

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

§16.3.2.11 **Commercial (C-1, C-2, C-3).**

A. Purpose.

- (1) The purpose of the Commercial (C-1, C-2, C-3) Zones is to provide general retail sales, services and business space within the Town in locations capable of conveniently serving community-wide and/or regional trade areas and oriented primarily to ~~automobile-~~ vehicular access. Additionally, in the C-1 and C-3 Zones where significant existing infrastructure, minimal existing residential development, and the presence of under-developed or under-utilized commercial lots allows, development of a range of dwelling unit types is encouraged. To reflect the differing character of various parts of the commercial areas, it is divided into three zones that are shown on the Zoning Map:

C-1	Route 1 Commercial Zone
C-2	Route 236 Commercial Zone
C-3	Bypass/Old Post Road Commercial Zone

- (2) Where the standards or requirements for the zones vary, the provisions for the zone in which the parcel is located apply.

B. Permitted and special exception uses for each of the Commercial Zones follow: ~~The following uses are permitted in the Commercial Zones:~~

(1) **C-1 permitted uses.**

- (a) Public open space recreational uses, recreational facilities and selected commercial recreation;
- (b) School (including nursery school), hospital, long-term nursing care facility, convalescent care facility, municipal or state building or use, church or any other institution of educational, religious, philanthropic, fraternal, political or social nature;
- (c) Accessory uses and buildings including minor or major home occupations;
- (d) Business and professional offices;
- (e) Mass transit station;
- (f) Commercial parking lot or parking garage;
- (g) Retail uses and wholesale businesses, excluding used car lots and junkyards;
- (h) Service establishments;
- (i) Public utility facilities, including substations, pumping stations and sewage treatment facilities;

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- (j) Restaurant;
- (k) Veterinary hospital;
- (l) Motel, hotel, rooming house, inn;
- (m) Art studio/gallery;
- (n) Grocery, food store, convenience store;
- (o) Day-care facility;
- (p) Business service;
- (q) Personal service;
- (r) Building materials and garden supply;
- (s) Conference center;
- (t) Repair services;
- (u) Accessory dwelling unit; ~~and~~
- (v) Specialty food and/or beverage facility; [Added 6-10-2013 by Ord. No. 13-02] and
- (w) Dwelling, two-family.

**(2) C-1 special exception uses.**

- (a) Used car lot not connected with new car sales;
- (b) Gasoline sales if: i) not located within 1,000 feet of an existing station or private residence; and ii) not located within 150 feet of an existing structure;
- (c) Funeral home;
- (d) Place of assembly, including theater;
- (e) Transportation terminal excluding truck stops;
- (f) Warehousing and storage;

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- (g) ~~Mini storage;~~
  - (h) Research and development;
  - (i) Manufacturing operations that conform to the provisions of §16.1.3.2.2 and Chapters 16.8 and 16.9;
  - (j) Repair garages not located within 150 feet of a private dwelling or existing structure;
  - (k) Buildings and structures over 40 feet that conform to the provisions of Chapters 16.8 and 16.9. Buildings and structures higher than 40 actual feet from the lowest point of grade to the highest point of the building or structure must have side, rear and front yards of sufficient depth to adequately protect the health, safety and welfare of abutting properties and which may not be less than current standards or 50% of actual height, whichever is greater;
  - (l) Temporary, intrafamily dwelling unit;
  - (m) New motor vehicle sales;
  - (n) Mechanical services, excluding junkyard; ~~and~~
  - (o) Aquaculture;
  - (p) Cottage cluster;
  - (q) Dwelling, attached single-family;
  - (r) Dwelling, multifamily; and
  - (s) Dwelling units as part of a mixed-used building.
- (3) **C-2 permitted uses...** [Note to Housing Working Group and KLIC: no changes in uses proposed, section removed for brevity].
- (4) **C-2 special exception uses...** [Note to Housing Working Group and KLIC: no changes in uses proposed, section removed for brevity]
- (5) **C-3 permitted uses.**
- (a) Public open space recreational uses, recreational facilities and selected commercial recreation;
  - (b) School (including nursery school), hospital, elder-care facility, long-term nursing care facility, convalescent care facility, municipal or state building or use, church or any other institution of

