Deliverable E: Project Plan and Cost Estimate

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Wrike snapshot:
https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=JfmAPNZtoikT3a3xWnlzwURIxhN0axOI%7CIE2DSNZVHA2DELSTGIYA

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1. First prototype

1.1 First Floor

The two-story building's main level is intended to make storage and logistics more effective. It has two front garage doors that make it simple to load and unload cargo into the structure. There is a lean-to, which is attached to the left side of the building and provides extra storage space to accommodate extra tools or supplies. A loading bay at the back of the structure improves its logistical capabilities even further by offering a productive area for receiving and distributing goods. There is a walk-in freezer for perishable storage that is easily accessible from the front garage doors, obviating the need to move frozen goods across the building. In addition to conserving room on the main floor, a spiral staircase gives access to the second story. The main level has all the necessary facilities, including a pump room that might contain equipment for the building's infrastructure or utilities, a storage room for organization, a furnace room for heating, and a bathroom for comfort.

1.2 Second Floor

The building's second story was created with comfort and productivity in mind. It has a boardroom, which is a necessary facility for every business or organization since it provides a specific area for talks, meetings, and presentations. This floor's six cubicles offer private workplaces ideal for jobs needing attention and concentration. There is a second bathroom on this floor for your convenience. Another useful feature is a fully functional kitchen, which enables tenants to make meals, snacks, or drinks without having to leave the building and fosters a relaxing work atmosphere. The rooftop garden, which is the last feature, is located atop the lean-to and offers a verdant area for leisure as well as the possibility to grow vegetables or plants. This rooftop garden gives a nice view and improves the building's appearance.

