Land Development Design
and
Construction Standards Manual

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Approved:

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City Engineer

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SECTION 1 – INTRODUCTION

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1.1. PURPOSE

1.1.1. The purpose of this Manual is to provide procedural information and define material specifications for the construction of pavement and roadway improvements, water, sanitary sewer and storm sewer mains and all appurtenances that are to become a part of or to be connected to the City of Lebanon's Water, Wastewater, and Stormwater utilities. The requirements contained herein are to be followed by any person, firm, partnership or corporation in the construction of residential, industrial commercial subdivisions and/or developments in which water, sanitary and/or storm sewer utilities, sidewalks, curb and gutter, and/or roadway and pavement will be constructed. The goal of this Manual is to insure the protection of the health and welfare of the City of Lebanon.

1.1.2. It is not the intent of this Manual to take away from the Design Engineer any responsibility for the technical adequacy of the Design Engineer's design or freedom to use engineering judgment and discretion in the practice of the Design Engineer's profession. It is recognized that matters of engineering design cannot be set out in writing to cover all situations. Design methods or criteria different than that listed will receive consideration for approval, provided the proposed variances and the reasons for its use are submitted, in writing, to the City of Lebanon.

1.1.3. The City engineer has the authority to modify or waive any requirements in this manual on a case-by-case basis if the change is in coordination with the City of Lebanon Water and Sewer Master Plans, the City of Lebanon Comprehensive Plan, the City of Lebanon Thoroughfare Plan, and/or in the best interest of the public safety, health, and welfare.

1.1.4. All development within the City is provided with electric service from the City of Lebanon Electric utility. Telecommunication services are provided by a variety of area service providers. Sections 908 and 909 of the Lebanon Codified Ordinances provide direction as to the planning and construction of utilities in the public right of way and/or utility easements. The City requires these utilities to be designed and constructed in a manner that promotes cooperation and joint planning among providers in order to minimize public inconvenience and eliminate wasteful, unnecessary, or unsightly duplication of facilities. Unless otherwise approved in writing by the Service Director, new development electric and telecommunication utility infrastructure shall be constructed underground and reconstruction/replacement of electric and telecommunication utility infrastructure will be reviewed on a case by case basis for construction underground. For standards specific to electric infrastructure, please reference the City of

Lebanon Municipal Electric System General Service Rules & Regulations that are on file in the office of the Director of Electric.

1.2. DEFINITIONS

1.2.1. For the purpose of these specifications, the following terms, phrases, and definitions shall apply. Words used in the singular shall include the plural, and the plural, the singular. Words used in the present tense shall include the future tense. **The word "shall" is mandatory and not discretionary**. The word "may" is permissive. Words not defined herein shall have the meaning given by common and ordinary use as defined by the latest edition of Webster's Dictionary.

ACCELERATED WATER EROSION - The wearing away of the land surface by stormwater runoff, or snow melt water, occurring at a much more rapid rate than geologic or normal erosion, primarily as a result of denuding the land and/or altering its slope.

ACRE - a measurement of area equaling 43,560 square feet.

ADT - Average daily traffic – defined as the average number of vehicles per day which travel on a particular roadway as determined by conducting traffic counts over a stated length of time.

AGRICULTURAL LANDS - Those lands utilized for any agricultural use, including forestry.

ALLEY – Minor way which is used primarily for vehicular service access to the back or side of properties otherwise abutting on a street.

AMERICAN WATER WORKS ASSOCIATION (AWWA) - An organization that develops, adopts and publishes standards for the construction, operation and maintenance of improvements to water systems.

APPLICANT - Any person, or a duly designated representative, applying for a permit or other type of city, federal, or state regulatory approval to proceed with a project.

APPROVED - Material, equipment, workmanship, process or method that has been accepted by the City of Lebanon as suitable for the proposed use.

APPROVING AGENCY - The approving agency shall be the City Engineer of the City of Lebanon, Ohio.

AQUIFER - An underground formation, group of formations, or part of a formation that is permeable enough to transmit, store, or yield usable quantities of water.

AS-BUILT PLANS - The final plans amended to include all locations, dimensions, elevations, capacities, features and capabilities, as actually constructed and installed as compared with the locations, dimensions, elevations, capacities, features and capabilities, as shown on the approved pre-construction drawings.

BMP OR BEST MANAGEMENT PRACTICES - Programs, technologies, processes, site layout techniques and criteria, operating methods, measures, or devices that control, prevent, remove, or reduce pollution.

BRIDGE - Any structure, including supports, of 10 feet or more clear span or 10 feet or more in diameter on, above, or below a highway. The span of all bridges will be measured along the centerline of the highway.

CBR - California Bearing Ratio - The ratio of the force per unit area required to penetrate a soil mass with a 3 in^2 circular piston at the rate of 0.05 inches per minute to the force required for corresponding penetration of a standard crushed-rock base material; the ratio is usually determined at 0.1 inches of penetration.

CHANNEL - A natural stream that conveys water. A ditch, or passageway, excavated to

permit or accommodate the flow of water.

CITY - The City of Lebanon, Ohio.

CLEAN WATER ACT - Pub. L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, and Pub. L. 100-4, 33 U.S.C. 1251 et. seq. Referred to as the Federal Water Pollution Control Act or the Federal Water Pollution Control Act Amendments of 1972.

CLEARING - The removal of trees, brush, and other ground cover from all or a part of a tract of land, but shall not include mowing.

COLLECTOR STREET – Street which carries traffic from local streets to the arterial system of principal and arterial streets, including the principal entrance streets of a residential development and streets within such a development.

COMPENSATING STORAGE - Equivalent floodplain storage provided to counterbalance floodplain filling.

CONCENTRATED STORM RUNOFF - Surface runoff that converges and flows primarily through water conveyance features such as swales, gullies, waterways, channels or storm sewers and which exceeds the maximum specified flow rates of filters or perimeter controls intended to produce or control sheet flow.

CONSERVATION - The wise use, care, protection and management of natural resources.

CONSERVATION PLAN - A formal document that outlines a system of management practices to control soil erosion and to prevent the degradation of the water quality for a specific parcel of property. Said plan shall be prepared by the United States Department of Agriculture Soil Conservation Service (SCS), in conjunction with the Warren County Soil and Water Conservation District, or by an independent consultant using accepted engineering principles according to standards, specifications, and guidelines developed by the SCS for Conservation Plans, which provide a level of treatment equivalent to that of SCS.

CONSTRUCTION - The building, assembling, expansion, modification or alteration of the existing contours of a site or any part thereof, including trenching, the clearing of land, or the erection of buildings or other structures above or below the level of existing ground.

CONTRACTOR - The person, firm or corporation that will perform the construction of the utility improvements. The Contractor may be the Owner/Developer; an agent of the Owner/Developer; or a person, firm, partnership or corporation with whom the Owner/Developer has executed an agreement to perform the construction of utility improvements. The Contractor may be a person, firm, partnership or corporation with whom the City of Lebanon has executed an agreement to perform the construction of utility improvements.

CRITICAL STORM - a storm that is calculated by means of the percentage increase in volume of runoff by a proposed development area. The critical storm is used to calculate the maximum allowable storm water discharge rate from a developed site.

CROSSWALK - A right-of-way, publicly-owned, cutting across a block in order to provide pedestrian access to an adjacent street or property.

CUL-DE-SAC – A short local street, having one end open to motor traffic, the other end being permanently terminated by a vehicular turn around having an outside radius of not less than 50 feet to the back of curb.

CUT AND FILL SLOPES - A portion of land surface or area upon which soil material is excavated and/or filled, consequently forming a slope or embankment.

DEAD-END STREET - A street having only one outlet for vehicular traffic and not

containing a permanent vehicular turn around.

DESIGN ENGINEER - A registered Professional Design Engineer, licensed to practice engineering as defined by the Registration Act of the State of Ohio.

DETENTION OR TO DETAIN - The prevention of, or to prevent, the discharge, directly or indirectly, of a given volume of stormwater runoff into surface waters by providing temporary on-site storage.

DETENTION FACILITY - a basin, pond, oversized pipe, or other structure that reduces the peak flow rate of storm water leaving the facility by temporarily storing a portion of the storm water entering the facility.

DEVELOPMENT OR DEVELOPMENT ACTIVITY - The alteration, construction, installation, demolition or removal of a structure, impervious surface, pipe, conduit, cable or line, above or below ground, or the clearing, scraping, grubbing, killing or otherwise removing the vegetation from a site; or adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging or otherwise significantly disturbing the soil, mud, sand or rock of a site.

DEVELOPMENT AREA - a parcel or contiguous parcels owned by one person or persons, or operated as one development unit, and used or being developed for commercial, industrial, residential, institutional, or other construction or alteration that changes runoff characteristics.

DIRECTLY CONNECTED IMPERVIOUS AREAS - Those impervious areas which are connected to the City's drainage system by a ditch, storm sewer, channel, or other man-made device for the conveyance of stormwater runoff.

DISCHARGE - The flow of water from a project, site, aquifer, drainage basin, or other drainage facility.

DISTURBED AREA - an area of land subject to erosion due to the removal of vegetative cover and/or soil disturbing activities.

DITCH - An artificial waterway for the purpose of irrigation or for stormwater conveyance.

DRAINAGE FACILITY - Any component of a stormwater management system.

DRAINAGE SYSTEM - All facilities used for the movement of stormwater through and from a drainage area including, but not limited to, any and all of the following: conduits, pipes and culverts, including appurtenant features such as catch basins, inlets, manholes, and headwalls, channels, ditches, flumes, curbs, streets and other paved areas, and all watercourses, standing or flowing bodies of water, and wetlands. While some such facilities may be isolated in a given storm event, all are interconnected in a given drainage system for a storm event exceeding a certain magnitude.

EASEMENT - A grant by a property owner for a specified use of all or a specified portion of land to a person, an entity, or to the public at large.

EROSION - the process by which the land surface is worn away by the action of wind, water, ice, gravity, or any combination of those forces.

FEMA - Federal Emergency Management Agency.

FINAL INSPECTION - Inspection conducted by the City of Lebanon prior to final approval of the improvements.

EXTENDED CONVEYANCE - a storm water management practice that replaces and/or enhances traditional open or closed storm drainage conduits by retarding flow, promoting percolation of runoff into the soil, and filtering pollutants during the storm water quality event.

EXTENDED DETENTION - a storm water management practice that replaces and/or enhances traditional detention facilities by releasing the runoff collected during the storm water quality event over at least 24 to 48 hours, retarding flow and allowing pollutants to settle within the facility.

FINAL STABILIZATION - all soil disturbing activities at the site have been completed and a uniform perennial vegetative cover with a density of at least 80% coverage for the area has been established or equivalent stabilization practices, such as the use of mulches or geotextiles, have been employed.

FOREBAYS - Areas with hardened bottoms, located at detention basin inlets, that are designed to trap coarse sediment particles by separating approximately ten percent of the basin volume from the remainder of the basin with a lateral sill, rock-filled gabions, a retaining wall, or horizontal rock filters.

GRADING - the process in which the topography of the land is altered to a new slope.

GROUNDWATER - Water below the surface of the ground, in known or defined natural channels, whether flowing or not.

HYDROGRAPH - A graph of inflow and/or discharge versus time for a selected point in the drainage system.

ILLEGAL CONNECTION – Any connecion to the storm sewer system which allows any flows which are not entirely composed of clean water to enter the storm sewer system.

ILLICIT DISCHARGE - as defined at 40 C.F.R. 122.26 (b)(2) means any discharge to an MS4 that is not composed entirely of storm water, except for those discharges to an MS4 pursuant to a NPDES permit or noted in the City of Lebanon Codified Ordinances.

IMPERVIOUS SURFACE - A surface which has been compacted or covered with a layer of material so that it is resistant to infiltration by water, including semi-pervious surfaces such as compacted clay and gravel, most conventionally surfaced streets, roofs, sidewalks, parking lots, and other similar surfaces.

IMPROVEMENTS - Construction work, including materials and workmanship, to the water, sanitary, and/or storm sewer utility systems that are part of, will become part of or be connected to the City of Lebanon's water, sanitary and/or storm sewer utilities. Water improvements include but are not limited to water mains, valves, fire hydrants, service lines, pumps, meter pits, etc. Sanitary sewer improvements include but are not limited to sanitary sewer mains, manholes, laterals, cleanouts, etc. Storm sewer improvements include but are not limited to catch basins, manholes, stormwater detention and quality facilities, etc.

