

CUSTOM BUILD HOME

Design - Site Plan Approval - Building Permit

Our architectural designers design the true site-specific design to build our clients' dream custom build homes. Our designers creatively and cost effectively try their best to incorporate everything possible on our client's dream custom build home wish list. We pride ourselves on work diligently to create real value for each client.

Our Custom Build Home Building Permit Package to obtain Site Plan Approval for a Custom Build Home and Building Permits to construct a typical Custom Build Home up to 3,500sq.ft. is \$8,975^{+HST}.

Our Custom Build Home Building Permit Package includes the following plans, drawings, and reports.

Site Plan:

- ✓ Summary of permitted and proposed zoning provisions for lot area, building area (GFA), coverage, and grade elevations to confirm height.
- ✓ Property lines, lot area, right-of-way or easements (referenced to a current land survey)
- ✓ Overall dimensions of the custom build home (width/length)
- ✓ Proposed finished first floor & basement elevations of the custom build home
- ✓ Location of existing/proposed home with overall dimensions and setback dimensions to lot lines and adjacent homes.
- ✓ Dimensioned parking areas, driveways, hard & soft landscape treatments, accessory structures (sheds, decks, detached garages, etc).

Floor Plans - (Up to 3 Revisions - Any additional revisions to the Floor plans will be billed at \$195^{+HST} per each occurrence) Fully dimensioned, for each level showing uses of all spaces, including location of smoke alarms /carbon monoxide detectors and all plumbing fixtures in the proposed custom build home.

Elevations (Up to 3 Revisions - Any additional revisions to the elevations of the custom build home will be billed at \$195^{+HST} per each occurrence)

- ✓ Exterior finishes with roof slopes, window/door type, locations & sizes including height of sills above floor level of the custom build home.
- ✓ Exterior Cladding Materials Colour Palette Schedule
- ✓ Area of exposed building face, percentage/area of unprotected openings and required limiting distance(s).
- ✓ Exterior decks/landings, stairs, guards/handrails.
- ✓ Floor to floor, floor to ceiling and overall building heights.

Sections - Cross section(s) to show proposed construction of the custom build home and specifications of all floor, wall, & roof assemblies of the custom build home.

Construction Details and Notes

- ✓ Detail stairs, landings, guards & handrails.
- ✓ Building materials & specifications of all wall, floor, and roof assemblies with typical wall section and typical roof detail.
- ✓ Guard details including connection detail.

Site Grading Plan - To ensure that

- ✓ positive storm drainage is achieved according to Municipal Standards
- ✓ proposed grading will not adversely affect abutting properties or cause water to accumulate around the proposed construction.
- ✓ tree preservation is achieved as may be required

Site Drainage Plan - Site Drainage Plan is a necessary component of a custom build home. When a new custom build home is constructed, it is essential that the lot be graded properly to ensure that surface drainage is directed away from the custom build home and so that it does not cause problems or damage to neighbouring properties.

It is also important that the custom build home be elevated so that the top of the foundation wall is at least 150mm (6") above the adjacent ground level, to avoid water entering any masonry weep-holes and to prevent rotting at the bottom plate of the framing.

Downspouts from roofs should discharge at grade onto a splash pad at least one metre away from the custom build home and should not be directed towards adjacent properties nor render any sidewalk impassable. A well-defined swale along the side lot line should be established.

Erosion & Sediment Control Plan - Erosion and sedimentation are naturally occurring processes that involve particle detachment, sediment transport and deposition of soil particles. Construction of a custom build home commonly alter the landscapes where they are located, exacerbating these natural processes. During construction of a custom build home, siltation control methods shall be undertaken around the lot perimeter to prevent erosion and sedimentation on adjacent properties.

Designing and implementing an effective Erosion and Sediment Control Plan is essential for minimizing the potentially adverse environmental effects originating from a construction site of a custom build home. A good Erosion and Sediment Control plan should use a multi barrier approach which includes prevent erosion during the construction process of a custom build home to deal with suspended sediment at the source and minimize sediment transport from leaving the construction site of a custom build home.

Site Servicing Plan - Only single connections are permitted per lot for sanitary sewer, storm sewer and water service for a custom build home.

Typically, water service connections are at a depth of 1.75m at the streetline, located at a minimum of 0.5m from the property line and 19mm in diameter minimum except when the length of the connection from the main to the building setback exceeds 30m, then the minimum size shall be 25mm diameter. Waterboxes are installed on the street side of the streetline and shall not be located in the sidewalk or under a driveway. Minimum required separation between the water service connections and sewer connections is 2.5m.

Before demolishing the existing home, a CCTV inspection shall be performed from the cleanout inside the home to determine whether the condition of the existing service lateral within the municipal Right-of-Way is acceptable for reuse.

Typically, a 125mm diameter single sanitary SDR 28 PVC connection is installed at a 2% minimum grade for each new custom build home with a minimum of 2.75m cover at the streetline. In general, sewer bedding shall be as per OPSD-802.010 for

flexible pipes. If connections have less cover, it may be necessary to raise basement elevations to accommodate connections.

In general, foundation drains are connected to the storm service connection with a minimum 125mm diameter SDR 28 PVC, at 2% minimum grade.

In general, driveways of new custom build homes drain towards the street with slopes range between 2% and 8%. Driveways of custom build home driveways shall be straight and perpendicular to the curb and centred opposite the garage door as much as possible. Curb cuts and driveway edges shall be located with a minimum of 1.2m clearance from all street furniture including light poles, trees, hydro transformers, hydrants, watermain valves and utility pedestals. Deflection of the driveway to accommodate utilities is not permitted. Water boxes shall have a minimum 0.3m clearance from the driveway edge.