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- educational, religious, philanthropic, fraternal, political or social nature;
- (c) Accessory uses and buildings including minor or major home occupations;
- (d) Business and professional offices;
- (e) Mass transit station;
- (f) Commercial parking lot or parking garage;
- (g) Retail uses and wholesale businesses, excluding used car lots and junkyards;
- (h) Service establishments;
- (i) Public utility facilities, including substations, pumping stations and sewage treatment facilities;
- (j) Restaurant;
- (k) Veterinary hospital;
- (l) Motel, hotel, rooming house, inn;
- (m) Art studio/gallery;
- (n) Grocery, food store, convenience store;
- (o) Day-care facility;
- (p) Business service;
- (q) Personal service;
- (r) Building materials and garden supply;
- (s) Conference center;
- (t) Repair services;
- (u) New motor vehicle sales;
- (v) Boatyard;
- (w) Mechanical services, excluding junkyard;

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- (x) Commercial boating and fishing uses and facilities, provided only incidental cleaning and cooking of seafood occur at the site;
- (y) Aquaculture;
- (z) Accessory dwelling unit; and
- (aa) Specialty food and/or beverage facility; ; [Added 6-10-2013 by Ord. No. 13-02] and
- (bb) Dwelling, two-family.

~~C. Special exception uses. The following uses are permitted as special exception uses in the Commercial Zones:~~

**(6) C-3 special exception uses.**

- (a) Used car lot not connected with new car sales;
- (b) Gasoline sales if: i) not located within 1,000 feet of an existing station or private residence; and ii) not located within 150 feet of an existing structure;
- (c) Funeral home;
- (d) Place of assembly, including theater;
- (e) Transportation terminal excluding truck stops;
- (f) Warehousing and storage;
- (g) Mini storage;
- (h) Research and development;
- (i) Manufacturing operations that conform to the provisions of §16.1.3.2.2 and Chapters 16.8 and 16.9;
- (j) Repair garages not located within 150 feet of a private dwelling or existing structure;
- (k) Buildings and structures over 40 feet that conform to the provisions of Chapters 16.8 and 16.9. Buildings and structures higher than 40 actual feet from the lowest point of grade to the highest point of the building or structure must have side, rear and front yards of sufficient depth to adequately protect the health, safety and welfare of abutting properties, and which may not be less than current standards or 50% of actual height, whichever is greater;

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- (l) Temporary, intrafamily dwelling unit;
- (m) Commercial greenhouses;
- (n) ~~Adult entertainment establishment not located within 1,000 feet of an existing private residence, school or place of worship;~~
- (o) Shops in pursuit of trade; and
- (p) Construction services.
- (q) Cottage cluster;
- (r) Dwelling, attached single-family;
- (s) Dwelling, multifamily; and
- (t) Dwelling units as part of a mixed-used building-

DC. Standards.

- (1) C Zone standards. All development and the use of land in the C Zone must meet the following standards. Kittery's Design Handbook illustrates how these standards can be met. In addition, the design and performance standards of Chapters 16.8 and 16.9 must be met unless noted otherwise below.
- (2) The following space standards apply in the C-1, C-2 and C-3 Zones:
  - (a) Minimum lot size or density:

<u>C-1 and C-3 Zones</u>		<u>C-2 Zone</u>	
<u>Cottage Cluster;</u> <u>Dwelling, Attached</u> <u>Single-Family,</u> <u>Dwelling, Multi-</u> <u>Family, Dwelling,</u> <u>Two-Family,</u> <u>Dwelling Units as</u> <u>part of a Mixed-Use</u> <u>Building *</u>	<u>16 units per acre</u> <u>unless 25% of units</u> <u>are affordable</u> <u>housing units as</u> <u>defined by this code,</u> <u>in which case 20</u> <u>units per acre are</u> <u>allowed.*</u>	<u>All</u> <u>uses</u>	40,000 square feet
<u>All other uses</u>	40,000 square feet		

