

# **JOB DEMANDS ANALYSIS**

**Company:** Greater Vancouver Regional District **Location:** Victory Heights

Job Title: Water Mechanic Classification: Regular Duty

# Purpose of Activities

The Water Mechanic is responsible for the regular maintenance and repair of the Greater Vancouver Regional District (GVRD) heavy mechanical equipment (marine boats, water pumps, diesel powered generators, diesel powered water pumps, etc.).

# **Tools and Equipment**

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

- Dodge Cargo van
- Tools in van wrenches, pipe wrenches, screw drivers, pliers, portable flood lights, hydraulic generator, cut-off saw, impact gun and tools, buckets, rope, fan, bars, manhole cover bar, machete, hammers, sledge hammers, utility knife
- Lake City Shop Tools hand carts, furniture dolly, oxyacetylene torch on a cart, grinders, drill press, parts washer, sledge hammers, ropes, chains, wrenches, levels, clamps, pliers, cutters, pipe cutters, grease gun, bench vise, fire extinguishers, step and extension ladders, shop vac, portable welder, sand blaster
- Hard hat, steel toe boots, hearing protection, coveralls, face shield, safety harness, safety tripod to enter manholes and chambers, ropes, cell phone, two way radio
- Traffic controls signs, traffic cones

#### **Usual Methods**

- 1. Receive paperwork on job from Supervisor
- 2. Drive to Lake City Shop to collect tools and equipment required for maintenance or repair.\*\*
- 3. Drive to work site location.
- 4. Set up work site with tools and equipment. Generator and fan to pump clean air into chamber. Use gas detector to determine if chamber is safe to enter. Set up traffic



- 5. control if required. A second crew may perform traffic control duties if required. Set up tripod over chamber if required.
- 6. Enter chamber, pump house or building.
- 7. Prepare heavy equipment so that work can begin. In some cases this will include scraping and chipping tar off pipes, etc.\*\*
- 8. Perform maintenance tasks or repair with hand and power tools. Where required heavy equipment is brought in to lift heavy equipment or parts.
- 9. Complete maintenance task or repair.
- 10. Clean up work site. Drive to next job or to the Lake City Shop or back to Victory Heights Yard.

#### Administrative Issues

The Water Mechanic works from Monday to Friday 0730 to 1600 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 four Water Mechanics and two Water Mechanic's Helpers. The Water Mechanic is assigned to a north or south section of the GVRD and may work alone for some tasks. Overtime is rare, but the Water Mechanic is required to be on-call for one weekend out of five, from Friday afternoon to Monday morning. Water Mechanic's are required to enter confined spaces that may or may not contain hazardous gases (H2S, CO, etc.). The Water Mechanic estimates that he drives up to 100 kilometres per day to get to job sites in the GVRD.

# **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.

- Climb up and down a ladder to get in/out of a chamber (maximum 2.75 m deep)
- Raise and lower tools and equipment by hand or rope into chambers, vaults that can be up to 2.75 m deep
- Lift and carry tools, equipment, parts, materials from the van to the work area (2-10 m)
- Repair and maintain heavy equipment
- Kneel, crouch, bend and stoop to perform maintenance, repair or installation tasks
- Two ten-minute rest periods (one in the morning and one in the afternoon) and a 30minute lunch break
- Work in all weather conditions including prolonged periods of rain or heat
- Enter confined spaces that may contain sewer gases
- Sit to drive van
- Stand in van, in chambers, vaults, grass, dirt, concrete



# 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.

- Lifting techniques to some extent
- Task organization

## Accommodative Considerations

- People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during maintenance and repair of heavy equipment for the GVRD.
- 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 during maintenance and repair of heavy equipment.
- 3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the repeated jarring and the static grip forces required during hand and power tool use during maintenance and repair tasks.
- 4. People with injuries to the lower extremities may have difficulty climbing in and out of the van; up and down ladders to the chambers, vaults; bending, stooping, crouching, and kneeling required to access heavy equipment for maintenance and repair tasks.
- 5. People who do not work well in a low-autonomy environment will have difficulty with this position.
- 6. People who are claustrophobic and do not like confined spaces may have difficulty with this position.
- 7. Must hold a valid Journeyman's ticket for Heavy Duty Mechanic.

Prepared By: Jeffrey J. McGinn, Kinesiologist June 1, 1999



# **Summary of Stresses**

### Metabolic Stresses

The aerobic energy system will supply the major source of energy while performing the duties and responsibilities of the Water Mechanic. This energy system will be utilized during the maintenance and repair of GVRD heavy equipment. 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 Water Mechanic. 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 decondition 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 Water Mechanic will handle loads from less than one to 42 kilograms. Driving to and from each work location in a flexed spine position will also increase the risk for injury to the spine as described above.