Structural:

- ✓ Footing/Foundation Design
- ✓ Floor Framing Plan (including posts, beams, joists, lintels)
- ✓ Roof Framing Plan
- ✓ Joist Layout
- ✓ Truss Layout

Mechanical (HVAC)

- ✓ Mechanical System Layout - Layout of mechanical system at each floor level
- ✓ Mechanical Details - Type, location & size of equipment
- ✓ Heat Loss/Heat Gain Calculations
- ✓ Duct Design
- ✓ Ventilation Design/Calculations
- ✓ Energy Efficiency Design Summary

Stamped engineering shop drawings are required for pre-engineered floor systems and prefabricated roof trusses.

No additional charges for required revisions & changes to our drawings and plans due to the comments from the authorities upon reviewing the drawings prepared by us.

Land Survey

A land survey plan would include the location and dimensions of lot lines of a private lot, survey monumentation (bars), buildings, garages, decks, fences, retaining walls and other major improvements to the lot as well as easements, rights-of-way and other property interests.

An Ontario Land Surveyor is the only person who can confirm lot boundaries. All legal boundary survey work in Ontario must be carried out under the supervision of a licensed Surveyor of the Association of Ontario Land Surveyors. Legal boundary surveying certified by the surveyor confirms that extensive boundary research has been conducted and boundary corners have been marked with iron survey bars.

A survey plan is a representation of the physical conditions of the site at a specific point in time and reliance on any old survey plan should be done with caution, and with an awareness that physical conditions of any site can change with the erection of fences, building additions, and the passage of time. A copy of an old survey may not reflect the way lot is now and may not be useful for legal purposes.

Ontario Land Surveyors provide an expert opinion on the location of boundaries. Ontario Land Surveyors use historical research, knowledge of statute and common law, and the latest technology in measurement and data processing.

Typically, all the construction and development projects commence with a topographic survey (topo). Topographic survey (topo) is the recording of coordinates and height data of natural and man-made features of the landscape for a private lot including spot elevations of important features and requires benchmarks to which ground contours are related.

Architects require Topographic Survey (topo) to prepare proper site plans and design buildings or to decide where proposed buildings can and cannot be constructed on the site.

Engineers need Topographic Survey (topo) to prepare site grading plans, erosion and sediment control plans, drainage plans, site servicing plans, soil management plan, fill control plan, site alteration plan and stormwater management reports.

Topographic surveys (topo) may also be used when creating plans for drainage ditches, grading or other features, using the natural landscape as the basis for such improvements. Topographic Survey and Boundary Plan of Survey can be merged on to one survey plan or shown on separate survey plans.

The following services are included for legal (SRPR) and topographic survey on the property that will be completed in 7 day timeframe.

- ✓ Legal Search at the Toronto Land Registry Office
- ✓ Survey Records Search for Private Survey Notes
- ✓ Fieldwork to complete the topographical and boundary survey - Surveyor's Real Property Report showing Topography (official survey)
- ✓ Locating the buildings and obtain spot geodetic elevations throughout the property as well as finished floor elevations for the subject property and neighbors.
- ✓ Locating all visible utilities such as manholes, catch basins, hydro lines, fire hydrants, etc.
- ✓ Locating the edge of the pavement, curb, driveway, fences, retaining walls, sidewalk, and the centerline of the pavement, trees with associated diameter.
- ✓ Establish the legal boundary of the subject property and showing all the easements.
- ✓ Set two iron bars at the front of the property.
- ✓ Drafting - CAD
- ✓ OLS (Ontario Land Surveyor) time – Plan verification

The typical cost to complete the topographical and boundary survey for an urban infill lot in a subdivision including ALL disbursements is \$1,690^{+HST} which

Weather permitting, upon the receipt of all existing historical documents and plans a new legal/boundary survey with topographic details prepared by a licensed Ontario Land Surveyor could be completed in **seven (7) days**.

Geotechnical Investigation

A Geotechnical Investigation is required to evaluate the subsurface soil conditions including soil bearing capacity, groundwater table, soil infiltration rate, and percolation rate, for the proposed custom build home and provide appropriate recommendations for site preparation, foundation/footing design, drainage and other design and earthwork construction considerations including drainage, backfilling, asphalt pavement design, soil and groundwater conditions (confirming the suitability of soils for infiltration and location of groundwater table) as well as infiltration rates (i.e. percolation rates based on in-situ percolation tests).

A geotechnical assessment to evaluate the subsurface soil conditions including soil bearing capacity, groundwater table, soil infiltration rate, and percolation rate, at the proposed development and provide appropriate recommendations for site preparation, foundation/footing design, drainage and other design and earthwork construction considerations including backfilling, asphalt pavement design by our geotechnical engineer would cost \$3,950^{+HST} plus \$1,490^{+HST} per borehole. The turnaround time for a typical Geotechnical Engineering Evaluation is about 3 to 5 weeks. We would require the site plan of the proposed custom build home and the topographic survey to commence the work.

Fee for our Geotechnical Engineer is to inspect the footing excavation and certify the stability and bearing capacity of the soil prior to construction of a custom build home is \$1,295^{+HST}.

If required,

- **Septic System Design would cost \$1,295^{+HST}**
- **Entrance Permit Design would cost \$1,295^{+HST}**
- **Tree inventory, Arborist Report and Tree Preservation Plan would cost \$895^{+HST} + \$35^{+HST} /Tree**

Our Licensed Professional Engineers and Architectural Designers specializing in designing custom build homes offer Custom Build Home Building Permit Package to obtain site plan approval and building permits to construct new custom build homes in Ontario including Toronto ([City of Toronto](#)), Hamilton ([City of Hamilton](#)), Oshawa ([City of Oshawa](#)), Pickering ([City of Pickering](#)), Clarington ([Municipality of Clarington](#)), Ajax ([Town of Ajax](#)), Whitby ([Town of Whitby](#)), Brock ([Township of Brock](#)), Scugog ([Township of Scugog](#)), Uxbridge ([Township of Uxbridge](#)), Burlington ([City of Burlington](#)), Halton Hills ([Town of Halton Hills](#)), Milton ([Town of Milton](#)), Oakville ([Town of Oakville](#)), Brampton ([City of Brampton](#)), Mississauga ([City of Mississauga](#)), Caledon ([Town of Caledon](#)), Vaughan ([City of Vaughan](#)), Aurora ([Town of Aurora](#)), East Gwillimbury ([Town of East Gwillimbury](#)), Georgina ([Town of Georgina](#)), Markham ([City of Markham](#)), Newmarket ([Town of Newmarket](#)), Richmond Hill ([Town of Richmond Hill](#)), [Whitchurch-Stouffville](#) ([Town of Whitchurch-Stouffville](#)), King ([Township of King](#)), Bradford-West Gwillimbury ([Town of Bradford-West Gwillimbury](#)).

