



## JOB DEMANDS ANALYSIS

**Company:** Greater Vancouver Regional District

**Location:** Lynn Pump Station

**Job Title:** Pump Crew

**Classification:** Regular Duty

### Purpose of Activities

The Pump Crew is responsible for the inspection, maintenance and repair of Trunk Sewers, Interceptors, Siphons, Control and Valve Chambers, Outfalls and Pumping Stations. Each Pump Crew may be responsible for approximately 50 or more kilometres of sewers line, (on and off road), 400 manholes, ten-siphons, 25 control structures and 12 outfalls.

### Tools and Equipment

The Pump Crew will use the following tools and equipment to perform their duties:

- Traffic cones, traffic signs
- Power tools- chain saws, weed eaters, brush kings, generators, vacuum, lawn mowers, drills, skill saw, brush saws, Hilti Drill, pump
- Hand tools – wrenches, screw drivers, hand saws, shovels, axes, picks, pry bar, flash light, extension ladder, step ladder, brooms, measuring tools, sledge hammers, buckets, bench vise, clamps, fire extinguisher, pike poles
- Coveralls, gloves, latex gloves, leather gloves, safety glasses, face shield, Self Contained Breathing Apparatus (SCBA), harness, tripod, gas detector
- One-ton Chevy cube van
- Two-way radio, cell phones, pagers, head set

### Usual Methods

1. Determine work for the day (inspection, maintenance or repair).
2. Arrange traffic control with other crews if required. Arrange for Tradesman (Water Mechanic, etc.) if required.
3. Load van with tools equipment and/or materials.
4. Drive to work location.
5. Get out of van and set up traffic control if required.
6. Unload necessary tools, equipment and materials. Carry to the work location (10-50 m from van).
7. Perform task (inspection, maintenance, and repair).
8. Gather tools, equipment and material and return to the van.
9. Drive to next work location.
10. Repeat steps 1-9 for the remainder of the day.



## Inspection

Facility inspection includes determining the condition of the facility and equipment, pumps, generators, compressors, topping up diesel tanks, picking up paper work, monitoring flow chart; Wet Well Pump Downs, Pump De-ragging; General Housekeeping; Backflow Preventors and staff Gauges, etc.

## Maintenance

Regular preventative maintenance includes tasks such as checking and inspecting control chambers, valve chambers, siphons, weirs and overflows, castings; flushing and extracting grit from Grit Chambers; Brush Cutting from sewers lines, pump stations, Interceptors, manholes and chambers; Painting manholes, air stacks, service boxes and signs; Mechanical maintenance of pumps and valves, Isolation Gates, Sump Pumps, Water Strainers, Cast Iron Slide Gates, Electrical Communication and Instrumentation Equipment, generators; Landscaping around high profile location; Exterior painting of buildings, Interior painting of station

## Repairs

Repairs include unscheduled non-routine inspection and repair of surging manholes during heavy rain, replacing broken castings and lids, broken sewer lines or forcemains, minor construction and supervision of contractors, H<sub>2</sub>S control and repair, pumps, Electrical Communications and Instrumentation Equipment, plumbing, etc.

**The presence of \*\* indicates non-value added tasks. These tasks do not contribute to the stated purpose of the work.**

## Administrative Issues

The Pump Crew 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. Emergency response is a requirement of this position during the evening and weekends. The Pump Crew works in all weather conditions. There are three positions assigned to each Pump Crew (Area Operator, Assistant Area Operator and a Worker 1). The only difference between these positions is the level of responsibility. Pump Crews are assigned to a specific area within the Greater Vancouver Regional District (GVRD). The crew estimates they drive between 50 to 150 kilometres per day.

Confined entry to manholes and valve chambers is required by the Pump Crew. Worker's Compensation Board regulations are followed for this type of entry. The deepest manholes or chamber is approximately seven metres deep. The Pump Crew is also required to enter live sewer lines.

## 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.

- Lift and carry tools, equipment, supplies and materials (<1-41-kg) from the van to the work site or shop (<5 to 50 metres)



- Lift, carry, hold and operate hand, air and power tools (<1 to 41-kg) from below grade to above shoulders
- Walk several kilometres to clear and remove under growth from off road sewer line with weed eater, brush king, etc.
- Stand at work site on grass, dirt, rock, asphalt, concrete, wet wells, etc.
- Bend, stoop, kneel, crawl to perform inspection, maintenance and repair tasks
- Work from below feet to above shoulder height inspect, maintain and repair
- Work in all weather conditions including prolonged periods of rain or heat
- Sit in van to drive between work locations
- Push/pull tools and equipment
- Climb step and extension ladders, climb in and out of manholes, valve chambers, etc.
- Enter confined spaces with a body harness, tripod extraction device
- Enter confined spaces with H<sub>2</sub>S and methane gas
- Enter and work in a live sewer environment

### 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 technique to some extent
- Body position in tool use to some extent
- Task organization

### Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required in 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 in this position.
3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the static grip forces required during any power or hand tool use.
4. People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use of hand and power tools (compression and vibration) below, at and above shoulder height.
5. People with injuries to the hand and fingers will have difficulty with the fine motor manipulation tasks required to perform the activities of this position.
6. People with lower extremity injuries to the hips, knees and ankles may have difficulty with standing on concrete asphalt, grass, dirt and kneeling for extended periods.
7. People with lower extremity injuries to the hips, knees and ankles may have difficulty with the climbing in and out of manholes and valve chambers (to seven metres deep).
8. Claustrophobic people may have difficulty working in confined spaces and under ground.
9. Waste Water Treatment and Management courses are required in this position.