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

\*NOTE: These uses are exempt from net residential acreage calculations but are subject to minimum land area per dwelling unit requirements as described in § 16.7.8.4 Exemptions to net residential acreage calculations

(b) Minimum street frontage:

<u>C-1 and C-3 Zones</u>		<u>C-2 Zone</u>	
<u>All uses</u>	<u>No minimum*</u>	<u>All uses</u>	150 feet

\*NOTE: All lots must meet the requirements of Article XVI Lots unless specifically modified by this section (16.3.2.11). Street frontage must provide sufficient vehicular and pedestrian access for the uses proposed while meeting public health and safety requirements (e.g. Fire Department, Department of Public Works). The applicant must demonstrate to the municipal permitting authority, that the street frontage and lot design meet these requirements to the extent practicable.

(c) Maximum front yard setback:

<u>C-1 and C-3 Zone</u>		<u>C-2 Zone</u>	
<u>All uses</u>	<u>15 feet*</u>	<u>All uses</u>	50 feet

\*NOTE: The Planning Board may, at its discretion, allow a greater setback when public amenities such as benches, pocket parks or seating areas are proposed.

(d) Minimum rear and side yards setbacks:

<u>C-1 and C-3 Zones</u>		<u>C-2 Zone</u>	
<u>All uses</u>	<u>10 feet*</u>	<u>All uses</u>	<u>30 feet**</u>

\*NOTE: Except where side and/or rear setbacks of proposed new uses about a single-family use in which case a minimum of 15 feet is required.

(\*\*NOTE: Except as may be required by the buffer provisions of this title, and where the side and/or rear yards of the proposed nonresidential use about a residential zone or use; in which case a minimum of 40 feet is required.)

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

(e) Maximum building height:

C-1 and C-3 Zones		C-2 Zone	
<u>Multi-Family, Dwelling, Dwelling Units as part of a Mixed-Use Building</u>	<u>50 feet, not including solar apparatus*</u>	<u>All uses</u>	40 feet
<u>All other uses</u>	40 feet		

\*NOTE: Flat roofs, proposed to locate heating, cooling, or other such mechanical or electrical apparatus off the ground, are acceptable provided that such apparatus are screened from view and the screening is designed as an integral part of the building to aid both aesthetics and noise attenuation. Flat roofs proposed for the purpose of solar array installations are also acceptable.

(f) ~~Maximum building and outdoor stored material coverage~~ Impervious surface:

For lots in the C-1 and C-3 zones which are currently developed and for which new multi-family, attached single-family or two-family dwellings, cottage clusters, or dwelling units as part of mixed-use building are proposed, either with or without existing or new commercial uses on the same lot, the maximum impervious surface, including but not limited to driveways, buildings, sidewalks and parking areas:

[1] Is 70%; or

[2] The Planning Board may, at its discretion, allow greater than 70% if proof that all stormwater will be managed on-site, utilizing LID (Low Impact Development) and BMP (Best Management Practice) systems. The stormwater report and plan demonstrating that this requirement is met must be included with the application at the time of submission.

For lots in the C-3 zone which are currently vacant (no existing structure) and for which new multi-family, attached single-family, or two-family dwellings, cottage clusters, or dwelling units as part of mixed-use building are proposed, the maximum impervious surface, including driveways, buildings, sidewalks and parking areas:

[1] Is 60% or

[2] The Planning Board may, at its discretion, allow greater than 60% if proof that all stormwater will be managed on-site utilizing LID (Low Impact Development) and BMP (Best Management Practice) systems. The stormwater report and plan demonstrating that this requirement is met must be included with the application at the time of submission.



*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

For lots in the C-1 or C-3 zones which are currently developed and for which redevelopment is proposed with new non-residential structures, the maximum impervious surface, including but not limited to driveways, buildings, sidewalks and parking areas:

[1] Is 70%; and all stormwater must be managed on-site, utilizing LID (Low Impact Development) and BMP (Best Management Practice) systems. The stormwater report and plan demonstrating that this requirement is met must be included with the application at the time of submission.

For all uses in the C-2 Zone, building and outdoor material coverage must not exceed 40%.

(g) Minimum setback from water body and wetland setback for functionally water-dependent uses: zero feet.