Land & Building Experts

Professional Engineers Ontario

Certificate of Authorization # 100205934

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**LAND &
BUILDING
EXPERTS**

Minor Variance

Municipal Zoning By-laws help guide development and protect the rights of residents. If the property is covered by a site plan control by-law, building permit for the proposed development of a custom build home will not be issued until the plans and drawings for the proposed custom build home have been approved by the municipality. In addition to the planning approval and building permit which are required to construct a custom build home, other permits and approvals including Conservation Authority may be required.

Zoning by-law rules that apply to the property must be determined during the preliminary planning stage of a custom build home project. Municipal Zoning by-laws regulate the use, size, location and types of custom build homes permitted on property. The Municipal By-law contains a wide array of land use and development regulations that must be met before a property can be used or a custom build home erected.

The regulations address such matters as:

- Setbacks from the property lines
- Height
- Floor areas
- Lot coverage (usually a maximum percentage of the lot that may be covered)

When a building permit application is made for a custom build home, the Municipal Building Department staff will make a comparison between the proposed custom build home and the minimum development requirements set out in the municipal zoning by-law. If one or more municipal zoning by-law requirements cannot be met and it is not possible to revise the proposed custom build home to fully conform to the municipal by-law, you are provided the option of seeking minor variance approval. If all provisions of the municipal by-law are met no minor variance approval is required and you may proceed to the next step in the building permit application process for the custom build home. Minor Variances for a proposed custom build home are heard by the Committee of Adjustment.

The owner of any land, or any person authorized in writing by the owner who is unable to comply with the provisions of the Zoning By-law for the construction of

a custom build home may apply to the Committee of Adjustment by means of an "Application for Minor Variance". A Minor Variance provides approval for the proposed custom build home that does not fully comply with the Municipal Zoning By-law. A Minor Variance will not change the Zoning By-law, it merely grants a relief from certain existing provisions/standards of the By-law, where appropriate for the proposed custom build home.

The Planning Act directs that the Committee of Adjustment must be satisfied that an application for a minor variance on four points — that the variance requested maintains the intent and purpose of the Official Plan and Zoning By-law; that it is considered desirable for the appropriate and orderly development or use of the land; and that the variance(s), in the view of the Committee is truly minor in nature. The Committee of Adjustment operates as a quasi-judicial tribunal in accordance with the authorization granted to it under the Planning Act. The Planning Act directs the Committee with respect to the scope of its authority; the considerations that it must have when making any decision on an application presented to it; and the administrative provisions it must comply with regarding notice of Minor Variance applications and hearing procedure.

A Notice of Hearing Sign for your minor variance application under Section 45(1) or application for permission under Section 45(2) of the Planning Act will be provided by the Secretary-Treasurer of the Committee of Adjustment.

This sign must be posted at least 10 days before the actual Committee of Adjustment meeting date to comply with the requirements of the Planning Act. The sign must be attached to a stake and put in the ground in the boulevard in front of the property so that it is clearly visible from the road.

Once the sign has been posted the municipality must be notified. Failure to comply will result in the application for the minor variance being tabled until the next available Committee of Adjustment meeting and until the sign is posted and the applicant has complied with the requirements of the Planning Act. Remove the sign 21 days after the Committee of Adjustment has made a decision on the application for the minor variance. Minor Variances may be granted provided that, in the opinion of the Committee of Adjustment, the request is minor in nature, is desirable for the appropriate development or use of the land and if in the opinion of the Committee of Adjustment, the general intent and purpose of the Zoning By-law and the Official Plan are maintained.

Relief from the provisions of Zoning By-Laws may be required to permit reduced lot frontages, reduced minimum interior side yard setbacks, increased building height, increased maximum gross floor area and increased maximum lot coverage to accommodate the construction of a typical 2 storey custom built home.

Our fee for applying for the required minor variances to construct a custom build home, on behalf of the property owner and attending a committee of adjustment meeting is \$795^{+HST}

Septic Design - Septic Design for Septic Permit

Our licenced Professional Engineers have extensive experience in designing onsite septic systems for custom build homes in Ontario. Properties in rural areas rely upon onsite septic systems for their sewage disposal. In the 1970s, the responsibility for overseeing the installation of commercial septic system systems in Ontario was transferred from the Ministry of Health to the Ministry of Environment. Afterwards, regulations governing private onsite septic systems were then transferred from the Ministry of Environment to the Ministry of Municipal Affairs and Housing and subsequently incorporated into the Ontario Building Code.

Part 8 of the Ontario Building Code governs the design, construction, operation, and maintenance of onsite septic systems up to a capacity of daily sewage flow of 10,000 litres on one individual lot. The local municipality's Building Department examines building permit applications for proposed construction of a septic system, issues building permits for construction of septic systems, and does inspections for septic systems regulated under the Part 8 of the Ontario Building Code.

The Municipality / Health Unit Officials regulate the design, construction, and approval of on-site private sewage systems with a design capacity of less than 10 000 litres per day.

The two main factors that dictate the size and complexity of a septic system are the maximum amount of wastewater that the building could produce on a daily basis, and soil/site conditions.

Geotechnical investigation including proper soil testing ensures the septic system meets the specific requirements of a site. Enlisting the help of a qualified and registered professional engineering firm is a key element to the successful septic system design.