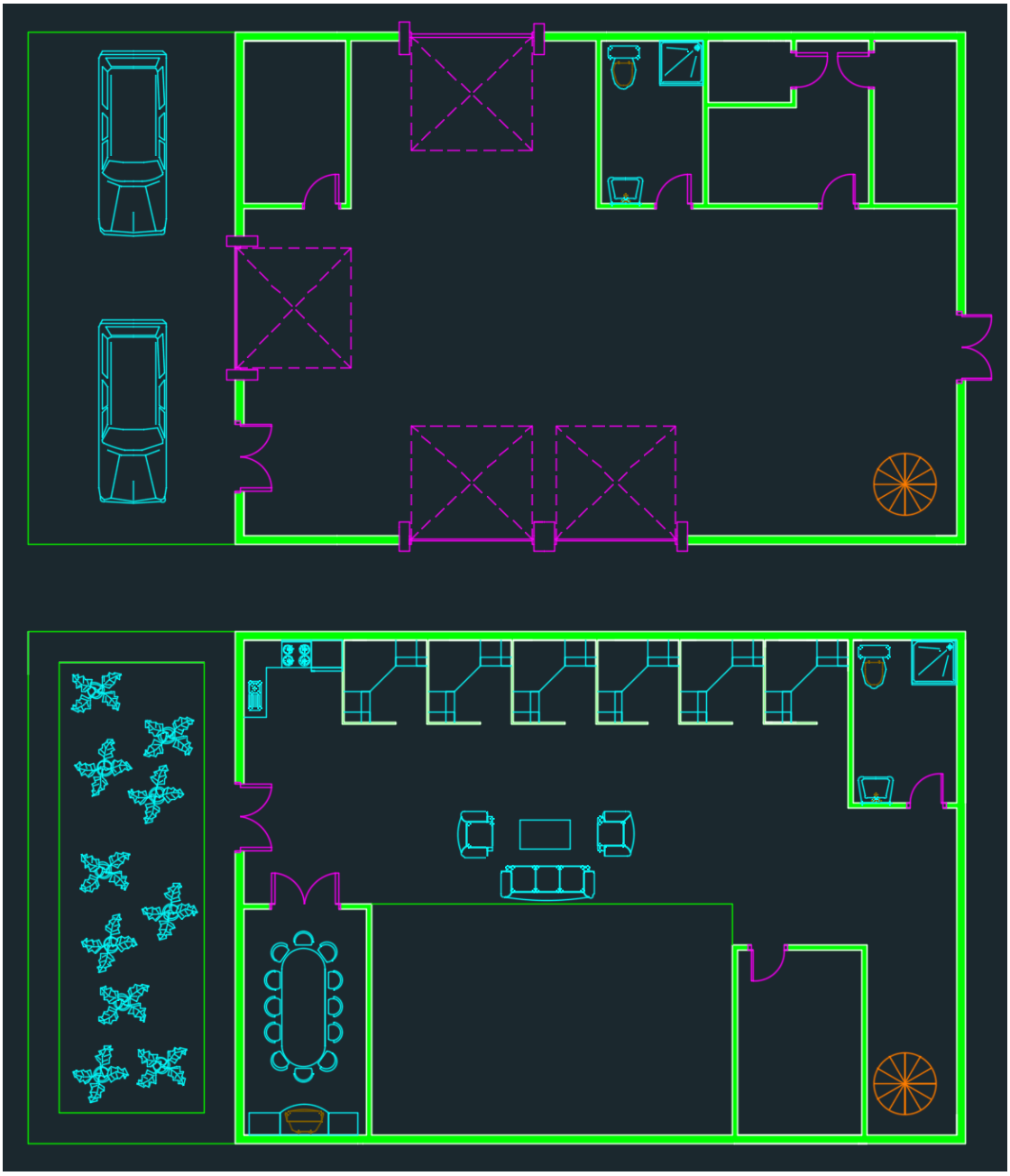

Figure 1: AutoCAD blueprint design of the building (first prototype)

2. Bill of Material for the estimate costs

Estimate Name: GNG1103 - G7

Data Release: Year 2018

Model: Office, 2-4 Story with Stone Veneer / Wood Frame

$1,107,325.63	NATIONAL AVERAGE	2	No
Building Cost	Location	Stories (Ea.)	Basement
$246.07	4,500	12.00	$2,127.00
Cost per S.F.	Floor Area	Story Height	Additive Cost

+ Add Assembly | ⇄ Swap Assembly | ✖ Remove Assembly | Notes

			Quantity	% of Total	Cost per S.F.	Cost
A		**Substructure**		**7.04%**	**$12.60**	**$56,695.00**
A1010		Standard Foundations			$9.53	$42,902.50
◉		Foundation wall, CIP, 4' wall height, direct chute, .148 CY/LF, 7.2 PLF, 12" thick	280		$5.60	$25,200.00
○		Strip footing, concrete, reinforced, load 14.8 KLF, soil bearing capacity 6 KSF, 12" deep x 32" wide	280		$3.05	$13,720.00
○		Spread footings, 3000 PSI concrete, load 200K, soil bearing capacity 6 KSF, 6' - 0" square x 20" deep	4.5		$0.88	$3,982.50
A1030		Slab on Grade			$2.90	$13,050.00
○		Slab on grade, 4" thick, non industrial, reinforced	2250		$2.90	$13,050.00
A2010		Basement Excavation			$0.16	$742.50
○		Excavate and fill, 10,000 SF, 4' deep, sand, gravel, or common earth, on site storage	2250		$0.16	$742.50
B		**Shell**		**44.97%**	**$80.48**	**$362,148.09**
B1010		Floor Construction			$15.49	$69,682.80
○		Wood column, 8" x 8", 20' x 20' bay, 10' unsupported height, 133 BF/MSF, 160 PSF total allowable load	2250		$0.23	$1,035.00
○		Door, aluminum & glass, with transom, bronze finish, hardware, 3'-0" x 10'-0" opening	0.45		$0.37	$1,676.25
○		Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening	0.45		$0.28	$1,269.00
B3010		Roof Coverings			$1.48	$6,663.28
○		Asphalt roofing, strip shingles, inorganic, Class A, 4" slope, 210-235 lbs/SQ	2250		$1.07	$4,815.00
○		Gutters, box, aluminum, .027" thick, 5", enameled finish	140		$0.29	$1,306.20
○		Downspout, aluminum, rectangular, 2" x 3", embossed mill finish, .020" thick	112		$0.12	$542.08
C		**Interiors**		**12.99%**	**$23.25**	**$104,616.26**
C1010		Partitions			$4.50	$20,247.24
○		Wood partition, 5/8"fire rated gypsum board face, none base,2 x 4,@ 16" OC framing,same opposite face, 0 insul	1260		$1.43	$6,426.00
○		Wood partition, 5/8" fire rated gypsum board face, 1/4"sound deadening gypsum board, 2x4 @ 16" OC framing, same opposite face, sound attenuation insul	540		$1.05	$4,735.80
○		Gypsum board, 1 face only, exterior sheathing, fire resistant, 5/8"	5376		$1.22	$5,483.52
○		Add for the following: taping and finishing	5376		$0.80	$3,601.92
○		Wood column, 8" x 8", 20' x 20' bay, 10' unsupported height, 133 BF/MSF, 160 PSF total allowable load	2250		$0.23	$1,035.00
○		Wood beam and joist floor, 12"x16" girder, 8"x16" beam, 2x10 joists @ 16", 20'x20' bay, 75 PSF LL, 102 PSF total load	2250		$7.20	$32,400.00
○		Fireproofing, gypsum board, fire rated, 2 layer, 1" thick, 14" steel column, 3 hour rating, 22 PLF	896		$7.83	$35,212.80
B1020		Roof Construction			$4.05	$18,225.00
○		Wood roof truss, 2' OC, 60' span, 4:12 pitch, 1' overhang, 5/8" sheathing, 1x8 fascia, R30 insulation	2250		$4.05	$18,225.00
B2010		Exterior Walls			$48.28	$217,273.50
○		Stone wall, ashlar veneer, 4" thick, 8' high, 2x4@16" stud back-up, low priced stone	5376		$47.49	$213,696.00
○		Insulation, fiberglass batts, 6" thick, R19	2250		$0.80	$3,577.50
B2020		Exterior Windows			$9.80	$44,118.26
○		Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"	58.43		$9.80	$44,118.26
B2030		Exterior Doors			$1.37	$6,185.25
○		Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening	0.45		$0.72	$3,240.00