(h) Minimum setback from streams, water bodies and wetlands: in accordance with Table 16.9, §16.3.2.17 and Appendix A, Fee Schedules.

(i) Affordable housing requirements:

[1] All requirements in 16.X.X.X Affordable Housing must be met.

[2] Density incentives outlined above in (2).(a) may be applied to projects that create affordable housing units, as defined by this code. No proportional payment-in-lieu is required if the affordable dwelling unit requirements for the density incentives are met. In order to be eligible for this density incentive, the affordable housing units must remain affordable (via deed restriction or other legal instrument, a copy of which must be submitted to the Town prior to issuance of any building permits) for the longest term permitted under federal, state and local laws and ordinances, or 45 years, whichever is greater.

(j). Mixed-use buildings which include residential dwelling units must be comprised of at least 50% commercial uses on the first floor.

(k) Cottage cluster requirements:

[1] Cottage cluster dwelling units must either face the required common open space or the street.. The required open space must be held in common for use by all the cottage cluster residents and must be immediately accessible to each dwelling unit, via either the front or the back of each unit.

[2] Each cottage cluster dwelling unit must be no greater than 1,200 square feet. Spacing between units must comply with the requirements of the Fire Department and/or the State Fire Marshall's office.

[3] Shared parking areas must be connected to each dwelling unit via a sidewalk.

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- (3) C-1 Zone standards. All development and the use of land except for new multi-family, attached single-family or two-family dwellings, cottage clusters, or dwelling units as part of a mixed-use building within the C-1 Zone must meet the following standards:

[Note to Kittery Housing Working Group and KLIC: No changes are proposed, section removed for brevity].

- (4) C-1 and C-3 Zone standards for attached single-family dwellings, multi-family dwellings, two-family dwellings where more than one two-family dwelling is proposed for a single lot, cottage clusters, and dwelling units as part of a mixed-use building:
- (a) Design standards.
- [1] Sidewalks must be installed within the right-of-way to meet minimum requirements as specified in 16.8 Table 1, subject to review and approval by the Department of Public Works.
- [2] All service areas for dumpsters, compressors, generators and similar items must be screened by a fence at least six feet tall, constructed of a material similar to surrounding buildings, and must surround the service area except for the necessary ingress/egress.
- [3] Parking must be located behind multi-family dwellings and mixed-use buildings with residential dwelling units when viewed from the street. The Planning Board may allow parking to the side or front of such residential or mixed-use buildings at its discretion, but it is incumbent upon the applicant to demonstrate why rear parking is not feasible.
- [4] Lighting plans, including lighting fixture designs and photometric plans must be included at the time of application submission. All fixtures must be cut-off to prevent light trespass and meet all requirements of Chapter 16.8 Article XXIV.
- [5] A single new two-family dwelling proposed for a lot or the addition of another dwelling unit to an existing single-family residence to create a two-family dwelling is exempt from these design standards.
- (b) Open space standards.
- [1] Open space must be provided as a percentage of the total area of the lot, and may include wetlands, water bodies, streams, and setbacks. Fifteen percent (15%) of each lot must be designated as open space.
- [2] For multifamily dwellings, mixed-use buildings with residential dwelling units and attached single-family dwellings, in cases where the property does not meet the 15% requirement due to existing development, and where redevelopment will remain at the same or a lower percentage

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

of the lot, the Planning Board may, at its discretion, allow a smaller percentage of open space. In granting this concession, the Board may require more intensive landscape plantings.

(c) Parking standards.

The following minimum off-street parking requirements must be provided and maintained in case of new construction, alterations, and changes of use:

- [1] Parking requirements must be met on site unless an existing building covers so much of the lot as to make the provision of parking impractical in whole or in part. If meeting the parking requirements is not practical, then the parking demand may be satisfied off site or through joint-use agreements as specified herein. Notwithstanding the off-street parking requirements in Article IX of Chapter 16.8, minimum parking requirements for the uses below are modified as specified:

[a] Dwelling units: 1 parking space per dwelling unit.