Our licensed professional engineers design onsite septic systems that will work best for the proposed custom build home based on the specific site-specific characteristics including:

- Soil conditions (percolation rate, soil type and depth)
- Height of groundwater table and bedrock
- Nature of the wastewater produced
- Sewage flow per day

The rate at which the wastewater will be absorbed into the soil is called a "T" time. "T" time is equal to the number of minutes it takes for the water level to drop per cm in a water filled hole in the receiving soil. In sandy soil a typical T time is less than 10 (meaning it took less than 10 minutes for the water level to drop 1 cm in the water filled hole). But in sandy loam soil the T time could be 20 or more because the smaller soil particles are slowing the rate of absorption. The worst soil though is clay where the T time is typically well over 50 because clay particles are so fine and tightly packed.

Once the maximum amount of wastewater that the proposed custom build home could produce daily (Daily Sewage Flow) and the "T" time is identified, we can then figure out how large the septic system has to be. Each type of system then has a different equation to be used to figure out the size of the septic system for a custom build home.

Ontario Building Code Design Standards

General Requirements

Site Evaluation

- (1) A site evaluation shall be conducted on every site where a new sewage system is to be installed.
- (2) The percolation time shall be determined by,
 - (a) conducting percolation tests, or
 - (b) classifying the soil according to one of the following methods,
 - (i) the Unified Soil Classification System as described in MMAH Supplementary Standard SB-6, "Percolation Time and Soil Descriptions", or
 - (ii) the Soil Texture Classification as described in Chapter 3 of USDA, "Soil Survey Manual".
- (3) Where the percolation time is determined by a percolation test, there shall be a minimum of 3 locations selected, suitably spaced to accurately evaluate the leaching bed area, with the highest percolation time of the tests being used.

Minimum Clearances

For Septic Treatment Units

Structure	1½m
Well, Lake, Pond, Reservoir, River, Spring, Stream	15m
Property Line	3 m

For Septic Distribution Piping

Structure	5m
Well with a watertight casing to a depth of at least 6 m	15m
Any other well	30m
Well, Lake, Pond, Reservoir, River, Spring, Stream	15m
Property Line	3m

On-site private septic system has two basic parts: a septic tank which receives the untreated sewage and in which solids settle out, and a leaching bed (tile bed) through which the liquid waste portion of the sewage is dispersed into the soil.

The main function of the septic tank is to allow solids to settle and to let clear effluent flow to the tile bed. Biological reactions within the septic tank will break down some solids to liquids and gases, but the retained solids will eventually accumulate in the septic tank. Only clear liquid waste should be discharged from the septic tank to the septic tile bed. This liquid waste will then undergo further biological break-down and treatment. To ensure efficient operation of the entire septic system, it is important that the sludge, scum, and solids which can accumulate in the septic tank do not enter the septic leaching bed (tile bed). The septic tank should be inspected by a licensed professional at least once every two years and the septic tank shall be pumped out when necessary.

Design of an onsite septic system for new custom build home is always a challenge because of the very limited area available for the septic system due to the required minimum setbacks from the well, property lines and the proposed custom build home.

Advanced septic treatment systems are required when:

- dealing with properties with inadequate conditions for conventional systems
- coping with small lots that cannot accommodate the size of conventional leaching bed
- building on hard-to-access properties where finding and/or transporting traditional materials for conventional systems is costly or difficult
- wanting to provide additional protection to groundwater by additional nitrate reduction which some of the treatment units could provide

Septic tanks do not use oxygen as part of the septic treatment. This is known as anaerobic treatment. Advanced septic treatment units use oxygen to enhance septic treatment. This is known as aerobic treatment. Aerobic septic treatment units treat septic sewage by adding air. Aerobic septic treatment units inject and circulate air so that oxygen-dependent bacteria can thrive. The bacteria break down organic matter, reduce pathogens and transform nutrients (e.g., ammonia to nitrate). Aerobic septic treatment units often have a pre-treatment tank where the scum and solids are separated and stored before the effluent is passed to an aeration chamber. At the aeration chamber, air is added to the effluent, which allows the bacteria to feed on the contaminants thereby producing cleaner effluent. Generally, Aerobic septic treatment units are classified based on the status of bacteria in the wastewater within the treatment unit. Bacteria are either suspended in the liquid or attached to some media. Aerobic septic treatment units require air compressors and in most cases pumps, and use an area bed or shallow buried trench for final distribution and treatment

In suspended growth septic treatment units, wastewater flows from the pre-treatment tank into the aeration chamber where an air compressor and air diffuser supply oxygen and mix the liquid waste. The air keeps the bacteria “suspended” or floating in the liquid waste. It does not attach to any surface. The oxygen supports the growth of the bacteria and other micro-organisms that break down the wastewater and solids. The effluent then flows into a shallow buried septic trench or area bed. Suspended Growth Treatment Units presently used in Ontario include, [Aquarobic](#), [Biocycle](#), [Clearstream](#), [Norweco Singulair](#), and [WSB](#).

In attached growth treatment units, wastewater from the pre-treatment tank flows into an aeration tank that contains pieces of plastic or other synthetic material. Attached growth units rely on oxygen-dependent bacteria to break down wastewater and solids like suspended growth units. The difference is that attached growth units let the bacteria attach, grow and thrive on the synthetic material (e.g., plastic shavings, balls, etc.). An air diffuser provides continuous aeration around the synthetic material to enhance bacterial activity and waste treatment. Some attached growth treatment units require an air compressor. The effluent then flows to a shallow buried trench or area bed. Attached growth treatment units presently used in Ontario include [Bionest](#), [Bio-Microbics](#) — FAST, [Nayadic](#), and [Rotordisk](#).