C1020		Interior Doors			$3.92	$17,625.00
		Door, single leaf, kd steel frame, hollow metal, commercial quality, flush, 3'-0" x 7'-0" x 1-3/8"	14.42		$3.92	$17,625.00
C1030		Fittings			$0.23	$1,029.38
		Toilet partitions, cubicles, ceiling hung, plastic laminate	1.12		$0.23	$1,029.38
C2010		Stair Construction			$4.41	$19,845.00
		Stairs, steel, pan tread for conc in-fill, picket rail,12 risers w/ landing	1.57		$4.41	$19,845.00
C3010		Wall Finishes			$1.78	$7,988.64
		Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats	3600		$0.71	$3,204.00
		Painting, interior on plaster and drywall, walls & ceilings, roller work, primer & 2 coats	5376		$1.06	$4,784.64
C3020		Floor Finishes			$2.12	$9,531.00
		Vinyl, composition tile, maximum	1350		$0.92	$4,131.00
		Tile, ceramic natural clay	450		$1.20	$5,400.00
C3030		Ceiling Finishes			$6.30	$28,350.00
		Acoustic ceilings, 3/4" fiberglass board, 24" x 48" tile, tee grid, suspended support	4500		$6.30	$28,350.00
D		**Services**		**34.74%**	**$62.16**	**$279,741.38**
D2010		Plumbing Fixtures			$2.16	$9,707.63
		Water closet, vitreous china, bowl only with flush valve, wall hung	1.12		$0.85	$3,825.00
		Urinal, vitreous china, wall hung	0.45		$0.15	$666.00
		Lavatory w/trim, vanity top, PE on CI, 20" x 18"	0.9		$0.28	$1,251.00
		Service sink w/trim, PE on CI,wall hung w/rim guard, 24" x 20"	0.67		$0.58	$2,615.63
		Water cooler, electric, wall hung, wheelchair type, 7.5 GPH	0.67		$0.30	$1,350.00
D2020		Domestic Water Distribution			$0.59	$2,671.88
		Gas fired water heater, commercial, 100< F rise, 100 MBH input, 91 GPH	0.22		$0.59	$2,671.88
D3050		Terminal & Package Units			$18.45	$83,025.00
		Rooftop, multizone, air conditioner, offices, 25,000 SF, 79.16 ton	4500		$18.45	$83,025.00
D4010		Sprinklers			$4.01	$18,048.60
		Wet pipe sprinkler systems, steel, light hazard, 1 floor, 5000 SF	1530		$1.74	$7,848.90
		Wet pipe sprinkler systems, steel, light hazard, each additional floor, 5000 SF	2970		$1.99	$8,939.70
		Standard High Rise Accessory Package 3 story	0.22		$0.28	$1,260.00
D4020		Standpipes			$1.06	$4,784.06
		Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor	0.27		$0.57	$2,571.75
		Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, additional floors	1.01		$0.49	$2,212.31
D5010		Electrical Service/Distribution			$16.09	$72,416.25
		Overhead service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1000 A	1.25		$4.20	$18,906.25
		Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A	100		$5.44	$24,500.00
		Switchgear installation, incl switchboard, panels & circuit breaker, 120/208 V, 3 phase, 1200 A	1.2		$6.45	$29,010.00
D5020		Lighting and Branch Wiring			$13.55	$60,968.00
		Receptacles incl plate, box, conduit, wire, 16.5 per 1000 SF, 2.0 W per SF, with transformer	4500		$5.01	$22,545.00
		Miscellaneous power, 1.2 watts	4500		$0.35	$1,575.00
		Central air conditioning power, 4 watts	4500		$0.63	$2,835.00
		Motor installation, three phase, 460 V, 15 HP motor size	2		$1.16	$5,240.00
		Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF	5175		$6.39	$28,773.00
D5030		Communications and Security			$6.25	$28,119.38
		Telephone wiring for offices & laboratories, 8 jacks/MSF	3375		$1.72	$7,728.75
		Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and wire	0.22		$2.08	$9,360.00
		Fire alarm command center, addressable with voice, excl. wire & conduit	0.22		$0.62	$2,795.63
		Internet wiring, 8 data/voice outlets per 1000 S.F.	3.37		$1.83	$8,235.00
D5090		Other Electrical Systems				$0.58

		Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW	0.45			$0.58
E		**Equipment & Furnishings**		**0.26%**	**$0.47**	**$2,127.00**
E1090		Other Equipment			$0.47	$2,127.00
E1090282313102000	⊕	1.00-Closed circuit television system (CCTV), surveillance, one station (camera & monitor)	1.00		$0.33	$1,475.00
E1090101310102400	⊕	1.00-Directory boards, building directory, aluminum black felt panels, 1 door, 24" x 18"	1.00		$0.14	$630.00
E1090096913100110	⊕	1.00-Access floors, package price, w/ conc. fill panels, 18" ht., including floor panel, pedestal, & stringers, 1500 lbs. load, no finish	1.00			$22.00
F		**Special Construction**		**0%**		
G		**Building Sitework**		**0%**		
		SubTotal		**100%**	**$178.96**	**$805,327.73**
		Contractor Fees (GC,Overhead,Profit)		**25.0%**	**$44.74**	**$201,331.93**
		Architectural Fees		**10.0%**	**$22.37**	**$100,665.97**
		User Fees		**0.0%**	**$0.00**	**$0.00**
		Total Building Cost			**$246.07**	**$1,107,325.63**

Figure 2: Bill of materials estimate for the building

3. Bill of materials / Equipment list

Name	**Quantity**	**Cost**
3mm MDF board	608.68cm^2	$0.00
PLA filament for 0.8mm nozzle	7.58m	$0.00
AutoCAD license	1	$0.00
Laser cutting fees	N/A	$0.00
3D printing fees	N/A	$0.00
total		$0.00

Figure 3: Bill of materials table

4. Project risks and contingency plan

There are several project hazards that might arise when constructing a two-story structure. These include the risk of issues with permits and environmental restrictions, which might cause delays in the project and even financial fines. Due to the unique geology, unforeseen geological and soil complexity, such rock or unstable soil, may arise. This might have a negative impact on project costs and deadlines and need the use of specialist foundation solutions. Construction projects in the area are at danger due to the region's erratic weather patterns, which can result in delays and safety problems. In addition, a lack of experienced workers and a lack of laborers in Ontario's construction sector might cause delays in projects and higher labor expenses. Disruptions to the global supply chain may also have an effect on the price and availability of building supplies, which might have an influence on the project's budget.

Another risk specific to this project is having the client unsatisfied with the final project or aspects of the design. This risk can be managed by having clear communication with the client and constantly seeking feedback.

5. Prototyping test plan

Test ID	Test objective	Description of prototype used and basic test method	Description of results to be recorded and how the results will be used	Estimated test duration and planned start date	Stopping criteria
1	Receiving feedback on the 3D office cubicle model	The walls and floor of the model will be made of 3mm MDF board, and the furniture will be 3D printed. We will show the client the model and ask for their opinions on the layout.	The results will be in the form of feedback from the client, either positive or negative and will be used to rework our design to both meet the client's specific requests for this space and their requests for the overall building, so that neither part causes problems for the other.	The estimated test period for this objective begins with the creation of the model and ends once feedback from clients is given, and could be repeated if the model is changed. This can be expected to take from early november until design day.	It will finish when either the client approves of the design or there is not enough time to remodel the design.

2	Receiving feedback on the current laboratory design	The current blueprint of the building features an open laboratory on the first level of the building. We will show the client this design and express to them our concerns about this design choice.	The feedback will be in the form of feedback from the client on whether or not they would like the current laboratory design to be changed from an open area in the centre of the first floor to be a closed off area on the first floor that could be more conducive to hygiene. From these results, we will either keep the design the same or redesign it to fulfill the client's wishes.	This process should be resolved during the next client meeting on Friday November 10th.	This process will be complete when the feedback from the clients is given, and the group reaches a decision that works with their solution.
3	Receiving feedback on the current building blueprint	We have made a new blueprint of the building that amalgamates the parts of each previous design that the client liked. We will show this design to the client and ask them about their opinions on the new layout.	The results will be in the form of feedback from the client on each individual part of our blueprint. From the results, we will keep the parts they like unchanged, and redesign the parts the client did not like so that the parts are designed the way the client wishes.	This process should be resolved during the next client meeting on Friday November 10th.	This process will be complete when the feedback from the clients is given, and the group reaches a decision that works with their solution.

Figure 4: prototyping test plan table