[b] For multifamily dwellings, if more than ten parking spaces are required, up to 20% of the parking may be designated for compact cars. See 16.8.9.4 Off-Street Parking Standards.

- [2] Off-site parking. Required off-street parking may be satisfied at off-site locations, provided such parking is on other property owned by the applicant or is under the terms of a contractual agreement that will ensure such parking remains available for the uses served. Applicant must present evidence of a parking location and a contractual agreement;

- [3] Joint-use parking. Required off-street parking may also be satisfied by the joint use of parking space by two or more uses if the applicant can show that parking demand is nonconflicting and will reasonably provide adequate parking for the multiple uses without parking overflowing into undesignated areas. Nonconflicting periods may consist of daytime as opposed to evening hours of operation or weekday as opposed to weekends or seasonal variation in parking demand.

[a] Such joint parking areas must be held under ownership of the applicant or under terms of a contractual agreement that ensures such parking remains available to all users of the shared parking spaces;

[b] Determination of parking adequacy will be based on a most frequent basis, not a "worst case" scenario;

[c] Joint use parking areas must be located within 1,500 feet of the uses served, but do not need to be located on the same lot as the uses served;

[d] Ease and safety of pedestrian access to shared parking by the users served must be demonstrated, including any proposed improvements or shuttle service that may be offered and its requisite loading/unloading areas;

[e] Such joint parking areas must not be located in residential zones of the Town.

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

- [4] In making determinations on off-site or joint-use parking under a development plan review, the municipal permitting authority with jurisdiction to review and approve will make a final determination of the joint-use and/or off-site spaces that constitute an acceptable combination of spaces to meet the required parking demand.
- [5] Electric car charging stations are allowed in parking lots but must not interfere with pedestrian movement on sidewalks.

(d) Landscaping and screening

- [1] For new multi-family, attached single-family, or dwelling units as part of a mixed-use building or any new residential use that will create more than three dwelling units on a site, the following standards apply:
  - [a] A landscape plan prepared by a registered landscape architect is a submission requirement. However, a landscape plan done by other design professionals may be allowed at the Planning Board's discretion.
  - [b] A minimum of one street tree must be planted for each 25 feet of street frontage. Trees may be planted in groups or spaced along the frontage. However, trees must be planted to ensure survival, using silva cells, bioretention cells or tree wells. Trees are to be a minimum of 2.5-inch caliper and 12 feet high at the time of planting. Existing large healthy trees must be preserved if practical and will count towards this requirement. Trees proposed within the right-of-way must remain under 20 feet tall at maturity.
  - [c] Surface parking lots designed for five or more cars that will service multi-family or mixed-use buildings with dwelling units and which abut a street must provide screening in one of the following ways:
    - i. One tree per 25 feet of street frontage backed by a fence constructed of a material similar to surrounding buildings which must screen the parking area from the street except for necessary vehicular and pedestrian access. To ensure survival, trees must be planted using silva cells, bioretention cells or tree wells. Trees must be at least 2.5-inch caliper and 12 feet high at the time of planting. Existing large healthy trees must be preserved if practical and will count towards this requirement. Trees proposed within the right-of-way must remain under 20 feet tall at maturity.
    - ii. A combination of trees and shrubs including at least 50% evergreen species, all at least six feet high at time of planting, in a planting bed at least eight feet wide. Plantings must be sufficient, as determined by the Planning Board, to screen the parking area from the street except for necessary vehicular and

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

pedestrian access. Planting beds may be mulched but no orange or red-dyed mulching material may be used.

- [d] A minimum of 10% of any surface parking area consisting of 10 or more spaces must be landscaped with trees and vegetated islands. This requirement is in addition to the aforementioned screening and street tree requirements.
- [e] Native trees are preferred and must be drought and salt tolerant when used along streets. A diversity of tree species (three to five species per every 12 trees) is required to provide greater resiliency to threats from introduced insect pests and diseases.
- [f] Any required plantings that do not survive must be replaced within one year.
- [g] If 25% of the proposed development will be affordable dwelling units, the Planning Board may, at its discretion, modify surface parking lot landscaping and screening requirements under [c] and [d].

(e) Buffers.