The [BIONEST](#) system is an advanced generation of onsite wastewater treatment systems. It is a biological process consisting of an extended aeration fixed film reactor. Biomass (good bacteria) develops and firmly attaches to both sides of the BIONEST ribbon shaped polymer media. The high population of bacteria and the support offered by the media for their growth provide the reactor with an outstanding performance level and resistance to hydraulic shock (peak flow). Unlike activated sludge systems which require daily sludge ‘wasting”, the extended retention time in the BIONEST system minimizes the biological sludge production. The BIONEST system is designed to ensure sufficient opportunity time for the biomass to remove pollutants. The major portion of the reactor is aerated through linear air pumps and fine bubble diffusers, which provide turbulent conditions to ensure enhanced treatment. Multiple pumps are used to supply air to the reactor allowing for redundancy, thus ensuring continuous treatment even during maintenance or failure of one or more air pumps. In the remaining portion of the BIONEST reactor, a high level of dissolved oxygen further assists in the oxidation process, in a calmer environment.

This calm zone ensures that no solids escape the reactor and that the final effluent is extremely clear. The BIONEST system incorporates a recirculation loop that makes the system a multi-pass process bringing performance to a very high level. Filtration units utilize trickling filter technology. Wastewater flows to a pre-treatment tank. Wastewater then flows from the pre-treatment tank into the filtration unit that is filled with materials such as peat moss, sand or a synthetic medium. As the wastewater trickles or percolates down through the filtration unit, a bacterial slime grows and thrives. Typically, trapped air fills the voids in the medium and encourages aerobic conditions where bacteria break down the waste as it slowly moves through the filter medium. The effluent then flows to a shallow buried trench or an area bed for final distribution and treatment in the soil. Filter beds can be made verifiable by installing underdrains, which would keep the sand free-draining and aerobic. High-quality effluent from filter beds, peat or foam filters can then be placed in a “shallow area bed” for low-risk disposal. The shallow area septic bed technology, used in Ontario since 1994, affords a two-stage filtration septic treatment train. The “roughing filter” of sand, peat or foam removes ~95% of the organics and >99% of E. coli.

The second “polishing filter” is the fine sand layer in the shallow area septic bed that removes the remaining E. coli for a total of 99.9993% removal before entering the natural environment. The soil and the groundwater are both protected, and health risks are minimized.

The double safeguard of septic filtration treatment followed by filtration disposal is like the preferred “multiple-barrier” approach to drinking water safety. The multi-barrier approach or defence in depth has been an approach which has long been used by the drinking water industry to provide safe and secure supplies of drinking water. The single biomat barrier in soil based septic systems does not provide the safety of the multiple-barrier approach.

Synthetic Media Filter Treatment Units presently used in Ontario include [Waterloo Biofilter](#) and [Orenco AdvanTex](#). The Waterloo Biofilter is an aerobic trickling filter that uses an absorbent synthetic filter material developed by researchers at the University of Waterloo and first installed in Ontario in 1991. Septic tank effluent is applied intermittently to the top of the filter media.

The synthetic media is a support for microbiological growth, and these microorganisms are responsible for the aerobic breakdown of the wastewater. The core of the Waterloo Biofilter system is a synthetic, absorbent filter medium that is configured as a free draining, attached growth, biological trickling filter to treat sewage and process wastewaters.

This patented, engineered Waterloo Biofilter medium is consistent in its physical properties and has been optimized to:

- Be stable and consistent over very long periods of time without the need for cleaning or replacement
- Maximize the surface area to volume ratio thereby reducing the system footprint
- Accept very high, long-term loading rates without plugging or compromising treatment – typically up to 10 times greater than sand filters or soils
- Simultaneously provide aerobic, anaerobic, and anoxic environments for biological treatment – without air compressors and their high energy use and aerobic sludge production
- Absorb and retain wastewater thereby increasing retention time and providing higher levels of treatment
- Maintain biological populations even during periods of no use – enabling consistent treatment levels in seasonal applications like cottages, golf courses, and campgrounds
- Eliminate short-circuiting of untreated sewage to the environment during events such as surge flows or power failures

The absorbent Waterloo Biofilter filter medium creates an ideal environment for microbial attachment. Beneficial bacteria colonize the interior surfaces of the absorbent Waterloo Biofilter filter medium where they are protected from predators, desiccation, and freezing. These microbes degrade and oxidize organic pollutants, coliform bacteria, ammonium, and other contaminants as the wastewater is retained in the absorbent Waterloo Biofilter filter medium by capillarity. Air passively circulates throughout the absorbent Waterloo Biofilter filter medium providing an aerobic treatment environment without the need for forced aeration. This attached growth process (also referred to as a fixed film process, intermittent filter, packed bed media filter, or percolating filter) outperforms activated sludge or suspended growth (suspended sludge) processes with lower energy requirements, fewer moving parts, simpler operation, less maintenance, and a better ability to handle shock loads of chemical addition or hydraulic overloads. Waterloo Biofilter is proven in frigid -50°C temperatures, treating cold sewage with influent temperatures as low as 3°C.

Compared to other media-based trickling filters, the Waterloo Biofilter does not slough off microbes in the form of aerobic sludge, maintains high treatment levels even in very cold climates, has longer retention times, and can accept much higher organic and hydraulic loads without plugging. Waterloo Biofilters consistently provide tertiary, sand filter quality effluent (< 10 mg/L cBOD & TSS) that is clear and odourless. Highly treated effluent is easily and safely dispersed back into the soil via small, shallow disposal beds or trenches, or can be reused onsite for purposes such as irrigation, truck washing or toilet flushing.

Peat Filter Treatment Units presently used in Ontario include [Premier Tech — Ecoflo](#) and [Puraflo](#). The Ecoflo Biofilter is a trickling filter that uses peat to treat wastewater. The Ecoflo Biofilter consists of an open-bottomed fibreglass shell full of harvested peat. Effluent from a septic tank is delivered by pump or by gravity (depending on relative elevations) to the top of the peat media. Wastewater percolates downward through the peat and then through the infiltration zone, which consists of 200 mm of clear stone & 300 mm of clean sand. After moving through this infiltrative zone, wastewater infiltrates into the native soils. The peat acts both as a place for aerobic bacteria to anchor and treat wastewater as it passes through the filter and as a physical filter. Some limited chemical reactions are also achieved. Aeration of the unit is passive, i.e. there are no blowers or fans to enhance air movement through the peat. The peat must be replaced approximately every 8 years.