INFILTRATION - a storm water management practice that does not discharge to a water resource during the storm water quality event, requiring collected runoff to either infiltrate into the groundwater and/or be consumed by evapotranspiration, thereby retaining storm water pollutants in the facility.

INSPECTOR - The City Engineer, or his/her representative, who may be required to be on the job site during any construction of facilities that are to become part of the City of Lebanon.

INTENSITY - The depth of accumulated rainfall per unit of time.

IPS – Iron Pipe Standard

ISO - Insurance Services Offices

LARGER COMMON PLAN OF DEVELOPMENT - a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan.

LEBANON STANDARD CONCRETE – ODOT Class C Portland cement concrete possessing the following qualities:

Maximum water to cement (w/c) ratio of 0.50
No fly ash
Minimum compressive strength of 4,000 psi
Air entrainment of 6% ±2%

LOCAL STREET – Street used primarily for access to abutting properties.

MAINTENANCE - The action taken to protect, preserve, or restore the as-built, functionality of any facility or system.

MAJOR ARTERIAL – Roadway that carries regional traffic, links cities, and carries long-distance statewide trips.

MAJOR COLLECTOR – Collects and distributes traffic to arterial roads. Provide access to specific traffic destinations, allow easy movement from one neighborhood to another, and provide cross-town traffic movement.

MAXIMUM EXTENT PRACTICABLE - the level of pollutant reduction that operators of small municipal separate storm sewer systems regulated under 40 c.f.r. parts 9, 122, 123, and 124, referred to as NPDES storm water phase ii, must meet.

MINOR ARTERIAL – Roadway Carries local and regional traffic, links communities, and carries intermediate and long-distance trips.

MINOR COLLECTOR – Takes traffic from local roads, carries it a short distance, and distributes it to major collectors and arterials.

NOI (NOTICE OF INTENT) APPLICATION - application form to request initial coverage or to renew coverage under a general permit. The applicant must certify their intention to comply with a general permit by submitting a complete NOI. The application shall be submitted to Ohio EPA's Central Office. Refer to the following web address: http://www.epa.state.oh.us/dsw/storm/stormform.html

NON-IMPROVED ROAD – any roadway not meeting current City Of Lebanon standards regarding width and/or does not have curb and gutter and/or sidewalks.

NONSTRUCTURAL STORM WATER MANAGEMENT PRACTICE - storm water runoff control and treatment techniques that use natural practices to control runoff and/or reduce pollution levels.

NPDES - national pollutant discharge elimination system. A regulatory program in the federal clean water act that prohibits the discharge of pollutants into surface waters of the United States without a permit.

ODNR - Ohio Department of Natural Resources.

ODOT - Ohio Department of Transportation.

OEPA - Ohio Environmental Protection Agency.

OHIO UTILITIES PROTECTION SERVICE - (OUPS) – 1-800-362-2764 or 811.

OPEN CHANNEL - An uncovered ditch, channel, or swale used to convey stormwater runoff.

OUTDOOR ACTIVITY AREAS - Areas where pollutants are, or may become, more concentrated than typical urban runoff as characterized by the USEPA National Urban Runoff Program (NURP), as listed below or as otherwise defined by the City Engineer:

Industrial material, waste handling, and storage areas, including but not limited to

loading docks, fuel and other liquid storage/dispensing facilities, material bins, containers, stockpiles, and other storage containers, waste dumpsters, bins, cans, tanks, stockpiles, and other waste containers.

Processing, manufacturing, fabrication, cleaning, or other permanent outdoor equipment or work areas.

Areas where vehicles and equipment are repaired, maintained, stored, disassembled, or disposed of.

OWNER - The person in whom the fee, ownership, dominion, or title of property (i.e., the proprietor) is vested. This term may also include a tenant, if chargeable under his lease for the maintenance of the property, and any agent of the owner or tenant including a developer.

OWNER/DEVELOPER - An individual, group of individuals, partnership, firm, association or corporation that is constructing, or is having constructed, water, sanitary and/or storm sewer improvements that are to become a part of or be connected to the City of Lebanon water, sanitary, and/or storm sewer utilities.

PARCEL OR PARCEL OF LAND - A tract, or contiguous tracts, of land.

PEAK RATE OF FLOW - The maximum rate of discharge resulting from a given storm event.

PERMITTEE - Any person who has been granted a permit to proceed with a project.

PERSON - Any individual, firm, corporation, governmental agency, business trust, estate, trust, partnership, association, two or more persons having a joint or common business interest, or any other legal entity.

POLLUTANT - Any liquid, solid, or semi-solid substance, or combination thereof, that enters stormwater runoff in concentrations or quantities large enough to contribute to the degradation of the body of water receiving the discharge.

POSITIVE OUTLET - A gravity discharge from a basin via overland flow, artificial waterway, natural waterway, or pipe.

POST-DEVELOPMENT - The physical, hydrologic and hydraulic condition of a project site immediately following completion of the development for which a permit has been applied.

PRE-DEVELOPMENT - The physical, hydrologic and hydraulic condition of a project site immediately before development or construction begins.

PRINCIPAL ARTERIAL – Streets that service metropolitan centers, corridors with the highest traffic volume, and the longest trip lengths that carry most trips entering and leaving urban areas that provide continuity for all rural arterials that intercept urban boundaries.

PROFESSIONAL ENGINEER - A professional engineer licensed by the State of Ohio, skilled in the practice of civil engineering and the engineer of record for the project under consideration.

PROHIBITED DISCHARGE - Any discharge which is not composed entirely of stormwater, unless authorized under a discharge permit issued by the OEPA.

RAINFALL INTENSITY - The depth of accumulated rainfall per unit of time.

RATE - Volume of water, or other material, per unit of time.

RECEIVING WATERS OR WATER BODY - Any water body, watercourse, or wetland into which surface water flows.

RECHARGE - The inflow of water into an aquifer.

RETENTION OR TO RETAIN - The prevention of, or to prevent, the discharge, directly or indirectly, of a given volume of stormwater runoff into receiving waters by complete on-site storage.

RIPARIAN AREA - land adjacent to any brook, creek, river, or stream having a defined bed and bank that, if appropriately sized, helps to stabilize streambanks, limit erosion, reduce flood size flows, and/or filter and settle out runoff pollutants.

RUNOFF - the portion of rainfall, melted snow, or irrigation water that flows across the ground surface and is eventually returned to water resources.

SCS - The United States Department of Agriculture Soil Conservation Service.

SEDIMENT - Solid material, whether mineral or organic, that is in suspension, is being transported, or has been moved from its place of origin by water.

SEDIMENTATION - the deposition of sediment in water resources.

SEDIMENT CONTROL DEVICE - Any structure or area that is designed to hold runoff water until suspended sediment has settled out.

SIGHT DISTANCE – Refers to the arrangement of geometric elements so that sufficient visibility is provided for safe and efficient operation.

SITE - Any tract, lot, or parcel of land or contiguous combination of tracts, lots, or parcels of land that is in one ownership, or contiguous and in diverse ownership, where development is to be performed as part of a unit, subdivision, or project.

STORM EVENT - A storm of a specific duration, intensity, and frequency.

STORMWATER OR STORMWATER RUNOFF - Refers to the flow of water which results from, and which occurs during and following a rainfall event.

STORMWATER DESIGN STANDARDS - The design standards presented in the Stormwater Regulations, and such other standards that may be adopted by the City from time to time.

SITE STORMWATER MANAGEMENT PLAN - Refers to the approved, detailed analysis, drawings, and design of the stormwater management system required for all construction.

SOIL DISTURBING ACTIVITY - clearing, grading, excavating, filling, or other alteration of the earth's surface where natural or human made ground cover is destroyed and that may result in, or contribute to, increased storm water quantity and/or decreased storm water quality.

STABILIZATION - the use of best management practices that reduce or prevent soil erosion by storm water runoff, trench dewatering, wind, ice, gravity, or a combination thereof.

STORMWATER MAINTENANCE AGREEMENT - a formal contract between a local government and a property owner designed to guarantee that specific maintenance functions are performed.

STORMWATER MANAGEMENT SYSTEM OR FACILITIES - Refers to the existing, designed, and/or constructed features which collect, convey, channel, store, inhibit, or divert the movement of stormwater.

STORMWATER MANAGEMENT PLAN - The technical and policy manuals, plans, regulations and/or calculations, and any subsequent updates or amendments thereto, used by the City Engineer to administer the stormwater regulations.

STREAM – A blue-line waterway as shown on an USGS map.

STREET – A way for vehicular traffic, whether designated as a street, highway, thoroughfare, parkway, road, boulevard, lane, place, or however otherwise designated.

STRUCTURAL STORM WATER MANAGEMENT PRACTICE - any constructed facility, structure, or device that provides storage, conveyance, and/or treatment of storm water runoff.

STRUCTURE - Anything constructed or installed with a fixed location on or in the ground, or attached to something having a fixed location on or in the ground.

SUBDIVIDER - Any person, individual, firm, partnership, association, corporation, estate, trust or any other group or combination acting as a unit, dividing or proposing to divide land so as to constitute a subdivision as herein defined and including any agent of the subdivider.

SUBDIVISION - The division of any parcel of land shown as a unit or as contiguous units on the tax rolls as of January 6, 1959, into two or more parcels, sites or lots, any one of which is less than five acres for the purpose, whether immediate or future, of transfer of ownership, provided, however, that the division or partition of land into parcels of more than five acres, not involving any new streets or easements of access, and the sale or exchange of parcels between adjoining lot owners, where such sale or exchange does not create additional building sites, shall be exempted; or

The improvement of one or more parcels of land for residential, commercial or industrial structures or groups of structures involving the division or allocation of land for the opening, widening or extending of any street or streets, except private streets serving industrial structures; the division or allocation of land as open spaces for common use by owners, occupants or leaseholders, or as easements for the extension and maintenance of public sewers, water, storm drainage or other public facilities.

SUBGRADE - The top elevation of graded and compacted earth underlying roadway pavement.

SURFACE WATERS OF THE STATE - all streams, lakes, reservoirs, marshes, wetlands, or other waterways situated wholly or partly within the boundaries of the state, except those private waters which do not combine or affect a junction with surface water. Waters defined as sewerage systems, treatment works or disposal systems in section 6111.01 of the Ohio Revised Code are not included.

SURVEYOR - A Registered Surveyor, as defined by the Registration Act of the State of Ohio.

SWALE - An artificial or natural waterway which may contain contiguous areas of standing or flowing water following a rainfall event. A swale may be planted with or otherwise contain vegetation suitable for soil stabilization, stormwater re-treatment, and/or nutrient uptake; or may be designed to accommodate or account for soil erodibility, soil percolation, slope, slope length, and contributing area, so as to prevent erosion and reduce the pollutant concentration of any discharge.

TAILWATER - The water into which a spillway or outfall discharges.

TOTAL MAXIMUM DAILY LOAD (TMDL) - the sum of the existing and/or projected point source, nonpoint source, and background loads for a pollutant to a specified watershed, water body, or water body segment. A TMDL sets and allocates the maximum amount of a pollutant that may be introduced into the water and still ensures attainment and maintenance of water quality standards.

USEPA OR EPA - United States Environmental Protection Agency.

WATER BODY - Any natural or artificial pond, lake, reservoir, or other area that ordinarily or intermittently contains water, and which has a discernible shoreline.

WATERCOURSE - Any natural or artificial stream, creek, channel, ditch, canal, waterway, gully, ravine, or wash in which water flows either continuously or intermittently, and which has a definite channel, bed, or banks.

WATER QUALITY VOLUME - the volume of runoff from a contributing watershed that must be captured and treated, equivalent to the maximized capture volume as defined in the American Society of Civil Engineers (ASCE) manual and report on engineering practice no. 87 and water environment federation manual of practice no. 23 titled *Urban Runoff Quality Management*.

WATER RESOURCE - any public or private body of water; including wetlands; the area within the ordinary high water level of lakes and ponds; as well as the area within the ordinary high water level of any brook, creek, river, or stream having a defined bed and bank (either natural or artificial) which confines and conducts continuous or intermittent flow.

WATER RESOURCE CROSSING - any bridge, box, arch, culvert, truss, or other type of structure intended to convey people, animals, vehicles, or materials from one side of a watercourse to another. This does not include private, non-commercial footbridges or pole mounted aerial electric or telecommunication lines, nor does it include below grade utility lines.