Prepared By: Jeffrey J. McGinn, Kinesiologist

June 8, 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 Pump Crew. This energy system will be utilized during the inspection, maintenance and repair tasks required. The anaerobic energy system may be required to supply energy for brief intense periods of work, which may include heavy lifting, carrying or holding tools, materials and equipment; 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** – Typically, flexion, extension, lateral flexion and rotation movements will be performed while the Pump Crew is handling a load (hand or power tools, debris, 1 to 41-kg). Forward flexed postures during hand and power tool use 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.

**Neck, Shoulders and Upper Extremity**– This position requires prolonged and repeated static and dynamic movements from below to above shoulder height. The static and dynamic movements through the shoulder and upper extremity often require the rotator cuff muscle groups, upper trapezius and scalene muscles of the neck to maintain a constant and significant load. Hand and power tool use (predominately dominant hand) will increase the static and dynamic loading of the forearm flexors, extensors, supinator, pronator teres and the pronator quadratus. Weed eater, chains saw, lawn mower, etc. use will increase the vibration and compressive forces from the grip to the elbow and shoulder that may lead to over use tendon or nerve injuries. Impingement and inflammatory injuries to the shoulders are likely due to the prolonged static arm position (flexed and abducted shoulder and elbow) required during some work.

Almost all of the Pump Crew'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** – will be taxed in the many dynamic movements associated with walking, standing, climbing, lifting and carrying on stable and unstable surfaces (concrete, asphalt, grass, dirt, ladders, van, etc.). These surfaces may be wet or dry. Twisting an ankle or knee or a slip and fall injury are the most likely to the lower extremities.

**Insect Stings** – fieldwork in will expose the Pump Crew to insect stings that may range from localized swelling of the affected area to anaphylactic shock and death.



**Gas Poisoning** – confined entry to areas where H<sub>2</sub>S and Methane gas are present will increase the risk of exposure that could range from minor irritation to death,

### **INTERVENTIONS**

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

1. Encourage the Pump Crew to maintain an increased level of fitness away from work that will focus on cardiovascular endurance, muscular strength, muscular endurance and flexibility.
2. Provide the Pump Crew with postural awareness training that focus on the importance of proper body posture and how it relates to their ultimate physical comfort and reducing fatigue level.

PJDC-Pump Crew

Referral: Keith Arkell		Organization: GVRD							Title: Pump Crew	
Dept.: Engineering		Division:							Contact: Nick Bertolini	
PHYSICAL DEMANDS		R E Q U I R E D	S I D E	FREQUENCY*				Max. Weight (kg)	Usual Weight (kg)	COMMENTS
				Sel 1	Low 2	Mod 3	High 4			
S T R E N G T H	Lifting - Floor to Knuckle	X	B			X		41	<1-10	tools/equip/material to/from chamber pump stat.
	Lifting - Knuckle to Waist	X	B				X	41	<1-10	tools/equip/material to/from chamber pump stat.
	Lifting - Waist to Shoulder	X	B			X		41	<1-10	tools/equip/material to/from chamber pump stat.
	Lifting - Over Head	X	B		X			41	<1-10	tools/equip/material to/from chamber pump stat.
	Carrying - With Handles	X	E				X	41	<1-10	tools, equipment, materials
	Carrying - Without Handles	X	E				X	41	<1-10	tools, equipment, materials
	Pushing - Upper Extremity	X	B			X		41	<1-10	tool use, inspect, maintain and repair
	Pushing - Hip/Leg Assist	X	B			X		41	<1-10	tool use, inspect, maintain and repair
	Pulling - Upper Extremity	X	B			X		41	<1-10	tool use, inspect, maintain and repair
	Pulling - Hip/Leg Assist	X	B			X		41	<1-10	tool use, inspect, maintain and repair
	Reach - Shoulder or Above	X	E			X		41	<1-10	tool use, inspect, maintain and repair
	Reach - Sho. or Above extnd	X	E		X			41	<1-10	tool use, inspect, maintain and repair
	Reach - Below Shoulder	X	B				X	41	<1-10	lift, carry tools, equip., materials,
	Reach - Bel. Shoulder extnd	X	B		X			41	<1-10	lift, carry tools, equip., materials,
	Handling	X	E				X	41	<1-10	tools, equipment, materials
Gripping	X	E				X	41	<1-10	tools, equipment, materials	
Fine Finger Movements	X	D					max.	low	inspect, maintain and repair facility, pumps, etc.	
E N R G	Aerobic (percent)	X					95			perform facility inspection, maintenance and repair
	Anaerobic (percent)			neg.						possibly heavy lifting, fatigue at end of day
	High Energy Expenditure									
	Low Energy Expenditure	X					X			perform facility inspection, maintenance & repair
P O S T U R E + M O B I L I T Y	Neck - Static Flexion	X					X			work below shoulders for facility inspection, maintenance & repair
	Neck - Static Neutral	X					X			stand, walk, sit
	Neck - Static Extension	X				X				work above shoulders in bend, stoop, crouch, kneel, crawl
	Neck - Rotation	X	E				X			perform facility inspection, maintenance and repair
	Throwing	X		X						possibly debris from shovel, objects to the surface
	Sitting	X			X					in van to drive to next work location 50 to 150 km/day
	Standing	X					X			on gravel, concrete, asphalt, mud, water, sewage
	Walking	X					X			to/from van to work location, brush cutting X 2-3 km
	Running/Jumping									
	Climbing - Arms and Legs	X				X				ladders to valve chambers, in manholes
	Climbing - Legs Only	X			X					hills, stairs at pump stations
	Bending/Stooping	X					X			perform facility inspection, maintenance and repair, in sewers
	Crouching	X				X				perform facility inspection, maintenance and repair, in sewers
	Kneeling	X			X					perform facility inspection, maintenance and repair, in sewers
	Crawling	X		X						perform facility inspection, maintenance and repair, in sewers
Twisting	X	E				X			perform facility inspection, maintenance and repair	
Balancing	X		X						on ladders, hill sides, manholes, valve chambers	
G E N E R A L	Traveling	X				X				in the GVRD designated area
	Work Alone									in a crew of 3
	Interact with Public	X		X						possibly at pump station, manholes, valve chambers
	Operate Equip/Machinery	X					X			van, power tools, pumps, generators, winches
	Irregular/Extended Hours	X		X						0700-1530, Monday to Friday, emergency response call out