Sand Filter Treatment Units presently used in Ontario include [Orenco](#).

Advanced septic treatment systems are very effective in treating septic sewage. With cleaner effluent leaving these advanced septic treatment systems, the size of the soil component (leaching bed) that is needed to complete the septic treatment is smaller than for those using septic tanks only. Advanced septic treatment systems could use one of two small leaching bed systems that are currently approved or authorized in Ontario: shallow buried trench and area bed. Advanced septic treatment systems can be used with a variety of above ground and in-ground distribution options and offer several unique final distribution options.

Advanced control panels, auto-dialer alarm systems, and remote monitoring service make operation of the septic system simple and efficient.

Effluent Filter

An effluent filter installed at the outlet of the septic tank, dramatically improves the quality of effluent being discharged to the leaching bed, effectively extending its life. The addition of an effluent filter to all systems is strongly recommended. Sewage enters the first chamber of the septic tank through an inlet baffle or tee. Most of the larger particles settle out and the effluent enters the second chamber. The second chamber (much smaller than the first) further enhances the settling process. If flows are heavy at times, solids can pass through both compartments and enter the leaching bed. The effluent filter minimizes this. Effluent filters in accordance with [NSF/ANSI 46](#), "Evaluation of Components and Devices Used in Wastewater Treatment Systems" must now be sized to filter out particles of 1.6 mm [1/16"] and have a minimum area of 550 cm²[85 in²], in addition to being installed in accordance with the manufacturers requirements.

Effluent filters:

- Assist in the settling of both large and small particles,
- Help slow down sewage flow to further enhance particle settling before damage is done to the leaching bed.
- Improves effluent quality.
- Extends leaching bed life.
- Can be used in any septic tank.
- May be installed in a new system or retrofitted into an existing septic tank.
- Corrosion proof construction.
- Relatively simple installation.
- Simple maintenance.
- Can be equipped with an alarm to warn that filter needs cleaning.

Pumps and Siphons

- Where the total length of distribution pipe required is 150 m or more, the sewage system shall have at least one pump or a siphon contained in a dosing tank that may be a separate compartment within the tank structure, for distribution of the effluent.
- Alternating siphons shall not be installed in a sewage system.
- Where 2 or more pumps are employed within a dosing tank, the pumps shall be designed such that the pumps alternate dosing, and dosing shall continue in the event that one pump fails.
- Where a pump or siphon is required, the pump or siphon shall be designed to discharge a dose of at least 75% of the internal volume of the distribution pipe within a time period not exceeding fifteen minutes. Septic systems dispose of sewage and rely on the soil to absorb and disperse wastewater. They are designed to keep effluent underground and to filter wastewater before it reaches groundwater, streams or lakes. "Sewage" can include domestic wastewater from toilets, showers and bathtubs and kitchen and laundry wastes.

Area Bed

An area bed is an infiltrative zone similar to that of a filter bed. Area beds have very small footprints, are only allowed in conjunction with alternative treatment units providing tertiary level treatment.

Area bed generally consists of a clean stone layer 250 mm thick underlain by a sand layer 200 to 300 mm thick. The sand layer may vary in depth and size depending on the septic treatment unit being used. Some advanced septic treatment systems have open bottoms that sit right on top of the stone layer while others have distribution network of PVC laterals placed in the stone layer for effluent distribution. Typically, effluent from the advanced septic treatment system will flow by gravity to an area bed. However, some systems have a pump as an integral part of the system, and sometimes a pump is added to overcome an elevation difference between the advanced septic treatment system and the area bed. The header and distribution pipes within area beds must be designed and built in such a way that they can be detected by one of the following:

- Magnetic means.
- 14-gauge TW solid copper light colored plastic coated tracer wire.
- Any other type of subsurface detection.

Landscape design should not interfere with the natural functioning of a septic system. A balanced combination of oxygen and organisms will maintain healthy soils necessary for the septic system.

Shallow Buried Trench

A shallow buried trench is an alternative to a conventional leaching bed. Shallow buried trenches may only be used when the wastewater has been treated to tertiary standards. A shallow buried trench consists of small-diameter PVC laterals running through open-bottom plastic chambers. The laterals are perforated at regular intervals on the top of the pipe. Effluent from the advanced septic treatment system is pumped under pressure through distribution pipes at regular intervals (time-dosed). When the dosing pump is activated, wastewater is forced along the entire length of the lateral and sprayed upwards where it hits the chamber and trickles down into the soil. By sizing the pump correctly, the entire footprint of the system is dosed at the same time, ensuring much more efficient distribution and use of the soil absorption system. This pressurized distribution allows for small doses to be evenly distributed along the entire length of the trench and greatly enhances the soil's ability to receive and treat the effluent.

Shallow buried trenches are typically installed in the natural soil close to the surface of the ground, allowing plant roots and bacteria in the soil to take up additional nutrients. Shallow buried trenches can be installed as one row or several rows to meet minimum trench length standards as required by the Ontario Building Code. This method is versatile because the septic trench can follow an irregular pattern (e.g., around trees). The footprint of a shallow buried trench system is much smaller than a conventional system, because the soil is not relied upon to complete very much treatment. In addition, shallow buried trenches may be installed in native soils with a T-time up to 125 min/cm. Shallow buried trench system is appropriate for sites with a high water table, shallow depth to bedrock or tight soils.