WATERSHED - the total drainage area contributing storm water runoff to a single point.

WET DETENTION - A detention basin that contains a permanent pool of water that will retain runoff for a minimum period of 14 days for an average rainfall summer, and which has a littoral zone over a substantial portion of the pond surface area.

WATERS OF THE STATE OF OHIO - all streams, lakes, reservoirs, marshes, wetlands, or other waterways situated wholly or partly within the boundaries of the state, except those private waters which do not combine or affect a junction with surface water. Waters defined as sewerage systems, treatment works or disposal systems in section 6111.01 of the Ohio Revised Code are not included.

WETLAND - An area that is inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

WORKS - All artificial, manmade structures, including, but not limited to, canals, ditches, swales, conduits, channels, culverts, pipes, and other construction that connects to, draws water from, drains water into, or is placed in or across the waters of the state.

1.3. REFERENCES

1.3.1. Certain technical aspects concerning construction materials and methods of construction are based on the Ohio Department of Transportation, Standard Specifications for Road and Bridge Construction, hereafter referred to as ODOT.

1.3.2. Other standards or specifications referred to are those of the American Society of Testing Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), Portland Cement Association (PCA), American Public Works Association (APWA) the American Water Works Association (AWWA), and the Ten States Standards.

1.3.3. Standard drawings showing details of certain improvements, shall be complementary to and a part of this manual.

1.3.4. The Codified Ordinances of the City of Lebanon.

1.4. GENERAL REQUIREMENTS

1.4.1. Prior to the development of detailed plans and specifications for the construction of proposed improvements, the Owner/Developer shall complete and file a Development Utility Needs Analysis form with the City of Lebanon so that the impact of the proposed improvements can be evaluated and determined. A copy of this form can be found in the Appendix of this document.

1.4.2. In order to ensure that the design and construction of water and sanitary sewer Improvements meet generally accepted Engineering Standards and Practices, the Owner/Developer proposing the Improvements, must employ a Design Engineer, registered as a Professional Engineer in the State of Ohio. The Owner/Developer shall employ the Design Engineer to:

1.4.2.1. Prepare detailed construction drawings on standard drawing sheets of 22" x 34". 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing.

1.4.2.2. Prepare stormwater detention and stormwater calculations in accordance with City of Lebanon standards.

1.4.2.3. Provide to the City of Lebanon detailed submittals of all parts and materials required to be used during construction in accordance with the approved plans.

1.4.2.4. Prepare and submit a certified construction cost estimate, signed and stamped by a Professional Engineer registered in the State of Ohio.

1.4.2.5. Prepare and submit PTI applications to OEPA for all water and sanitary improvements.

1.4.2.6. Prepare and submit NOI applications for all developments.

1.4.2.7. Provide a complete set of As-Built drawings to the City of Lebanon. As-Built drawings shall be provided on Mylar sheets (4-mil double matte finish, white) and as a digital file compatible with AutoCAD. As-Built drawings shall conform to the requirements found in the Appendix.

1.4.2.8. Prepare and submit certified final as-built quantities signed and stamped by a Professional Engineer registered in the State of Ohio. The As-Built quantities shall conform to the requirements found in the Appendix.

1.5. CITY AUTHORITY

1.5.1. The City of Lebanon shall be responsible for answering questions that may arise as to the quality and acceptability of construction materials used and workmanship performed. The City of Lebanon shall interpret the intent of the requirements contained in this Manual in a fair and unbiased manner for all decisions.

1.5.2. Nothing contained in this Manual is intended to conflict with any State or Federal law or regulation. If such a case arises, the more stringent requirement shall be met. In no case shall the requirements of this Manual be less stringent than any existing State or Federal law or regulation.

1.5.3. Plans are approved by the City of Lebanon subject to the condition of compliance with applicable Federal, State and local laws, rules, regulations and standards. Approval of plans does not constitute an assurance that the proposed improvements will properly function, operate or meet-compliance with Federal, State or local laws and regulations.

1.5.4. The City of Lebanon, at any time during design or construction, shall have the authority to modify any engineering or construction detail or require additional testing whenever necessary for the protection of the public interest.

1.5.5. This Manual shall be revised as needed to insure that the requirements contained herein keep abreast with current State and Federal laws and regulations, approved construction materials and recognized construction methods.

1.6. REQUIREMENT TO MEET CURRENT STANDARDS

1.6.1. Any development which has been approved, but the preliminary plan has expired, shall meet all current standards for all uncompleted areas and any subsequent development.

1.7. OBLIGATION OF THE CONTRACTOR

1.7.1. The Contractor shall perform and complete the work to the satisfaction of the City of Lebanon and in accordance with approved plans. The Contractor shall conduct his/her work so as to minimize interference with public and/or private business and traffic. The Contractor shall, at his/her own expense, whenever necessary or required, provide barricades, flagmen, maintain lights, and take other precautions as may be necessary to protect life, property, adjacent buildings and structures. The Contractor shall be liable for all damages and injuries received or sustained by any person(s) or property in consequence of any neglect in safeguarding the work of subcontractors, employees or workmen. Traffic control procedures shall follow the most current ODOT regulations and the Ohio Manual of Uniform Traffic Control Devices.

1.7.2. The Contractor shall pay for all overtime expenses of City of Lebanon personnel for testing, inspection or "Call-Outs" after normal business hours, weekends, or on holidays.

1.7.3. At least two (2) working days prior to the start of any construction, the Contractor shall notify the City of Lebanon in writing of his/her intent to commence work.

1.7.4. The Contractor is responsible for contacting all utilities covered under The Ohio Utilities Protection Service (OUPS), 1-800-362-2764, or 811 as well as the utilities in the Lebanon area that are not a member of OUPS.

1.7.5. The Contractor is responsible for ensuring that they meet state certification where applicable, i.e. state fire codes for installation.

1.7.6. The Contractor shall be responsible for correcting and/or repairing defects found to exist or those that develop in the Improvements for a period of two years from the date of final inspection and acceptance by the City of Lebanon. Failure of the Contractor to comply with this manual or directive by the City of Lebanon will result in a revocation of permit and/or fines or the denial to perform work within the City of Lebanon.

1.8. TESTING

1.8.1. In addition to the tests listed below, all tests found in other sections of this Manual shall be performed as required.

1.8.2. Concrete Testing

1.8.2.1. Concrete testing will be required on a case-by-case basis.

1.8.2.2. When required, concrete testing shall be conducted as follows:

1.8.2.2.1. One set of cylinders (three cylinders) shall be prepared for every 100 CY of concrete placed on each day, but no less than one set of cylinders per day.

1.8.2.2.2. Each cylinder set shall be broken as follows:

1.8.2.2.2.1. One cylinder at seven days.

1.8.2.2.2.2. The remaining two cylinders at 28 days.

1.8.2.3. The City of Lebanon reserves the right to request any concrete tests. The costs for any tests shall be borne by the Owner/Developer or Contractor.

1.8.3. Compaction Testing

1.8.3.1. Compaction testing shall be required every 50 feet as follows:

1.8.3.1.1. Subgrade shall be compacted to within 95% of Modified Proctor maximum density

1.8.3.2. The City of Lebanon reserves the right to request any compaction tests. The costs for any tests shall be borne by the Owner/Developer or Contractor.

1.8.4. Proof Rolling

1.8.4.1. Proof rolling shall be required prior to all curb, curb and gutter, and pavement installations.

1.8.4.2. A representative of the Office of the City Engineer shall be present during the proof roll test.

1.8.4.2.1. The representative will witness the test and will mark any areas needing repair.

1.8.4.2.2. All repairs shall be made and all repaired areas shall pass an additional proof roll prior to the placement of curb, curb and gutter or pavement.

1.8.4.3. Proof rolling shall be performed by a tandem dump truck loaded with a minimum of 18 tons of gravel.

1.8.4.3.1. A load ticket indicating the net and total weight provided for the test shall be provided to the City of Lebanon at the time of the proof roll.

1.8.4.3.2. "Cheater" wheels shall be raised during the entire proof rolling test.

1.8.5. Additional Tests

1.8.5.1. Additional testing may be required by the City Engineer on an as-needed basis.

1.9. DEFECTIVE MATERIAL AND WORKMANSHIP

1.9.1. Materials and workmanship not in accordance with the approved plans and/or specifications shall be rejected and replaced in a satisfactory manner.

1.9.2. Upon notification by the Design Engineer and/or City of Lebanon, corrections shall be required to comply with the approved plans and/or specifications.

1.10. CONSTRUCTION INSPECTION

1.10.1. The City Engineer or inspectors designated by him or her shall inspect all work performed and materials used in constructing and installing the improvements to ascertain if they are in accordance with the approved plans and specifications. The subdivider or his or her contractor shall notify the City Engineer at least 24 hours in advance of any construction.

1.10.2. Third Party Inspections

1.10.2.1. The City of Lebanon reserves the right to retain a construction inspection firm for the inspection of developments. The Owner/Developer shall be responsible for reimbursement to the City of Lebanon for the costs of the construction inspections above and beyond the standard inspection fee described in the City of Lebanon Codified Ordinances. Full reimbursement shall be required prior to final plat approval unless approved otherwise.

1.10.3. A Final Inspection will be made, prior to final acceptance of any Improvements by the City of Lebanon, after all Improvements are completed. The Final Inspection will be made upon written request of the Owner/Developer to the City of Lebanon stating that all Improvements are complete and all corrections have been made. Prior to the final acceptance of the work, the City of Lebanon shall be given a completed set of As-Built Drawings. All sanitary and storm manholes or access openings shall be opened and all pipes and conduits shall be cleaned of all dirt, mud, and other foreign matter. All water valve boxes shall be opened, cleaned of all mud and debris and inspected for proper alignment. The Contractor shall provide personnel as required to aid in the performance of the Final Inspection.

1.10.3.1. A video inspection of all sanitary and storm sewer mains shall be conducted at the Contractor's expense by a professional inspection firm. Copies of all video and written reports shall be provided to the City of Lebanon for review and approval prior to the

acceptance of the improvements or the release of bonds. Refer to the video inspection requirements found in Section 2.13. of this manual.

1.11. EXISTING UTILITIES

1.11.1. Precautions shall be taken by the Contractor to avoid damage to existing overhead, at grade, and underground utilities owned and operated by public or private utility companies.

1.11.2. Where existing underground or aboveground utilities or appurtenant structures are encountered, they shall not be displaced or disturbed unless necessary, and in such case shall be replaced in as good or better condition than found. Prior to disturbing any underground or aboveground utilities or appurtenant structures, the office of the City Engineer shall be notified and a solution shall be agreed to.

1.11.3. The Contractor shall bear the entire responsibility for locating, avoiding, or repairing damage to said existing utilities.

1.12. UTILITY SHUTDOWNS

1.12.1. No planned utility shutdowns shall be performed without approval of the City of Lebanon.

1.12.2. The Contractor shall notify the City of Lebanon a minimum of 48 hours prior to the planned shutdown.

1.12.3. Upon approval by the City, the contractor shall notify all affected residences and businesses no less than 24 hours in advance of the shutdown.

1.12.4. The City of Lebanon reserves the right to require the shutdown to be performed at a different time than requested by the Contractor to prevent significant inconveniences or hazards to affected residences or businesses.

1.13. SERVICE LINE ABANDONMENTS

1.13.1. If any structure is to be demolished, all utility services shall be properly abandoned.

1.13.2. Water services

1.13.2.1. Curb stop shall be closed and water service shall be properly capped.

1.13.2.2. The private water service shall be exposed and properly sealed at a point outside the limits of demolition, within ten feet of the property line, R/W line, or the water main. Demolition contractor shall provide at least three-dimensional ties to the end of the sealed service line.

1.13.3. Sanitary laterals

1.13.3.1. Sanitary laterals shall be properly capped.

1.13.3.2. The private sewer lateral shall be exposed and properly sealed at a point outside the limits of demolition, within ten feet of the property line, R/W line, or the sewer main. Demolition contractor shall provide at least three-dimensional ties to the end of the sealed lateral.

1.13.4. Prior to backfilling, abandoned water services and sanitary laterals shall be inspected and approved by the City Engineer.

1.14. BLASTING

1.14.1. Blasting shall not be permitted unless:

1.14.1.1. All other excavation methods have been tried and exhausted, and

1.14.1.2. Permission is granted by the City Engineer.

1.14.2. Prior to the commencement of any blasting the following items shall be completed:

1.14.2.1. An investigation shall be performed to ensure there are no subsurface features that will be impacted by the blasting activities. Copies of the investigation shall be provided to the Office of the City Engineer.