**Neck, Shoulders and Upper Extremity**— the Water Mechanic 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 (drill, grinders, 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.

Almost all of the Water Mechanic's work is carried out in front of his body with some type of tool or implement. This position will weaken the shoulder girdle support structure and increase the risk of injury to this area. Rotator cuff and biceps tendon tendonitis injuries are likely as the muscle of the upper back and shoulder weaken through prolonged use. As this happens, thoracic spine kyphosis will increase and the cervical spine will be pulled forward out of its neutral position.



Hips and Lower Extremities – Standing and walking on concrete and asphalt will increase the compressive forces through the ankles, knee, hips and spine. The awkward positions required to access heavy equipment will not allow the Water Mechanic 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. Climbing in and out of the van and up and down ladders into and out of the chamber increase the risk of a slip and fall injury. Working in a wet environment will also increase the risk of injury due to slip and fall.

#### **INTERVENTIONS**

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

- 1. Encourage the Water Mechanic 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 Water Mechanic for any work where kneeling is required, specifically on concrete, asphalt or other hard surfaces.
- 3. Provide regular education in effective use of the body and neutral joint positions for this type of work.

Ref	erral: Keith Arkell									Title: Water Mechanic
Dep	t.: Engineering		Organization: GVRD Division: Waterworks							Contact: Neil Walsh
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		E	Ī	Sel	Low	Mod	Hiah		Weight	
	PHYSICAL DEMANDS	Q	Ď					(kg)	(kg)	COMMENTS
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	Lifting - Knuckle to Waist	Х					Х	42		tools, equipment, parts, materials
	Lifting - Waist to Shoulder	Х				Х		42	<del></del>	tools, equipment, parts, materials
1	Lifting - Over Head	X			Х			20		tools, equipment, parts, materials
	Carrying - With Handles	X			X			42		tools, equipment, parts, materials
s	Carrying - Without Handles	X				Х		42		tools, equipment, parts, materials
<del>Ŭ</del>	Pushing - Upper Extremity	X					X	42		tools, equipment, parts, materials
R	Pushing - Hip/Leg Assist	X				Х	<del>  ^</del>	42		tools, equipment, parts, materials
E	Pulling - Upper Extremity	X	$\vdash$				Х	42		tools, equipment, parts, materials
	Pulling - Hip/Leg Assist	X				Х		42		tools, equipment, parts, materials
1	Reach - Shoulder or Above	X	$\vdash$		Х			30		tools, equipment, parts, materials
G   T	Reach - Sho. or Above extnd	x	$\vdash$	Х				20		
1			<del></del>	^			-			tools, equipment, parts, materials
H	Reach - Below Shoulder	X	_		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		X	42		tools, equipment, parts, materials
	Reach - Bel. Shoulder extnd	X	<u> </u>		Х		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	42		tools, equipment, parts, materials
	Handling	X					X	42		tools, equipment, parts, materials
	Gripping	Х					Х	50		tools, equipment, parts, materials
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	Aerobic (percent)	Х					95			ntain mechanical equipment
	Anaerobic (percent)	Х	<u> </u>	neg.				heavy I	ift, hold	part for repair or to fasten part
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G	Low Energy Expenditure	Х								ntain mechanical equipment
	Neck - Static Flexion	Х						work be	low shou	Ilders to repair and maintain mechanical equipment
	Neck - Static Neutral	Х					Х			, work at shoulder level
	Neck - Static Extension	Х				Х		work at	ove sho	oulders from bend/stoop/crouch/kneel/crawl
S	Neck - Rotation	Х	Е				Х	drive va	an, acce	ss mechanical equipment
T	Throwing									
U	Sitting	Х			Х			in van t	o drive t	to work location, shop
R	Standing	Х					Х	at work	site, in	chamber, in water, on concrete, dirt, asphalt
E	Walking	X								work site, chamber, less than 50 metres
+	Running/Jumping									·
	Climbing - Arms and Legs	Х		Х				ladders	, wall la	dders
0	Climbing - Legs Only	Х			Х				rills to w	
В	Bending/Stooping	Х					Х			aintain mechanical equipment
Ιī	Crouching	X				Х				aintain mechanical equipment
L	Kneeling	X			Х					aintain mechanical equipment
Ιī	Crawling	X		Х						nanical equipment
Ϊ́Τ	Twisting	X	Е			Х				aintain mechanical equipment
Ϊ́Υ	Balancing	X			Х					mps, motors, stairs
G E	Traveling	X	$\vdash$		<del>- ^`</del>	Х			D to wo	
	Work Alone	X	$\vdash$	Х		<u> </u>	<del>                                     </del>			t will usually have Mechanic's Helper
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	equency Legend	1 =	ا96 ا	uom;	NOT I	ually				y; < 1hr
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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.

#### PJDC-Water Mechanic GVRD

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**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.

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

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