- [1] Buffers are required between new residential uses and existing nonresidential uses and must be at least 10 feet wide. A buffer plan must be prepared in conjunction with the landscape plan as described in [d].[1].(a) above and consist of:
  - [a] A fence at least six feet high, constructed of material similar to surrounding buildings, with plantings of trees and shrubs at least six feet tall on the new residential side of the fence.
  - [b] Ground cover plantings must be used where appropriate.
  - [c] Plantings must be provided with irrigation to enhance survival unless they are part of a bioretention cell, rain garden or tree well.
  - [d] Any required plantings that do not survive must be replaced within one year.
  - [e] If 25% of the proposed development will be affordable housing dwelling units, the Planning Board may, at its discretion, waive or modify buffer requirements under [a] and [b].

(45) C-2 Zone standards. All development and the use of land within the C-2 Zone must meet the following standards:

[Note to Kittery Housing Working Group and KLIC: No changes are proposed, section removed for brevity].

(56) C-3 Zone standards. All development and the use of land except for new multi-family, attached single-

*Revisions to C-1 and C-3 Zones related to housing – May 5, 2020 – DRAFT*

family or two-family dwellings, cottage clusters or dwelling units as part of a mixed-use building,  
within the C-3 Zone must meet the following standards:

[Note to Kittery Housing Working Group and KLIC: No changes are proposed, section removed for brevity.]

**§ 16.7.8.4 Exemptions to net residential acreage calculations.**

- C. The Mixed-Use – Neighborhood Zone (MU-N) ~~zone~~ and certain residential uses in the C-1 and C-3 zones as noted in §16.3.2.11 are is exempt from § 16.7.8.2, Net residential acreage calculation, but is are subject to the minimum land area per dwelling unit as defined in Chapter 2, Definitions, except that 50% of all wetlands may be subtracted, rather than 100%.

## *Revisions to Definitions Related to Housing – May 5, 2020 – DRAFT*

### **§16.2 Definitions**

Affordable - The percentage of income a household is charged in rent and other housing expenses, or must pay in monthly mortgage payments (including insurance, HOA fees, and taxes), does not exceed 30% of a household's gross income, or other amount established in town regulations that does not vary significantly from this amount.

Affordable Housing Unit -One dwelling unit of either affordable housing for rent or affordable housing for sale.

Affordable Housing For Rent - A dwelling unit that may be rented for year-round occupancy for which the rental cost does not exceed the maximum cost set forth for households making up to 80% of area median income, as determined by HUD's York-Kittery-South Berwick Metro Fair Market Area (HMFA) limits. Annual rent increases are limited by deed restriction, lease agreement or other legally binding agreement to the percentage increase in the HUD York-Kittery-South Berwick Metro Fair Market Area (HMFA) median income figures for a household of that size.

Affordable Housing For Sale - A dwelling unit that may be purchased for year-round occupancy for which the selling price does not exceed the maximum price set forth for households making up to 100% of area median income, as determined by HUD's York-Kittery-South Berwick Metro Fair Market Area (HMFA) limits. The resale price is limited by deed restriction or other legally binding agreement for all future sales of the unit, or a lesser term if permitted by regulations, to the percentage increase in the HUD York-Kittery-South Berwick Metro Fair Market Area (HMFA) median income figures for a household of that size.

Cottage Cluster - A group of size-restricted single-family detached dwelling units that share a common lot as well as common open space and may share a parking area and/or accessory structures.

Dwelling Unit - A room or group of rooms forming a habitable unit for one family household, with facilities used or intended to be used for living, sleeping, cooking, eating and sanitary facilities. It comprises at least 650 square feet of habitable floor space, except for elderly housing, an accessory dwelling unit or a temporary, intrafamily dwelling unit. The term does not include a trailer. Such a unit must meet the building code standards adopted and amended from time to time by Maine's Bureau of Building Codes and Standards.

Impervious surface - The total area of a parcel that consists of buildings and any associated structures as well as roads, driveways, and parking areas, whether paved or unpaved and any additional area that is covered with a low-permeability material such as asphalt, stone or concrete or compacted through design or use to reduce permeability.