1.14.2.1.1. The Warren County Soil and Water Conversation District shall be contacted for subsurface information on the area in question.

1.14.2.2. All appropriate permits shall be applied for and granted through the City of Lebanon Fire Department,

1.14.2.3. A 48 hour notice shall be given to the City of Lebanon Engineer's Office and the City of Lebanon Fire Department prior to any blasting activities; and

1.14.3. Written notices, sent via certified mail with return receipts, shall be provided to **all** adjacent properties (north, south, east, and west) to the development. The notices shall be delivered 48 hours prior to any blasting activity and will need to inform residents of what is happening and what to expect. The notice shall also include a phone number and contact person for the Developer **and** the Blasting Company for residents to call should they have any questions or concerns.

1.15. APPEAL PROCESS

1.15.1. All appeals to the standards set forth in this manual shall be brought before the Council of the City of Lebanon. All decisions of the Council shall be final.

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SECTION 2 – PROCEDURES

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2.1. PURPOSE

2.1.1. The purpose of this section is to establish a working relationship between the Owner/Developer, Design Engineer, Contractor and City of Lebanon by describing the step by step procedure to be followed by each party in initiating and completing the construction of any improvements that are to be connected to or become a part of the City of Lebanon system. This section applies to all development that are to take place in the City of Lebanon, whether they are residential, commercial, institutional, industrial, etc.

2.1.2. The City Engineer reserves the right to waive any or all parts of the specifications in specific instances as appropriate, except where Ohio EPA, Federal and/or State regulations would be violated by such a waiver.

2.2. CITY OF LEBANON MONUMENTS

2.2.1. All developments shall be tied into the City of Lebanon monument system. Monument information will be provided upon request.

2.2.2. Unless waived by the City Engineer, all subdivisions and large developments (as determined by the City Engineer) shall be required to set a minimum of one pair of intervisible monuments to serve as permanent horizontal and vertical benchmarks.

2.2.2.1. Unless waived by the City Engineer, a minimum of one pair of monuments shall be placed for each section of a subdivision.

2.2.3. All reference monuments shall be Class I, Second-order monuments.

2.2.4. All monuments shall be placed in areas meeting the following criteria:

2.2.4.1. Areas that will not receive vehicular traffic.

2.2.4.2. Areas that will not be easily struck by a vehicle leaving the roadway.

2.2.4.3. Areas which are open to allow the use of GPS receivers as well as optical instruments.

2.2.4.4. As approved by the City Engineer.

2.2.5. Northing and Easting information of the set monuments shall be provided to the Office of the City Engineer. Northing and Easting information shall be tied to NAD-83.

2.2.6. Elevation information of the set monument shall be provided to the Office of the City Engineer. Elevation information shall be tied to NAVD-88.

2.2.7. Monuments shall be installed as per the standard drawing found in the Appendix.

2.3. FLOOD DAMAGE REDUCTION STANDARDS

2.3.1. The City of Lebanon Flood Damage Reduction Standards as found in Chapter 1308 of the Lebanon Codified Ordinances shall apply to all development taking place in the City of Lebanon.

2.3.2. The requirements set forth in the Flood Damage Reduction Standards include, but are not limited to:

2.3.2.1. All structures to be located within the flood plain shall have the lowest floor elevation (including the basement) a minimum of two feet (2') above the 100-year base flood elevation.

2.3.2.2. No development activity, include filling or grading shall take place within the floodway.

2.3.3. All development activity taking place in or adjacent to the 100-year flood plain or floodway shall require the completion of a Flood Hazard Area Development Permit Application.

2.3.4. Any storage of materials in or adjacent to the 100-year flood plain or floodway shall require the completion of a Flood Hazard Area Development Permit Application.

2.4. APPLICATION PHASE

2.4.1. The first step in the procedure is for the Owner/Developer to file a Development Utility Needs Analysis form with the Engineering Department of the City of Lebanon requesting utility service. In order to properly coordinate the work with Planning and Development, a copy of the application shall also be submitted to the City of Lebanon Planning and Development Department to serve as notification of the project. The application form may be obtained from the Engineering Department at 50 South Broadway, Lebanon, Ohio 45036. It is recommended that the Owner/Developer engage the services of a Design Engineer in the beginning to assist in preparing the application since much of the information requested must be provided by the Design Engineer.

2.4.2. In addition to the information to be provided on the application form, a site plan shall be provided on a 22" x 34" in sufficient detail to show the location of the proposed development. 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing.

2.4.3. Upon receipt of an application, the City of Lebanon shall evaluate the impact the proposed development will have upon the existing facilities. From the estimated water demand and the wastewater flow provided by the Design Engineer, the City of Lebanon shall determine whether the existing water system is adequate to provide service and whether the existing sanitary sewer system has capacity to receive the estimated wastewater flow. A determination that capacity is available at the time of application does not guarantee nor reserve that capacity indefinitely for that development. Approval of the application by the City of Lebanon indicates that capacity will be available for service immediately upon completion of the project proposed in the application. If the City of Lebanon is capable of providing these services, a letter of conditions shall be issued listing the requirements that must be met in order to obtain acceptance of the proposed facilities by the City of Lebanon. Should it be determined that capacity for water or sanitary sewer service is unavailable, the Owner/Developer shall contact the City of Lebanon to explore alternate solutions.

2.5. DESIGN PHASE

2.5.1. Design shall only be completed for improvements to be immediately constructed. For example, for a multi-section subdivision, design shall only be completed and submitted for the section to be platted, not for any or all sections to be platted at a later time. This is to help ensure that all improvements are constructed to current City of Lebanon standards.

2.5.2. Upon receipt of the letter of conditions from the City of Lebanon, the Owner/Developer may authorize his Design Engineer to prepare plans for the proposed development, in accordance with the requirements contained in the detailed specifications herein.

2.5.3. During the design phase, the Design Engineer shall work closely with the City Engineer to insure that the final product meets all requirements of the City of Lebanon. <u>There shall be no provisional approval.</u> All plans must show all necessary details before approval is granted.

2.5.4. Plans and specifications for water distribution, storm sewer, sanitary sewer, and roadway improvements shall be prepared by or under the supervision of a Professional Engineer registered in the State of Ohio who shall affix his/her seal and signature to each plan and/or plan-profile sheet and specifications.

2.5.5. The Design Engineer shall provide the following design data attached to the plans:

2.5.5.1. Hydraulic calculations for the water system.

2.5.5.1.1. A minimum pressure of 35 psi at the highest point of the development at finished grade must be maintained throughout the system for all fire flow and domestic use conditions. All water mains shall be looped unless a dead end main is approved by the City of Lebanon in writing.

2.5.5.1.2. Any flow or pressure measurements will be the responsibility of the developer. The City of Lebanon does not perform flow or pressure testing. Any tests shall only be performed with permission of the City of Lebanon and under direct supervision of the City of Lebanon.

2.5.5.1.3. ISO needed fire flow calculations shall be performed in accordance with the requirements set forth in the *Guide for determination of needed fire flow* which can be downloaded at http://www.isomitigation.com/downloads/ppc3001.pdf. These calculations shall be submitted to the City Engineer for approval.

2.5.5.2. Design calculations of gravity sanitary sewer mains shall show the grade, expected average flow, peak flow, capacity, and velocity at peak flow between each manhole.

2.5.5.3. Design calculations of sewage lift stations and force mains shall show pump capacity at design TDH (Total Dynamic Head), head loss thru the force main, static head between pump discharge and force main discharge, the velocity thru the force main, capacity of wet well and expected frequency of operation. A copy of the manufacturer's pump curve data and specifications must be provided.

2.5.5.3.1. The Owner/Developer shall provide one of the following emergency measures for each lift station:

2.5.5.3.1.1. The Owner/Developer shall provide emergency power back-up for the lift station and bypass pumping quick connect fittings.

2.5.6. Plans prepared by the Design Engineer for the construction of water mains shall be drawn on plan 22" x 34" sheets to a minimum scale of 1" = 50' for horizontal and 1" = 5' for profile. 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.6.1. Title Sheet

2.5.6.1.1. Name and address of the Design Engineer

2.5.6.1.2. Name and address of the Owner/Developer

2.5.6.1.3. Name of Development and Phase number, if applicable

2.5.6.1.4. Vicinity map with scale indicated

2.5.6.1.5. Signature line for the City Engineer

2.5.6.1.6. Signature line for the City Planner

2.5.6.1.7. Signature Line for the Owner

2.5.6.1.8. Index of sheets

2.5.6.2. Plan Sheets

2.5.6.2.1. Existing and proposed topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines, utility easements, etc.)

2.5.6.2.2. Pipe material and pressure rating

2.5.6.2.3. Pipe size

2.5.6.2.4. Location and type of valves

2.5.6.2.5. Location and size of hydrants

2.5.6.2.6. Location and size of blowoff valves

2.5.6.2.7. Location, size and material of water services, curb stop, box, water meter pit and assembly

2.5.6.2.8. Profile of water main and other proposed underground utilities

2.5.6.2.9. Existing utilities, i.e. hydrants, valves, line sizes, storm drains, and sewer lines

2.5.6.2.10. The statement "All construction shall be in accordance with the City of Lebanon Standards and Specifications."

2.5.7. Plans prepared by the Design Engineer for the construction of sanitary sewer mains shall be drawn on plan 22" x 34" sheets to a minimum scale of 1" = 50' for horizontal and 1" = 5' for profile. 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.7.1. Title Sheet

2.5.7.1.1. Name and address of the Design Engineer

2.5.7.1.2. Name and address of the Owner/Developer

2.5.7.1.3. Name of Development and Phase number, if applicable

2.5.7.1.4. Vicinity map with scale indicated

2.5.7.1.5. Signature line for the City Engineer

2.5.7.1.6. Signature line for the City Planner

2.5.7.1.7. Signature Line for the Owner

2.5.7.1.8. Index of sheets

2.5.7.2. Plan Sheets

2.5.7.2.1. Existing and proposed topography and layout of development (street, curb and gutter, sidewalks, drainage headwalls, utility poles, lot lines and utility easements)

2.5.7.2.2. Pipe material

2.5.7.2.3. Pipe size

2.5.7.2.4. Location by station number and type manhole

2.5.7.2.5. Length of sewer and grade between manholes

2.5.7.2.6. Invert of sewer at each manhole for both inlet and outlet and the fall within the manhole

2.5.7.2.7. Elevations of all tops of castings, etc.

2.5.7.2.8. Location, size and material of house connections and sanitary cleanout

2.5.7.2.9. Profile of sewer main and other proposed underground utilities

2.5.7.2.10. Existing utilities; i.e. manholes, line sizes, storm drains, and water lines

2.5.7.2.11. The statement "All construction shall be in accordance with the City of Lebanon Standards and Specifications."

2.5.8. Plans prepared by the Design Engineer for the construction of sewage lift stations shall be drawn on plan 22" x 34" sheets to a minimum scale of 1" = 50' for horizontal and 1" = 5' for profile. 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.8.1. Title Sheet

2.5.8.1.1. Name and address of the Design Engineer

2.5.8.1.2. Name and address of the Owner/Developer

2.5.8.1.3. Name of Development and Phase number, if applicable

2.5.8.1.4. Vicinity map with scale indicated

2.5.8.1.5. Signature line for the City Engineer

2.5.8.1.6. Signature line for the City Planner

2.5.8.1.7. Signature Line for the Owner

2.5.8.1.8. Index of sheets

2.5.8.2. Plan Sheets

2.5.8.2.1. Name of station manufacturer

2.5.8.2.2. Name of pump manufacturer

2.5.8.2.3. Number of pumps

2.5.8.2.4. Pump discharge at design TDH

2.5.8.2.5. Dimensions, elevations and capacity of wet well

2.5.8.2.6. Location and type of pump controls

2.5.8.2.7. Cathodic protection for steel tanks

2.5.8.2.8. Piping and valve arrangement inside station

2.5.8.2.9. The statement "All construction shall be in accordance with the City of Lebanon Standards and Specifications"

2.5.9. Plans prepared by the Design Engineer for the construction of storm sewer mains shall be drawn on plan 22" x 34" sheets to a minimum scale of 1" = 50' for horizontal and 1" = 5' for profile.