Ontario Building Code Requirements for Shallow Buried Trench Construction

- The treatment unit used in conjunction with a leaching bed constructed as a shallow buried trench shall provide an effluent quality that does not exceed 10 mg/L Carbonaceous biochemical oxygen demand (cBOD) & Suspended Solids (TSS) concentrations
- The effluent shall be distributed through a pressurized distribution system having a pressure head of not less than 600 mm when measured to the most distant point from the pump.
- The pump chamber shall be sized to provide sufficient storage volume so that the effluent is evenly dosed on an hourly basis over a 24-hour period.
- A shallow buried trench shall not be constructed unless the soil or leaching bed fill is sufficiently dry to resist compaction and smearing during excavation.
- Every chamber shall be as wide as the shallow buried trench in which it is contained, and the cross-sectional height of the chamber at its centre point shall not be less than half the width of the trench.
- Every chamber shall contain only one pressurized distribution pipe.

Reduce the use of phosphate-based detergents, soaps, and cleaners since phosphorus in detergents, soaps and cleaners doesn't break down in a septic system. When the phosphorus leaches into nearby bodies of water, it can promote algae growth and can impair water quality and fish habitat.

[CAN/BNQ 3680-600](#) Canadian national standard is based on the methodology of standard NSF 40 for onsite residential wastewater treatment technologies. Similar to standard NSF 40, the CAN/BNQ 3680-600 standard includes a six-month period with limitations and frequent sampling; this period is followed by an additional six months of less frequent sampling to verify the reliability of the treatment system during the four seasons of the Québec climate.

Effective January 01, 2017, CAN/BNQ 3680-600 replaced the criteria for treatment units set out in the 2012 Ontario Building Code, and the list of treatment units found in Supplementary Standard SB-5 which are deemed to meet these Code requirements. To be certified under CAN/BNQ 3680-600 and maintain a valid certification, all treatment units shall, in addition of the certification Standard, comply with the Protocol (Policies) BNQ 3680-900 defining all the terms and conditions required to maintain a product's certification. Once a year, the BNQ will refer to the manufacturer's database to select randomly a number of 10 sites to be inspected and sampled. The entire process is managed by the BNQ.

During the visit, the independent assessor shall first ensure that the system is functioning correctly and is receiving design flows and loads. 24h composite sampling will be performed by a local accredited laboratory. The manufacturer should be free to choose a representative of his choice to accompany the laboratory technician and the independent assessor. If the system is not functioning correctly and the device or component responsible for the malfunction is not manufactured by the manufacturer, the assessor shall advise in writing only the owner of the malfunction. In all other cases, the assessor shall advise in writing both the owner and the manufacturer

Effluent from 80% of the sites inspected shall comply with the performance standard applicable for the said system. If not, a resampling is performed for the non-complying results. If the 80% of compliance is still not reached, another series of samples from systems that obtained substandard results shall be drawn. If the results of these new analyses confirm initial results obtained and more than 20% of the systems remain substandard, another set of new site inspection/sample equal to twice as many sites as initially will have to be carried out. In this case, it is mandatory that 80% of the sites be compliant. All costs are entirely at the manufacturer's expense. Manufacturer shall be kept informed of all results coming out of this process and, when applicable, informed in writing of any non-conformities and corrective measures required to assure the compliance of the systems under investigation. Manufacturer shall introduce appropriate changes and advise certification and regulatory entities in writing. Some cases of nonconformity may require an additional audit visit and testing.

In cases where the non-conformity is caused by occupant overloading or abusing the system and that the owner does not agree to a modification to the design, the manufacturer shall notify the regulatory agency that shall be responsible to require compliance. Tests are conducted according to the procedures specified in the Certification Requirements for CAN/BNQ 3680-600 and compliance to the requirements (80%) is part of the conditions for certificate renewal every 2 years. Failure to successfully pass the field performance audit process could lead to certification revocation and consequently automatic de-listing of the product from BNQ official public listing.

Our licenced Professional Engineers design variety of advanced, innovative, predictable, permanent, robust, cost-effective, compact, low energy, low maintenance, visually subtle, and efficient onsite septic systems for off-sewer developments including custom build homes in Ontario.

Our septic system designs meet requirements of Ontario Building Code and Ministry of the Environment and Climate Change, and offer the most affordable, long-lasting site-specific septic system design. Inappropriate septic system design, bad construction practices, or poor maintenance can all lead to septic system failure.

A small house with a maximum daily flow rate of about 1,000 liters / day, and if that system is being installed in sandy soil (which has a high absorption rate) then the system could be quite small and be installed at a cost of a few thousand dollars. On the other hand, a big custom build home with a maximum daily sewage flow rate of 9,000 Litres / day and hard clay soil (which can only absorb 4 litres, per square metre, per day) then the cost could be over \$50,000 because a tertiary system may need to be installed.

The Ontario Building Code - Septic Tanks

8.2.2.3. Septic Tanks

- (1) The minimum working capacity of a septic tank shall be the greater of 3 600 L and,**
 - in residential occupancies, twice the daily design sanitary sewage flow, or
 - in non-residential occupancies, three times the daily design sanitary sewage flow.
- (2) Every septic tank shall be constructed in such a manner that any sanitary sewage flowing through the tank will pass through at least 2 compartments.**
- (3) The working capacity of the compartments required in Sentence (2) shall be sized such that,**
 - the first compartment is at least 1.3 times the daily design sanitary sewage flow but in no case less than 2 400 L, and
 - each subsequent compartment shall be at least 50% of the first compartment.
- (4) Where multiple tanks are to be used to meet the requirements of Sentences (2) and (3), the tanks shall be connected in series such that,**
 - the first tank in the series shall have at least a capacity as calculated in Clause (3)(a), however at no time shall a tank having a working capacity of less than 3 600 L be used,
 - all additional tanks after the first tank, excluding pump or dosing tanks shall have at least a working capacity equal to the volume required by Clause (3)(b),
 - the pipe between the outlet of one tank and the inlet of the next tank in the series shall have a minimum slope of 2%,
 - there shall be no partitions in the tank except where a partition is required to maintain the structural integrity of the tank, in which case openings within the partition shall be provided to allow the free movement of sanitary sewage throughout the tank, and
 - all piping between tanks shall be continuous and shall be connected to the tank through the use of flexible watertight seals that will permit differential movement between the tanks.