\* 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.

PJDC-Pump Crew

Referral:		Organization:						Title: see 1st page header	
Dept.:		Division:						Contact:	
PHYSICAL DEMANDS		REQD	SIDE	FREQUENCY*				COMMENTS	
				Sel. 1	Low 2	Mod. 3	High 4		
P E R C E P T I O N	Hearing - Conversations	X					X	Pump Crew, Supervisor, other trades, public	
	Hearing - Other Sounds	X					X	traffic, gas detector alarm	
	Vision - Far							facility inspection, maintenance, repair & general cleaning	
	Vision - Near								
W O R K E N V I R O N M E N T	Vision - Colour	X			X			lights on panel board	
	Vision - Depth	X					X	perform work at pump stations, manholes, valve chambers	
	Perception - Spatial	X					X	perform work at pump stations, manholes, valve chambers	
	Perception - Form								
W O R K E N V I R O N M E N T	Feeling (Tactile)	X					X	hand & power tool use, open/close valves	
	Reading	X			X			work orders, safety paperwork	
	Writing	X			X			work orders, safety paperwork	
	Speech	X					X	with Pump Crew, Supervisor, other trades, possibly public	
	Inside Work	X				X		in pump stations, valve chambers, buildings, van	
	Outside Work	X					X	facility inspection, maintenance, brush cutting, painting	
	Hot Conditions >25 deg. C	X		X				possibly in spring, summer & fall	
	Cold Conditions <10 deg.C	X		X				possibly in fall, winter & spring	
	Humid	X			X			in chambers, manholes, sewers, wet weather conditions	
	Dust	X		X				cleaning chambers, weed eater/chain saw use	
	Vapor Fumes	X		X				H2S, methane gas, combustibles in sewers, manholes & chambers	
	Hazardous Machines	X					X	power tools, equipment, pumps, generators, van	
	Proximity to Moving Object	X					X	traffic, power tools/equipment blades ,chains, etc.	
	Noise	X				X		pumps, generators, power equipment/tools	
	Electrical Hazard	X		X				power equipment in wet environments	
	Sharp Tools	X				X		chain saw, lawn mowers, weed eaters, drills, knives, skill saw, etc.	
Radiant/Thermal Energy	X		X				hot motors, generators, sun		
Slippery Conditions	X		X				water, wet grass around or in sewers, manholes, chambers, etc.		
Vibration and Related	X					X	power tool use, weed eaters, chain saws, driving in van		
Chemical Irritants	X		X				H2S, methane gas, combustibles in sewers, manholes & chambers		
Organic Substances	X			X			raw sewage in manholes, chambers, sewers lines		
Medical Waste									
Blood Products									
Congested Worksite	X		X				confined entry into valve chamber 3x/week		
Lighting - Direct	X					X	day light, sun light, building or valve chamber light		
Lighting - Indirect	X					X	day light, sun light, trouble light		
Lighting - Adjustable	X				X		trouble light in pump stations, valve chambers		
Lighting - Fluorescent	X				X		in pump stations, light in van		
Lighting - Incandescent	X			X			possibly in valve chambers, pump stations		
Lighting - Shadows etc.	X			X			in pump stations, valve chambers, depends on time & location		

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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