24” x 36” drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.9.1. Title Sheet

2.5.9.1.1. Name and address of the Design Engineer

2.5.9.1.2. Name and address of the Owner/Developer

2.5.9.1.3. Name of Development and Phase number, if applicable

2.5.9.1.4. Vicinity map with scale indicated

2.5.9.1.5. Signature line for the City Engineer

2.5.9.1.6. Signature line for the City Planner

2.5.9.1.7. Signature Line for the Owner

2.5.9.1.8. Index of sheets

2.5.9.2. Plan Sheets

2.5.9.2.1. Existing and proposed topography and layout of development (street, curb and gutter, sidewalks, drainage headwalls, utility poles, lot lines and utility easements)

2.5.9.2.2. Pipe material

2.5.9.2.3. Pipe size

2.5.9.2.4. Location by station number and type manhole, catch basin, headwall, etc.

2.5.9.2.5. Length of sewer and grade between structures

2.5.9.2.6. Invert of sewer at each structure for both inlet and outlet and the fall within the structure

2.5.9.2.7. Elevations of all tops of castings, grates, etc.

2.5.9.2.8. Profile of sewer main and other proposed underground utilities

2.5.9.2.9. Existing utilities; i.e. manholes, line sizes, storm drains, and water lines

2.5.9.2.10. The statement “All construction shall be in accordance with the City of Lebanon Standards and Specifications.”

2.5.10. Plans prepared by the Design Engineer for the construction of roadways shall be drawn on plan 22” x 34” sheets to a minimum scale of 1" = 50’ for horizontal and 1” = 5’ for profile. 24” x 36” drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.10.1. Title Sheet

2.5.10.1.1. Name and address of the Design Engineer

2.5.10.1.2. Name and address of the Owner/Developer

2.5.10.1.3. Name of Development and Phase number, if applicable

2.5.10.1.4. Vicinity map with scale indicated

2.5.10.1.5. Signature line for the City Engineer

2.5.10.1.6. Signature line for the City Planner

2.5.10.1.7. Signature Line for the Owner

2.5.10.1.8. Index of sheets

2.5.10.2. Plan Sheets

2.5.10.2.1. Existing and proposed topography and layout of development (street, curb and gutter, sidewalks, drainage headwalls, utility poles, lot lines and utility easements)

2.5.10.2.2. Centerline profile of the roadway

2.5.10.2.3. Intersection details

2.5.10.2.4. Pavement width

2.5.10.2.5. Right-of-Way width

2.5.10.2.6. Centerline, gutter and top of curb spot elevations and any additional spot elevations needed to ensure proper drainage

2.5.10.2.7. Elevations of all tops of castings, etc.

2.5.10.2.8. Profile of all underground utilities

2.5.10.2.9. Existing utilities; i.e. manholes, line sizes, storm drains, and water lines

2.5.10.2.10. Typical sections taken at a maximum of 25-foot intervals and at all points of pipe crossings

2.5.10.2.11. The statement "All construction shall be in accordance with the City of Lebanon Standards and Specifications."

2.5.11. Plans prepared by the Design Engineer for the grading of a development shall be drawn on plan 22" x 34" sheets to a minimum scale of 1" = 50' for horizontal and 1" = 5' for profile. 24" x 36" drawings will be acceptable but not preferred. Other paper sizes will not be accepted unless specifically permitted by the City Engineer in writing. The drawings shall contain the following minimum information:

2.5.11.1. Title Sheet

2.5.11.1.1. Name and address of the Design Engineer

2.5.11.1.2. Name and address of the Owner/Developer

2.5.11.1.3. Name of Development and Phase number, if applicable

2.5.11.1.4. Vicinity map with scale indicated

2.5.11.1.5. Signature line for the City Engineer

2.5.11.1.6. Signature line for the City Planner

2.5.11.1.7. Signature Line for the Owner

2.5.11.1.8. Index of sheets

2.5.11.2. Plan Sheets

2.5.11.2.1. Existing and proposed topography and layout of development (street, curb and gutter, sidewalks, drainage headwalls, utility poles, lot lines and utility easements).

2.5.11.2.1.1. Proposed grading plans shall take into account Excavation material from basements/crawlspaces as it relates to building pads and development drainage.

2.5.11.2.1.1.1. For developments such as subdivisions where the exact size and dimensions of the future structures is unknown at the time of construction of the development, a building pad consistent with the type of homes anticipated for the development shall be assumed and grading shall be provided to provide proper drainage.

2.5.11.2.2. Final drainage patterns shall be clearly indicated with flow arrows.

2.5.11.2.3. The statement "All construction shall be in accordance with the City of Lebanon Standards and Specifications."

2.6. COST ESTIMATE

2.6.1. The Design Engineer shall prepare an itemized cost estimate of the proposed public improvements, stormwater quality and detention facilities, and erosion and sedimentation control provisions. The estimate shall be reviewed and approved by the City of Lebanon prior to approval of the plans and submittal of Public Improvement and Erosion and Sedimentation Control Bonds as described in Section 2.10. The cost estimate shall match the column format provided in the As Built Plan Requirements found in the Appendix. Copies of the estimate shall be submitted to the Office of the City Engineer in hard copy and digital format in Microsoft Excel format.

2.7. REVIEW PHASE

2.7.1. Seven sets of plans shall be submitted to the City of Lebanon for review and approval. The Owner/Developer shall allow a minimum 30 work day period for the review time; however, the City of Lebanon shall conduct its review as expeditiously as possible.

2.7.2. The City of Lebanon shall review improvement/construction plans for individual site developments and subdivisions/PUDs as to the standard specifications contained herein and in accordance with the checklists provided in the Appendix. The City of Lebanon will prepare comments identifying any changes that shall be made to the plans prior to acceptance of the plans by the City. After all corrections are made, the corrected plans shall be resubmitted to the City of Lebanon for review.

2.7.2.1. Upon the request of the office of the City Engineer, and prior to plan approval, the design engineer shall submit the current entire design of the development in AutoCAD format to allow for the design of the electrical infrastructure to serve the development. This request will not be made until the design has reached 90% completion. The City of Lebanon Electric Department shall complete their design within 15 working days from the receipt of the digital files. The City of Lebanon will return the design of the electrical infrastructure for the development to the Design Engineer for inclusion in the plans.

2.7.3. The Owner/Developer shall submit plans and specifications in accordance with the policies for plan submittals to the Ohio EPA for approval and permits to install.

2.7.4. Final approval shall not be granted by the City Engineer until the following applicable items are met:

2.7.4.1. All comments from the Office of the City Engineer have been satisfactorily addressed.

2.7.4.2. Water and Sanitary Sewer PTI's are received by the City of Lebanon from the OEPA.

2.7.4.3. NOI Applications and NPDES Permit received by the City of Lebanon from the OEPA.

2.7.4.4. All electrical facilities are shown on the plans in accordance with the Electric Department standards.

2.8. SUBMITTAL OF WATER AND SEWER PLANS TO OHIO EPA FOR APPROVAL

2.8.1. The purpose of this section is to establish the procedure for submission of water and/or sanitary sewer plans to the Ohio Environmental Protection Agency (OEPA) for approval.

2.8.2. Prior to plans being submitted to OEPA for approval, they shall have been approved by the City of Lebanon subject to OEPA's conditions and approval. Upon approval of the plans by the City of Lebanon, the City of Lebanon will provide to the Owner/Developer a letter of recommendation for approval by the OEPA. In the event that OEPA requirements are more stringent than City of Lebanon requirements, OEPA requirements shall prevail.

2.8.3. It should be noted that City of Lebanon review relates directly to those water mains and sanitary sewers that are to become public utilities. Private sanitary sewer and water mains are required to meet City of Lebanon performance standards as well as OEPA requirements.

2.8.4. The Owner/Developer is responsible for payment of all fees for the application, review, permit to install, or other costs associated with OEPA approval.

2.8.4.1. It shall be the Owner/Developer's (or his agent's) responsibility to assemble and submit the required documents to the OEPA for approval.

2.8.4.2. Information shall be sent to the following:

Ohio EPA
Southwest District Office
401 East Fifth Street
Dayton, Ohio 45402-2911

2.8.4.3. Responses to OEPA questions during their review shall be mailed to the OEPA representative involved.

2.8.4.4. At the same time plans are sent to the OEPA for review and approval, one (1) complete set of all materials submitted to OEPA shall be sent to:

Office of the City Engineer
City of Lebanon
50 South Broadway
Lebanon, Ohio 45036

2.8.4.5. The City of Lebanon is required to be copied on all correspondence both to and from the OEPA.

2.8.4.6. It is the Owner/Developer's responsibility to provide corrected copies of material during the review process to the City of Lebanon so that the City of Lebanon has a complete set of plans as approved by the OEPA.

2.8.4.7. When the City of Lebanon is notified of the OEPA's approval, it will notify the Owner/Developer.

2.9. APPROVED PLANS

2.9.1. No work shall commence on any public improvements until the Contractor has, in his possession a complete set of approved plans. Each set of plans shall also be approved and signed by the City Engineer.

2.9.2. Upon approval by the City Engineer, the Owner/Developer or Engineer shall submit a digital copy of the approved plans in AutoCAD format to the office of the City Engineer.

2.10. BONDING

2.10.1. Public Improvement Bonds shall be required for all private projects involving the installation of public utilities, and/or roadways.

2.10.1.1. For developments involving dedication of Right-of-Way, prior to the approval of a Final Plat by the City of Lebanon the developer shall post public improvement bonds in the amount of 130% of the estimated cost of the public improvements, as approved by the City of Lebanon, to secure the performance and construction of the uncompleted and unapproved public improvements. The bonding forms found in the Appendix shall be used when submitting bonds.

2.10.1.2. For development not involving the dedication of Right-of-Way, prior to the final approval of the construction drawings by the City of Lebanon and prior to the start of construction, the developer shall post public improvement bonds in the amount of 130% of the estimated cost

of the public improvements, as approved by the City of Lebanon, to secure the performance and construction of the uncompleted and unapproved public improvements. The bonding forms found in the Appendix shall be used when submitting bonds.

2.10.2. All developments shall post bonds for erosion and sedimentation control and stormwater detention and quality.

2.10.3. Prior to the Developer securing bonds, line item estimates for all items to be bonded shall be submitted to the Office of the city Engineer for approval of the bonding amounts.

2.10.3.1. The estimates shall indicate the item of work, the item unit, number of units, unit price, and total cost for each item to be bonded. Lump sum estimates shall not be submitted.

2.10.3.2. Separate bond estimates shall be submitted for each bond type (Streets and Appurtenances, Sidewalks, Water, Sanitary, and/or Storm Sewer, Stormwater Detention and Quality, and Sedimentation and Erosion Control).

2.10.4. After preliminary acceptance of the constructed improvements and a complete set of As-Built plans have been received and approved by the City of Lebanon in hard copy and digital format, the public improvement bond may be reduced to an amount determined by the City of Lebanon, but shall be no less than 20% of the estimated cost of the public improvements amount and 130% of all non-completed items. A maintenance bond will be held for a period of 24 months beyond the approval date of the improvements to cover any defects in construction of the improvements to be determined by the City of Lebanon. After this period and after the final inspection and completion of any punchlist items, the bond may be released to the Owner/Developer.

2.10.4.1. Approval of improvements shall not be granted until a punch list has been completed by the City of Lebanon and all items have been satisfactorily completed.

2.10.5. Erosion and Sedimentation Control Bonds shall be required for all private developments that meet the requirements set forth in Section SECTION 8 of this manual. Bonds shall be provided in the amount of 130% of the estimated cost of the sedimentation and erosion control measures for the site, as approved by the City of Lebanon.

2.10.5.1. Erosion and Sedimentation Control Bonds may be reduced upon approval of the site by the City Engineer. <u>Prior to approval, the site shall have been permanently stabilized</u>.

2.10.6. The City of Lebanon will accept security in any of five separate forms except in the case of Erosion Control improvements. In the case of Erosion and Sedimentation Controls, only a certified check or cashier's check is acceptable. As Developer, with the exception of Erosion Control improvements, you may, at your option, select the form of security as best suits your situation. The five forms of acceptable security are as follows:

2.10.6.1. Certified check or cashier's check payable to the City of Lebanon, Ohio. This check shall be deposited by the City in an appropriate fund and encumbered for the purposes set forth in the Security Agreement. Upon completion and proper maintenance of all improvements to City of Lebanon specifications, the principal amount of the funds will be disbursed back to the Developer.