(5) Partitions separating the septic tank into compartments shall extend at least 150 mm above the liquid level at the outlet, and there shall be one or more openings through or above the partition.

(6) The openings required between compartments referred to in Sentence (2) shall have a total cross-sectional area of at least three times the area of the inlet pipe and be located between the top and a level 150 mm above the liquid level at the outlet to provide for the free flow of air between compartments.

(7) sanitary sewage shall pass from one compartment to another of the septic tank as follows:

- **by means of a device similar to that described in CSA B66, "design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks" for outlet devices, or**
- **through two or more openings through the partition located in a horizontal line, and evenly spaced across the width of the partition, centred at approximately 40% of the liquid depth below the surface of the liquid, and having a total area of between three and five times that of the cross-sectional area of the inlet pipe.**

(8) A septic tank shall be of such design and construction as will permit the collection and holding of sanitary sewage in it to a depth of not less than 1 000 mm, except that a depth of not less than 900 mm is permitted where the excavation is in rock, or to avoid rupture or displacement of the tank due to ground water pressure.

(9) Except as provided in Sentences (10) and (11), every septic tank shall be installed in such a manner that the access openings are located not more than 300 mm below the ground surface.

(10) Where the top of the septic tank is located more than 300 mm below the ground surface, it shall be equipped with risers that extend from the access opening of the septic tank to within 300 mm of the ground surface.

(11) Where risers are used, they shall conform to the requirements of CSA B66, "design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks", and shall have adequate access openings to allow for regular maintenance of the septic tank

Our fee to prepare a typical residential septic design with stamped engineering drawings and plans to obtain septic permit for a proposed custom build home is \$1,295^{+HST}.

The septic contractor may have to contact Municipality / Health Department Officials to determine their requirements and if they need inspectors on site for the test pit investigation / assessment and number of test pits and arrange for septic test pit digging equipment based on site accessibility.

Reverse Slope Driveway

A reverse slope driveway is a driveway that leads downward from a public street to a parking area, such as a below-grade garage or in the lower levels of a building, are common to many land uses including in most large buildings, such as offices and apartments. The issue that is of concern in this situation is where a reverse slope driveway is leading downward from the street into a parking area in the lower level in a house – usually detached or semi-detached homes, and individual townhouse units that front onto a street. Reverse slope driveways have been the subject of several criticisms, ranging from safety to aesthetics; but the prime focus of attention is on the high risk of basement flooding posed by reverse slope driveways. Several municipal zoning regulations prohibit the construction of any new reverse sloped and below grade garages for new custom build homes. Some builders apply to the Committee of Adjustment to allow reverse sloped driveways when they are currently not permitted. Now municipalities in Ontario require that the proposed new reverse slope driveway design shall address a 100-year storm protection.

The City of Toronto's Zoning By-Law 569-2013 prohibits the construction of below-grade garages and reverse slope driveways for new single dwelling residential homes anywhere in the city. If you want to build a below-grade garage which needs a reverse slope driveway, you must apply for an exemption through a Minor Variance Application or a Re-zoning Application, depending on your development type. As part of the process of applying for a reverse sloped driveway, you may be required to have a Toronto Water Technical Review, if:

- The Committee of Adjustment's Notice of Decision or an Ontario Municipal Board decision requires a technical review and approval by Toronto Water for a reverse slope driveway.
- A technical review is requested through a re-zoning application approval process for a reverse slope driveway.
- The application proposes a storm connection to the City's sewer system to discharge water from the reverse slope driveway's trench drain.

We prepare a Stormwater flow analysis to identify the stormwater flow at the reverse slope driveway and the required features to drain it out for any proposed construction containing a reverse slope driveway and a below grade / underground garage.

We always propose high point of the reverse slope driveway higher than the centerline of the road elevation and design a trench drain and sump pump. No area other than the reverse slope driveway shall drain to the proposed trench drain up to 100-year storm event. Estimated flow from a 100-year storm is utilized to establish the required settling tank volume and sump pump capacity.

We also calculate the required backup electrical power (inverter/charger and batteries) for both primary and backup pumps in the event of temporary electrical failure.

The duplex sump pump system shall be factory pre-assembled with pumps, discharge pipe nipples, and floats pre-mounted in the basin. Floats shall be tethered to a removable standpipe/access cover assembly.

The cover shall be “heavy duty” 6mm steel plate, enamel-coated on both sides. The cover shall be fitted with two 400mm diameter pump openings, and one 250mm diameter inspection cover with integral standpipe for float tethering. All cover hardware shall be stainless steel.

The basin shall be constructed of heavy-duty polyethylene. The inlet hub shall be 100mm and preassembled to basin. The basin shall have “torque-stops” to locate and retain the pump in its proper position.

The vehicle geometry that causes the undersides of vehicles to drag on the pavement surface is a combination of ground clearance height and the wheelbase.

Adequate axle-to-axle ground clearance shall be provided to prevent underside drag at the sloped driveway for a typical vehicle with wheelbase from 2.6 m to 2.8 m.

A splash pad shall be provided at the outlet of the pump and outflow shall not enter into the neighbour’s property. The trench drain and the sump pump shall be inspected after every storm event and shall be kept clean and free of debris and silt.

SOLAR READY

Install a minimum of one 39mm (1.5") conduit from the electrical room to the attic should the homeowner want to install a solar panel in the future. The conduit should be metal, rigid PVC, liquid tight flex or metallic tubing and be in a straight line if possible. The Conduit shall be stubbed in the attic with the top is above the insulation and has a pull string.

Provide a small area near the electrical panel to provide more flexibility should the homeowner want to install a string inverter in the future.

For further information about solar-ready technical guidelines visit the following link:

https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/files/pubs/SolarReadyGuidelines_en.pdf

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