobic (percent)	X					70	install & repair water lines (main and to property), hydrants, fittings,		
	Anaerobic (percent)	X				30		shovel to expose water lines from grade (to 1 m X 1 m X 1m)		
	High Energy Expenditure	X				X		shovel to expose water lines from grade (to 1 m X 1 m X 1m)		
	Low Energy Expenditure	X					X	install & repair water lines (main and to property), hydrants, fittings		
POSTURE	Neck - Static Flexion	X					X	work below shoulders to shovel, make connection, install fittings		
	Neck - Static Neutral	X					X	stand, walk on grade, in ditch		
	Neck - Static Extension	X					X	work above shoulders from bend, stoop, crouch, kneel		
	Neck - Rotation	X	E				X	dig to expose service, install, connect service in ditch		
	Throwing	X	E					dirt from shovel to expose buried service		
	Sitting	X			X			possibly in ditch to install/connect service and fittings		
	Standing	X					X	on grade, in ditch, asphalt, concrete, mud, dirt, water		
	Walking	X				X		to 100 m from truck to service/ditch		
+MOBILITY	Running/Jumping	X			X			down into ditch from grade to 1 m		
	Climbing - Arms and Legs	X		X				ladder/banks to enter/exit ditch		
	Climbing - Legs Only	X			X			in/out of shallow ditch		
	Bending/Stooping	X					X	dig with shovel, tool use, etc. to install/repair service, hydrant		
	Crouching	X				X		dig with shovel, tool use, etc. to install/repair service, hydrant		
	Kneeling	X			X			dig with shovel, tool use, etc. to install/repair service, hydrant		
	Crawling	X		X				in ditch to expose or access service		
	Twisting	X	E				X	dig with shovel, tool use, etc. to install/repair service, hydrant		
	Balancing	X			X			on ladder, edge of ditch, on dirt, in mud, water		
GEN	Traveling	X			X			to work location within city		
	Work Alone	X		X				possibly when digging a service by hand		
	Interact with Public	X			X			at work locations in community		
	Operate Equip/Machinery	X			X			pumps, jack hammers, power saws, tapping machine		
	Irregular/Extended Hours	X		X				0700-1530, Monday to Friday, OT often		

* Frequency Legend 1 = Seldom; Not Daily 2 = Low Daily Activity; < 1hr
3 = Moderate Demand; Repetition 1 - 3 hrs daily 4 = High Frequency Demand; Repetition > 3 hrs daily

The following shading denotes a HIGH RISK TASK: Modifications should be considered

REQD is marked with an X if the particular demand or category is relevant to the purpose of the job.

SIDE refers to the side or limb required to execute a task. If it is marked **E**, it indicates either side, the most common choice is listed first. **D** refers to dominant and **B** to both sides.

Referral:	Organization:						Title: see 1st page header
Dept.:	Division:						Contact:
			FREQUENCY*				Date:
PHYSICAL DEMANDS	REQD	SIDE	Sel. 1	Low 2	Mod. 3	High 4	COMMENTS
PERCEPTION	Hearing - Conversations	X				X		crew, Truck Driver, Equipment Operator, Foreman, public
	Hearing - Other Sounds	X					X	trucks, equipment, vehicles, pumps, power saw, jackhammer
	Vision - Far	X					X	install and repair water lines, services, hydrants
	Vision - Near							
	Vision - Colour							
	Vision - Depth	X					X	dig with shovel, make connections, walk in/around ditch/equipment
	Perception - Spatial	X						dig with shovel, make connections, walk in/around ditch/equipment
	Perception - Form							
	Feeling (Tactile)	X					X	static grip on shovel, jackhammer use
	Reading							
	Writing							
	Speech	X				X		crew, truck driver, equipment operator, Foreman, public
WORK ENVIRONMENT	Inside Work	X			X			drive to next work location in Gruman Van
	Outside Work	X					X	at work location in all weather conditions
	Hot Conditions >25 deg. C	X		X				possibly in spring, summer or fall
	Cold Conditions <10 deg.C	X		X				possibly in fall, winter or spring
	Humid	X		X				during wet weather conditions
	Dust	X		X				digging to service at work site
	Vapor Fumes	X					X	diesel from trucks, backhoe, excavator
	Hazardous Machines	X				X		jackhammer, power saw, tapping machine
	Proximity to Moving Object	X					X	trucks, backhoe, excavator, traffic
	Noise	X					X	trucks, backhoe, excavator, traffic, jackhammer, power saw
	Electrical Hazard	X			X			possibly buried services, overhead wires
	Sharp Tools	X					X	shovels, pipe cutters, power saw
	Radiant/Thermal Energy	X		X				sun
	Slippery Conditions	X		X				in wet ditches, wet weather
	Vibration and Related							jackhammer, power saw, tapping machine
	Chemical Irritants							
	Organic Substances							
	Medical Waste							
	Blood Products							
	Congested Worksite	X					X	in ditch, around service, near traffic
	Lighting - Direct	X					X	day light, sun light
	Lighting - Indirect	X		X				day light
	Lighting - Adjustable							
	Lighting - Fluorescent							
	Lighting - Incandescent							
	Lighting - Shadows etc.	X					X	depends on time of day, weather and location of work

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For detailed descriptions of each of the different categories, please refer to the reference guide or inquire with Human Effort at 1-888-4EFFORT