2.10.6.2. Original Letter of Credit in favor of the City of Lebanon.

2.10.6.2.1. Please note that the Letter of Credit must include the following language for automatic renewal and notice to the City of Lebanon, Ohio in case of non-renewal:

2.10.6.2.1.1. "It is a condition of this Letter of Credit that it shall be deemed automatically extended without amendment for successive one year periods from its present or any future expiration date unless at least sixty (60) days before any such expiration date we notify the City Engineer of the City of Lebanon, at the address listed above, in writing by certified or registered mail, that we elect not to consider this letter of credit renewed for any such additional period, at such time the City of Lebanon, Ohio

may declare the Developer to be in default and demand immediate payment of all sums under this Letter of Credit."

2.10.6.2.2. If the Letter of Credit contains a draft presentment deadline, it is mandatory that the Letter of Credit include the following language:

2.10.6.2.2.1. "The draft presentment deadline set forth in this letter of credit shall automatically be extended for one year periods unless at least sixty (60) days prior to any draft presentment deadline, or any prior extension thereof, the _____ (name of financial institution) Bank notifies the City Engineer of the City of Lebanon, Ohio, 50 South Broadway, Lebanon, Ohio 45036, that the draft presentment deadline shall not be extended for a successive one year period, at such time the City of Lebanon, Ohio may declare the Developer to be in default and demand immediate payment of all sums under this Letter of Credit."

2.10.6.2.3. The Letter of Credit must also contain the following language:

2.10.6.2.3.1. "The Security Agreement referenced by this Letter of Credit and all its terms and conditions, is attached hereto, made a part hereof, and fully incorporated herein, as if fully rewritten".

2.10.6.2.4. Payment pursuant to the Letter of Credit shall not be conditioned except upon notification by the City Engineer to the issuing financial institution that the developer is in default of the installation and/or maintenance of improvements within the subject development.

2.10.6.2.5. The Letter of Credit must state that it is being issued in connection with the installation of improvements in a particular development being developed by a certain developer. This reference must be specific and identify the development and section or phase thereof as may be applicable. Additional reference must be made that the letter of credit is being issued in connection with the security agreement between the City and the developer.

2.10.6.3. Original Escrow Letter issued by a financial institution.

2.10.6.3.1. The following text shall be included:

2.10.6.3.1.1. "The Security Agreement referenced by this Original Escrow Letter and all its terms and conditions, is attached hereto, made a part hereof, and fully incorporated herein, as if fully rewritten".

2.10.6.4. Surety Bond issued by a surety company authorized to do business in the State of Ohio. An authorized representative must sign the security agreement which will serve as the bond. A power of attorney from the surety company authorizing the signature on behalf of the surety company must accompany the security agreement.

2.10.6.5. Surety Obligation of National Bank. A national bank may bind itself as surety to indemnify the City should the Developer default in the installation of the development improvements if it has a segregated deposit sufficient to cover the bank's total potential liability. Therefore, an authorized representative of the national bank must sign the security agreement, which signature shall also constitute a certification that the national bank has a segregated deposit sufficient in amount to cover the bank's total potential liability.

2.10.7. Irrespective of the type of security selected by the Developer, all security agreements with the exception of erosion control must be signed by the Surety.

2.10.8. The term "Surety" as used herein includes a bank, savings and loan or other financial institution where the security provided is a letter of credit, escrow letter or surety obligation of a national bank. The term "Surety" when referring to a bank, savings and loan or other financial institution is not intended to create obligations beyond those provided by the security agreement. In the event that Surety fails to make funds available to the City of Lebanon, Ohio in accordance with

the security agreement within thirty (30) days after notification of default, then amounts due shall bear interest at eight per cent (8%) per annum.

2.10.9. Other than filing in the blanks, no other alterations to the Security Agreements or escrow letter may be made. Do not retype the security agreements or the escrow letter. Use only the forms provided or photocopies thereof. Security agreements and escrow letters which have been altered or retyped will not be accepted. The Development name on a Security Agreement must exactly match the name of the Development on the record Development plat. No exceptions. For example, if the name of the Development is Spicewood, the name on the agreement must be spelled the same. The spelling Spice Wood is not the same as Spicewood. In addition, if the Development is Section One, referring to as Section 1 is not the same.

2.10.10. Upon completion of the Security Agreements by the Developer and the Surety, they must be returned to the Office of the City Engineer.

2.10.11. All Security Agreements must be submitted to the City Engineer with the plat of the improvement. In no circumstances will Security Agreements be approved the City Engineer until the plat has been approved by that City Engineer.

2.10.12. Following performance of improvements in a Development, the Developer may request a reduction in the bond. Such requests may be made in writing to the Office of the City Engineer, and shall be granted in the sole discretion of the City of Lebanon, Ohio.

2.10.13. A copy of each of the following Security Agreements is included in the Appendix:

2.10.13.1. Streets and Appurtenances

2.10.13.2. Sidewalks

2.10.13.3. Water, Sanitary Sewer, and/or Storm Sewer

2.10.13.4. Erosion Control

2.10.13.5. Stormwater Detention/Retention and Quality

2.10.13.6. Escrow Letter

2.11. PERMITS, EASEMENTS, AND RIGHTS-OF-WAY

2.11.1. The Owner/Developer shall make application for, obtain and pay for all licenses, permits, easements and rights-of-way. The Contractor shall be required to comply with all State and Municipal ordinances, laws and codes that may apply to the same.

2.12. CONSTRUCTION PHASE

2.12.1. The Contractor will not be permitted to commence work until he has obtained all insurance required by these documents and such insurance has been approved by the City of Lebanon.

2.12.2. Such insurance shall be secured from an insurance company or companies authorized to write casualty and property insurance in the State of Ohio and shall protect the Contractor, his subcontractors, the Owner/Developer, and the City of Lebanon from claims for bodily injury, death, property damage, fire and other risks set out herein.

2.12.3. Each policy of insurance covering the Contractor's operations under the contract shall provide, either in the body of the policy or by appropriate endorsement (rider) to the policy, that such policy cannot be altered or canceled in less than ten (10) days after the mailing of written notice of such alteration or cancellation to the Owner/Developer (insured) and the Design Engineer or not less than five (5) days after actual receipt by the Owner/Developer (insured) and the Design Engineer, of written notice of such pending alteration or cancellation.

2.12.4. Certificates of insurance coverage shall include a statement of alteration or cancellation provisions of the policy, sufficient to show definitely that such provisions comply with the requirements stated herein.

2.12.5. The construction phase shall not begin until a written Notice to Proceed from the City of Lebanon is received by the Owner/Developer. When the City of Lebanon is ready to issue a Notice to Proceed, a Pre-Construction Conference will be scheduled and held jointly by the City of Lebanon and the Contractor. The Owner/Developer shall be responsible to the City of Lebanon for the proper construction of the facilities.

2.12.6. The City Engineer and the Design Engineer shall be notified immediately of any conflicts encountered in the field between the water and sanitary sewer improvements and existing infrastructure.

2.12.7. It is required that the Contractor contact the City of Lebanon when water or sanitary sewer lines have been backfilled under streets so that a representative may visually inspect the backfill material before asphalt or concrete is placed on the streets. Compaction testing by a certified geotechnical firm may be required by the City of Lebanon at the expense of the Owner/Developer.

2.12.8. After the installation of each storm and sanitary sewer section from structure to structure, a preliminary check of the pipe slope shall be conducted and provided to the City of Lebanon. Refer to Paragraphs 4.11.6. and 7.10.7.

2.12.9. Foundation As-Built Drawings

2.12.9.1. Prior to the construction of any structure proceeding past the footer/foundation phase, an As-Built Foundation Plan shall be submitted to and approved by the City of Lebanon. The foundation as-built plan shall meet the following requirements:

2.12.9.1.1. The drawing scale shall not exceed 1” = 30’.

2.12.9.1.2. All property boundaries, including bearing and distance information, shall be shown.

2.12.9.1.3. All easements and building setback lines shall be clearly shown and labeled.

2.12.9.1.4. The footer/foundation of the structure shall be accurately located in the field by actual field survey.

2.12.9.1.5. The top of footer/foundation elevation shall be given. The elevation shall be based upon NAVD 88.

2.12.9.1.6. The minimum yard depth shall be provided to all lot lines. Distances shall be carried to the nearest 1/100 foot (e.g., 48.26’).

2.12.9.1.7. The drawing shall be provided in hard copy and shall be signed and stamped by a Professional Surveyor registered in the State of Ohio.

2.12.9.2. The Foundation As-Built Drawing will be compared to the site plan/plot plan submitted for the structure. The location and elevation of the structure will be checked to ensure the structure is constructed as approved by the City of Lebanon.

2.12.10. Any deviation, change, addition or deletion from the approved plans must be approved by the City of Lebanon in writing before the deviation, change, addition or deletion is made during construction.

2.12.11. Representatives of the City of Lebanon shall have the right to enter upon the project site to make periodic inspection of the work in progress.

2.12.12. Upon completion of construction, the Contractor shall pressure test and disinfect all water lines, and conduct infiltration, exfiltration or air tests on sewer lines as outlined in these standard specifications. Any section of lines that does not pass the prescribed test must be corrected to the

satisfaction of the City of Lebanon and retested until all testing procedures are satisfied. All testing must be conducted in the presence of a representative of the City of Lebanon.

2.12.13. A video inspection of the all sanitary and storm sewer mains shall be conducted in accordance with the requirements set forth in Section 2.13. Copies of the video and written reports shall be provided to the City Engineer prior to the acceptance of the improvements or the release of bonds

2.12.14. For residential developments, final asphalt shall not be placed until a minimum of 80 percent of homes in the section have been completed, unless otherwise approved by the City Engineer.

2.12.15. Upon completion of construction, the Owner/Developer shall certify, to the City of Lebanon in writing that all payments have been made to all parties involved in the construction of the facilities. The certifications shall state the final total project cost.

2.12.16. Upon the completion of construction, the City of Lebanon will perform a preliminary inspection of the improvements and prepare a punchlist, if required, and send a copy to the Owner/Developer. Punchlist items shall be addressed immediately upon the receipt of the punchlist and shall be completed in a timely manner.

2.12.17. Upon completion of final inspection punchlist items, receipt of As-Built Drawings, and final acceptance of the improvements, the Owner/Developer shall transfer ownership of the new facilities to the City of Lebanon and said facilities shall become an asset of the City of Lebanon.

2.13. VIDEO INSPECTION

2.13.1. It is strongly recommended that video inspections be performed upon the completion of the public infrastructure improvements (prior to individual site construction activities).

2.13.2. Video inspections shall be required at a time determined by the City Engineer which shall be prior to final bond release after a minimum of 80 percent build-out.

2.13.3. Video inspections shall only be performed by a professional firm specializing in utility video inspections.

2.13.4. Copies of the video inspections and written reports shall be submitted to the Office of the City Engineer.

2.13.5. The following procedures and limitations shall be adhered to:

2.13.5.1. The camera shall not follow a sewer jet.

2.13.5.1.1. If a sewer line requires cleaning, said cleaning shall be performed prior to the video inspection, not as part of the sewer inspection.

2.13.5.1.2. If use of the camera is required to ensure that the line has been thoroughly cleaned, this footage shall not be a substitute for the actual video inspection

2.13.5.2. If the line is to be cleaned prior to video inspection, upon the completion of the cleaning, clean water shall be placed into the upstream junction of the section to be inspected. Water shall be added until flow is observed in the downstream junction. This procedure is to ensure that any standing water in the sewer lines will be clearly visible.

2.14. INSURANCE REQUIREMENTS

2.14.1. Whenever work is performed in the right-of-way or in City-owned property, the contractor shall have insurance that conforms with the following:

2.14.1.1. Insurance, Worker's Compensation - The Contractor shall take out and maintain during the life of this contract, Worker's Compensation Insurance, as required by statute, for all of his employees employed at the site of the project, and in case any work is sublet, for all the subcontractor's employees not otherwise insured. In case any class of an employee, who is engaged in hazardous work at the site of the project, is not protected under the Worker's

Compensation Statute, the Contractor shall provide adequate coverage for the protection of the employees not otherwise protected.

2.14.1.2. Insurance, Public Liability - The Contractor shall take out and maintain during the life of this contract, such Public Liability (Bodily Injury and Property Damage) Insurance as shall protect him and any subcontractor performing work at the site from claims for damages because of bodily injury, including accidental death and from claims for property damages which may arise from operations under this contract, whether such operations be by him or by any subcontractor, or by anyone directly or indirectly employed by either of them.

2.14.1.2.1. Liability coverage is to be written on a comprehensive general liability policy and must include:

2.14.1.2.1.1. premises-operations, manufacturers and contractors, owners, landlords and tenants;

2.14.1.2.1.2. contractors protective;

2.14.1.2.1.3. products-completed operations;

2.14.1.2.1.4. contractual liability.

2.14.1.2.2. General liability shall also include underground property damage by mechanical equipment. When blasting is done, coverage must be provided for the explosion hazard.

2.14.1.3. Railroad Insurance - Where work on railroad right-of way is involved, the Contractor shall also be covered by Railroad Property Liability Insurance with limits of liability as required by the railroad company on whose property the work is being performed.

2.14.1.3.1. All comprehensive-automobile-general liability insurance policies shall include, as named insured, the Contractor, the Owner/Developer, and the City of Lebanon, Ohio.

2.14.1.4. Minimum Insurance Limits - The minimum amounts of insurance to be furnished by and for the general contractor and the subcontractors under this contract are:

2.14.1.4.1. Worker's Compensation –

OH Statutes Employers Liability
-$100,000 limit of liability

2.14.1.4.2. Comprehensive General Liability

Contracts less than $1,000,000.00
-$2,000,000.00 minimum coverage
Contracts in excess of $1,000,000.00
-$5,000,000.00 minimum coverage

2.14.1.4.3. Comprehensive Automobile Liability

-$1,000,000.00 combined single limit per occurrence

2.14.1.4.4. Railroad Protection Insurance - (where work is to be executed within the railroad right-of-way) Loss of Life or Injury to Person - As required by Railroad Property Damage - As required by Railroad

2.14.1.4.5. In all cases the City of Lebanon shall be listed as an additional insured.

2.15. CERTIFICATION OF COMPLETION

2.15.1. Upon completion of construction and all punchlist items, the Design Engineer or a Professional Surveyor registered in the State of Ohio shall certify to the City of Lebanon that the project has been constructed in accordance with the approved plans and the standard specifications contained herein. A complete set of As-Built drawings, in accordance with the current City of Lebanon As-Built Drawing Requirements, must accompany the Design Engineer's certification.

2.15.1.1. If any major deviations (as determined by the City of Lebanon) are encountered, the Design Engineer shall certify in writing whether or not the improvements as installed will adequately perform. These certifications shall be signed and stamped by a Professional Engineer registered in the State of Ohio. Copies of all calculations shall be included with the certification.

2.15.2. Upon receipt of these certifications and As-Built Drawings, the City of Lebanon shall accept the facilities as an extension of the existing public system.

2.16. COMPREHENSIVE PERMIT INSPECTIONS

2.16.1. Inspection Scheduling

2.16.1.1. All inspections will be performed between the hours of 9:00 AM and 4:00 PM, Monday through Friday, excluding holidays.

2.16.1.2. All requests to schedule inspections shall be called in before to 4:00 PM on the business day prior to the inspection being needed.

2.16.2. Inspection requirements

2.16.2.1. The following are general requirements for comprehensive permit inspections. See each respective section for complete requirements.

2.16.2.2. Water service line

2.16.2.2.1. All water services shall be installed by open cut or by directional drilling.

2.16.2.2.2. If open cut, the service line shall be bedded with a minimum of 6” of #9’s/Grits and shall have a minimum of 6” of #9’s /Grits over the top of the service line prior to backfilling the trench.

2.16.2.2.2.1. Trench shall not be backfilled prior to inspection approval. Inspection shall take place prior to placing material over top of service line.

2.16.2.2.2.2. Additional material shall be on site to allow for 6” of #9’s (grits) to be placed over the line upon approval of the inspection.

2.16.2.2.3. If directional drilled, the service line shall be potholed a minimum of once every 50 feet, no less than two per 100 feet, to verify depth.

2.16.2.2.4. Connections shall be made using compression fittings.

2.16.2.2.5. See Section 3 for additional requirements.

2.16.2.3. Sewer lateral

2.16.2.3.1. Trench shall not be backfilled prior to inspection approval.

2.16.2.3.2. The sewer lateral shall be laid in the trench with 6” of #9’s (grits) beneath the sewer lateral.

2.16.2.3.3. Connections shall be made using Fernco (or approved equal) couplings.

2.16.2.3.4. Additional material shall be on site to allow for 6” of #9’s (grits) to be placed over the lateral upon approval of the inspection.

2.16.2.3.5. See Section 4 for additional requirements.

2.16.2.4. Concrete

2.16.2.4.1. Crushed limestone 304 shall be in place and compacted.

2.16.2.4.2. Forms shall be in place. Proper form materials and heights shall be used.

2.16.2.4.3. Expansion joint material shall be on site and shall be of an approved type. Expansion joint material shall match the thickness of concrete being poured.

2.16.2.4.4. See Section 6 for additional requirements.

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3.1. PURPOSE

3.1.1. The purpose of this Section is to outline requirements for design, construction, inspection, and final acceptance of potable water mains and appurtenances, water service connections, and fire protection systems.

3.2. DESIGN REQUIREMENTS

3.2.1. Water system improvements shall be installed in public rights-of-way or, upon approval from the City of Lebanon, in a utility easement granted to the City of Lebanon. A utility easement shall be provided when a water main is located on private property. The utility easement width shall be no less than twenty feet (20') and shall be located over the center of the water main. Using the water main as the centerline, there shall be at least ten feet (10') of open space from the center of the water main for maintenance purposes. Water mains shall not run between residential or commercial structures unless authorized, in writing, by the City of Lebanon.

3.2.2. Each lot in a development shall be provided with a connection to the public water supply.

3.2.3. In cases where water is not available to a site, it shall be the Owner/Developer's sole responsibility and cost to extend the water main to the site.

3.2.4. It shall be the Owner/Developer's responsibility to determine if existing water mains will have the capacity to feed the development. If water main upsizing is needed it shall be the responsibility of the Owner/Developer. Copies of all sizing calculations shall be provided to the office of the City Engineer.

3.2.5. Dead end water mains shall be minimized by looping water mains with multiple feed points. Where dead ends occur, they shall terminate with a tee and plug and fire hydrant, tee and plug and flushing hydrant, water sampling station with a resilient wedge gate valve or any combination of the three devices herein described. This configuration shall be approved by the City Engineer.

3.2.6. To ensure future looping of the water system, the Owner/Developer shall install the proposed water main along the entire road frontage (including existing roadways) of the development and to all of the property boundary lines of the development. Final determination of the water extension shall be at the discretion of the City Engineer.

3.3. AMERICAN MADE PRODUCTS

3.3.1. All water main, service lines, fittings, valves, fire hydrants, and all appurtenances shall be manufactured in the United States of America.

3.4. WATER MAINS

3.4.1. Water mains are those pipes used to distribute water to service connections and public fire hydrants and are owned or under the control of the City of Lebanon. Water mains must be sized to meet present water consumption and projected average and maximum daily demands, including fire flow demand. The Owner/Developer shall provide design criteria and calculations, to establish water usage demands. A complete set of hydraulic computations, in a tabular form, shall be provided to the City of Lebanon which documents average and peak flows, ground elevations, elevations of hydraulic grade line and system operating pressures. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

3.4.2. Peak design flows shall be the greater of the following:

3.4.2.1. Flow determined by the Design Engineer as the instantaneous demand placed upon the system by the development; or

3.4.2.2. Flow required for fire protection by Insurance Services Offices of Ohio guidelines; or

3.4.2.3. Computed peak flow if development is commercial or industrial; or

3.4.2.4. As directed by the City of Lebanon under extenuating circumstances or circumstances not covered by these regulations.

3.4.3. All water mains, including those not designed to provide fire protection, shall be designed to maintain a minimum pressure of 35 psi at ground level for all flow conditions. A minimum flow of 1000 GPM at a residual pressure of 20 PSI at the highest ground elevation shall be required by the City of Lebanon for all new construction.

3.4.4. Water mains shall be the size specified by the most current City of Lebanon Water Master Plan for the water system expansion. In no case shall the size of the water main be less than eight inches (8") in diameter, unless approved, in writing, by the City Engineer.

3.4.5. The required depth of cover over the top of a water main and all fire hydrant branches shall be no less than four feet (48"). Any water main installed in a trench over five feet (60") in depth must first have the approval of the City Engineer.

3.4.6. Fire hydrant branch lines shall be the size specified by the City of Lebanon. In no case shall branch lines for fire hydrants be less than six inches (6") in diameter.

3.4.7. Water mains not designed nor intended to carry fire flows shall not have fire hydrants connected.

3.5. WATER SERVICE LINES

3.5.1. Water service lines are those water lines that tap off the water main and provide potable water service to a specific property or water user. All water service lines shall be connected to a designated City of Lebanon water main.

3.5.2. The Owner/Developer shall install the corporation stop, service line with appropriate gooseneck application, curb stop, and curb box in an approved manner from the water main to the Right-of-Way. Where applicable, a minimum of ten-foot (10') extension of the water service shall be provided to avoid conflicts with future sidewalks and utilities.

3.5.2.1. Curb stop boxes shall be the responsibility of the Developer. The developer may install the curb stop boxes at the time of utility installation, or the Developer may elect to have the curb stop boxes installed at the time of home construction. In either case bonds will not be released until properly installed curb stop boxes are in place.

3.5.3. The water service line and curb stop and box shall run in a perpendicular manner from the water main to the Public Right-of-Way line, or an area approved by the City of Lebanon in writing. A ten-foot (10') horizontal distance between water service lines and sewer laterals shall be maintained at all times. The intent is for the water service line and the sewer lateral to run parallel from the main connections to the residential or commercial buildings in a perpendicular manner.

3.5.4. All curb stops and boxes shall be placed within the Right-of-Way.

3.5.5. The City of Lebanon maintenance responsibility for the water service line shall be as described herein:

3.5.5.1. Where the water meter is located outside of the building and within the right of way the City of Lebanon will be responsible for the maintenance of the water service from the tap to the water meter, not including the outlet connection. The owner of premises served shall be responsible for the operation, maintenance, repair and reconstruction of the building water service line from the building to the point of connection with the water meter, including the outlet connection.

3.5.5.2. Where the water meter is located outside of the building and outside of the right of way the City of Lebanon shall be responsible for repairs from the public water main to the curb stop, including the curb stop. The owner of premises served shall be responsible for the operation, maintenance, repair and reconstruction of the building water service line from the building to the point of connection with the curb stop, including the outlet connection. The owner of the premise will also be responsible for the operation, maintenance, repair and reconstruction of the building water service line from the water meter to the curb stop.

3.5.5.3. Where the water meter is located inside the building the City of Lebanon shall be responsible for repairs from the public water main to the curb stop, including the curb stop. The owner of premises served shall be responsible for the operation, maintenance, repair and reconstruction of the building water service line from the inlet of the water meter to the curb stop located at the right of way.

3.5.5.4. In all cases, the water meter and the inlet coupling is the responsibility of the City of Lebanon.

3.5.6. Water service lines shall comply with the following:

3.5.6.1. From the water main to the curb stop, the minimum diameter of water service lines shall be one inch.

3.5.6.2. From the curb stop to the structure, the minimum diameter of water service lines shall be as determined by the current plumbing code.

3.5.6.3. Only the following materials are acceptable for water service lines:

3.5.6.3.1. All service lines less than three inches (< 3”) shall be Type K Copper tubing.

3.5.6.3.1.1. In certain cases where the service line will be in a length in excess of 100’, plastic water service may be used with written approval of the City Engineer.

3.5.6.3.1.1.1. If a plastic water service is installed, a trace wire shall be installed. The trace wire shall be terminated and made accessible in the curb stop box to allow future location of the water service.

3.5.6.3.1.1.2. If a plastic water line is installed, the plastic water line shall not protrude through the foundation/footer. The penetration shall only be made with Type K copper pipe. A minimum of 25 feet of buried Type K copper shall be provided between the point of foundation/footer penetration and the plastic water service material.

3.5.6.3.2. All service lines 3 inches and larger (≥ 3”) shall be Class 53 ductile iron pipe. All ductile iron pipe, bends, and fittings shall comply with the standards set forth for water mains.

3.5.7. All water service lines, from the water main to the structure, shall be covered with a minimum of forty-eight inches (48") and a maximum of sixty inches (60") of backfill material, measured from the top of the water service pipe to the final finished ground level.

3.5.8. All reasonable efforts to avoid placing a water service under driveways or walkways shall be made.

3.6. WATER PUMPING FACILITIES

3.6.1. General

3.6.1.1. All water pumping facilities shall be designed in accordance with the Recommended Standards for Water Works (10 States Standards) and shall be subject to the approval of the Director of Water and Wastewater and the City Engineer.

3.6.2. Pumps

3.6.2.1. All pumps shall be Gorman Rupp Pumps.

3.6.2.2. At least two pumping units shall be provided. With any pump out of service, the remaining pump or pumps shall be capable of providing the maximum pumping demand of the system. The pumping units shall:

3.6.2.2.1. Have ample capacity to supply the peak demand against the required distribution system pressure without dangerous overloading.

3.6.2.2.2. Be driven by prime movers able to meet the maximum horsepower condition of the pumps,

3.6.2.2.3. Be provided with readily available spare parts and tools,

3.6.2.2.4. Be served by control equipment that has proper heater and overload protection for air temperature encountered.

3.6.2.3. Duplicate Pumps

3.6.2.3.1. Each booster pumping station shall contain not less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service.

3.6.2.4. Metering

3.6.2.4.1. All booster pumping stations shall be fitted with a flow rate indicating and totalizer meter.

3.6.2.5. Inline Booster Pumps

3.6.2.5.1. In addition to the other requirements of this section, inline booster pumps shall be accessible for servicing and repairs.

3.6.3. Automatic and Remote Controlled Stations

3.6.3.1. All automatic stations shall be provided with automatic signaling apparatus which will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the applicable state and local electrical codes and the National Electrical Code.

3.6.3.2. SCADA Integration

3.6.3.2.1. All equipment related to the pump station shall be provided with all items necessary to be integrated into the City of Lebanon's SCADA system.

3.6.3.3. Standby Power

3.6.3.3.1. To ensure continuous service when the primary power has been interrupted, a power supply shall be provided from at least two independent sources or a standby or an auxiliary source shall be provided. If standby power is provided by onsite generators or engines, the fuel storage and fuel line must be designed to protect the water supply from contamination. See section 4.20.4. for generator set requirements.

3.6.3.3.2. Carbon monoxide detectors shall be provided when generators are housed within pump stations.

3.6.3.4. Water Pre-Lubrication

3.6.3.4.1. When automatic pre-lubrication of pump bearings is necessary and an auxiliary direct drive power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the pump is started or the pre-lubrication controls shall be wired to the auxiliary power supply.

3.7. FIRE PROTECTION

3.7.1. Fire suppression systems may utilize a City of Lebanon standard fire meter pit. If a fire meter pit is utilized, separate taps for fire suppression systems shall not be permitted. A detail of the City of Lebanon Standard Fire Meter Pit is included in the Appendix.

3.7.2. If a fire meter pit is not utilized, a separate tap for the fire suppression system and for the domestic water service may be provided. All required fire line valves (gate valves and double check valves) shall be located at the point of entry of the fire suppression line to the structure.

3.7.2.1. A remote Fire Department Connection (FDC) shall be provided. The location of the FDC shall be determined by the City of Lebanon Fire Department.

3.7.3. Fire lines shall be located in a separate trench from the domestic water service lines. The separation shall be no less than four feet from pipe edge to pipe edge, unless approved in writing by the City of Lebanon.

3.7.4. Water lines designed or constructed to carry water for fire protection shall comply, as a minimum, with the material and construction method requirements for water mains.

3.7.5. All fire protection lines shall be constructed of Class 53 ductile iron unless otherwise approved by the City of Lebanon, in writing. Joints and fittings shall comply with the standards set forth for water mains.

3.7.6. All water lines constructed for the purpose of fire lines shall have, at the point of entry (POE), an OEPA approved backflow device and shall conform to and abide by all rules and regulations contained in the City of Lebanon's Backflow/Cross Connection Control Program.

3.7.6.1. An ASSE 1015 Double Check Detector Check may be allowed upon condition of a written document stating no chemicals will be added to this fire line.

3.7.7. Fire hydrants and their drainage systems shall not be connected to or located within ten feet (10') of sanitary sewers or storm drain systems, unless approved in writing by the City of Lebanon.

3.8. SEPARATION OF WATER AND SEWER LINES

3.8.1. Water mains shall be laid at least ten feet (10') horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot (10') separation, the City of Lebanon may allow deviation on a case-by-case basis, if supported by data from the Design Engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least eighteen inches (18") above the top of the sewer.

3.8.2. Water mains crossing sewers shall be laid to provide a minimum vertical distance of eighteen inches (18") between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water main shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required. Any deviations from these standards will first be submitted in writing from the Design Engineer to the City of Lebanon for final determination. The City of Lebanon shall have final determination on all exceptions, and place such determinations in writing.

3.8.3. No water main or service shall pass through or come in contact with any part of a sewer manhole, sewer main, sewer lateral, or any other sewer appurtenance.

3.8.4. Design engineers shall exercise caution when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The Design Engineer must contact the City of Lebanon to establish specific design requirements for locating water mains near any source of contamination.

3.8.5. Surface water crossings present special problems. The City of Lebanon shall be consulted before any plans are prepared.

3.8.6. Aerial water main crossings are discouraged. If situations arise that require aerial crossings, they shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

3.8.7. Underwater main crossings shall have a minimum cover of four five (5') over the pipe. Open cut installations shall be encased in concrete. Installations that are bored and jacked shall be installed within a casing pipe.

3.8.7.1. When crossing water courses which exceed fifteen feet (15') in width, the following shall be provided on both sides:

3.8.7.1.1. The pipe shall be of special construction, for the purpose of underwater construction;

3.8.7.1.2. Valves shall be provided on both sides of the water crossing so that the section can be easily isolated for testing or repair;

3.8.7.1.3. The valves shall be easily accessible, and not subject to flooding;

3.8.7.1.4. Both valves shall be in a manhole with a one inch (1") corporation stop tapped into the top of the water main approximately one foot (1') on each side of the valves for the purpose of disinfection and testing.

3.9. DUCTILE IRON PIPE, FITTINGS AND JOINTS

3.9.1. Water mains shall be constructed of Class 53 ductile iron unless otherwise approved by the City of Lebanon, in writing.

3.9.2. Ductile iron pipe shall be designed in accordance with the latest revision of ANSI/AWWA C150/A21.50 for a minimum 150 psi (or project requirements, whichever is greater) rated working pressure plus a 100 psi minimum surge allowance; a 2 to 1 factor of safety on the sum of working pressure plus surge pressure.

3.9.3. Ductile iron pipe shall be manufactured in the U.S.A. in accordance with the latest revision of ANSI/AWWAC151/A21.51. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture.

3.9.4. Pipe shall have standard asphaltic coating on the exterior with a cement mortar lining on the interior in accordance with the most current revision of ANSI/AWWA C104/A21.4.

3.9.5. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

3.9.6. All pipe shall be furnished with push-on type joints, such as "Tyton" or "Fastite" unless mechanical joints with Mega-Lugs are required by the City of Lebanon. Joints shall be in accordance with ANSI/AWWA C111/A21.11, of latest revision, and be furnished complete with all necessary accessories. Field-LOK gaskets or approved equal may be required by the City of Lebanon where designated by the City of Lebanon Engineer. In all cases, Field-LOK gaskets or approved equal shall be required by the City of Lebanon for the first three (3) joints upstream and/or downstream of all bends, tees, reducers, and plugs/caps.

3.9.7. Fittings shall be manufactured in the U.S.A. and be either ductile iron or gray iron. Ductile iron fittings shall conform to the latest revisions of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Gray iron fittings shall be in accordance with ANSI/AWWA C110/A21.10, or latest revision. Fittings shall have a standard asphaltic coating on the exterior and a cement mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4, of latest revision.

3.9.8. All mechanical joints shall be restrained by the use of Mega-Lugs.

3.9.9. Fittings and accessories shall be furnished with either mechanical or push-on type joints in accordance with ANSI/AWWA C111/A21.11, or latest revision.

3.9.10. All pipe, fittings, and accessories shall be installed and tested in accordance with the latest revision of AWWA Standard C600. Newly installed ductile iron water mains shall be disinfected in accordance with the latest revision of AWWA Standard C651 prior to placing in service.

3.9.11. Mechanical joints, as well as plain and bell ends of fittings, shall conform to the dimensions set forth in AWWA C111-90 (ANSI A 21.11). The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

3.9.12. Care is to be taken when loading and unloading ductile iron pipe and its appurtenances. Improper handling may result in damage. Damaged material will not be accepted by the City of Lebanon.

3.10. POLYETHYLENE ENCASEMENT

3.10.1. All ductile iron pipe and ductile or gray iron fittings shall be protected by an eight-mil thick polyethylene encasement meeting the requirements of ANSI A21.5.

3.10.2. Polyethylene Encasement will not be required if a geotechnical investigation performed by a Professional Engineer registered in the State of Ohio indicates that the soils in the project area are not subject to corrosivity or conductivity and therefore will not be detrimental to the pipe material. Copies of all boring logs, a map indicating the location of the bores and a written report shall be provided to the Office of the City Engineer.

3.11. ENCASEMENT PIPE

3.11.1. Encasement pipe shall be steel, plain end, uncoated, unwrapped, have a minimum yield point strength of 35,000 PSI, and conform to ASTM A252 Grade 2 of ASTM Al30 Grade B without hydrostatic test. The steel pipe shall have welded joints and be in at least 18-foot lengths.

3.11.2. Wall thickness and encasement pipe diameter shall comply with all applicable ODOT and railroad authority requirements.

3.11.3. Stainless steel casing spacers (Cascade Waterworks, Mfg.) or their approved equal will be installed on the water main in the encasement pipe per the manufacturer's recommendations. After the water main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with brick or concrete block masonry and the encasement pipe shall be filled completely with sand in a manner acceptable to the City of Lebanon.

3.12. WATER MAIN APPURTENANCES

3.12.1. Valves

3.12.1.1. Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at all intersections and not more than 500-foot intervals in commercial/industrial districts and not more than one block or 800 feet in other districts. The final determination for the location, amount, and style of valves shall rest with the City of Lebanon.

3.12.1.2. Valves required in valve vaults shall have one-inch (1") corporation stops tapped into the top of the water main approximately one foot (1') on both sides of the resilient wedge gate valve. This one-inch (1") corporation stop will be utilized to inject disinfectant for new main construction and serve as a future disinfection or testing station.

3.12.1.3. All water valves sixteen inches (16") in diameter and larger shall be flanged butterfly valves unless otherwise approved by the City Engineer. All flanged butterfly valves shall have a gear operated closing mechanism.

3.12.1.4. All gate and butterfly valves shall open by turning left (close clockwise).

3.12.2. Gate Valves

3.12.2.1. Gate valves shall be of resilient wedge type.

3.12.2.2. Standards: Unless otherwise stated, the valves shall conform to the latest revisions of the following American Water Works Standards:

3.12.2.2.1. AWWA C515 Standard for Resilient-Seated Gate Valves for Water Supply Service

3.12.2.2.2. AWWA C111 American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

3.12.2.2.3. AWWA C550 Standard for Protective Epoxy Interior Coatings for valves and Hydrants

3.12.2.2.4. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

3.12.2.3. Gate valves shall be rated at 200 psi water working pressure with 400 psi hydrostatic test for structural soundness for 3" through 12". Testing shall be conducted in accordance with AWWA C515.

3.12.2.4. Valve Design: Resilient wedge gate valves and tapping valves shall be designed in accordance with the following requirements:

3.12.2.4.1. M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

3.12.2.4.2. Valve Ends

3.12.2.4.2.1. Flange ends shall conform to Section 4.4.1.4.1 of AWWA C515.

3.12.2.4.2.2. Push-on joints shall conform to AWWA C111 and shall be furnished with suitable gaskets and sufficient lubricant.

3.12.2.4.2.3. Tapping valve inlet end shall conform to Sec. 4.4.1.4.4 of AWWA C515 with the face finished in accordance with MSS SP-60, and shall be furnished with a suitable gasket. Tapping valve shall be furnished with bolts and nuts of 300 series 18-8 stainless steel, low zinc bronze, or approved equal for the inlet end.

3.12.2.4.2.4. Tapping valve outlet end shall have mechanical joint and shall be capable of accommodating a Mueller Machine for tapping the pipe. Accessories shall be furnished in accordance with the above paragraph.

3.12.2.4.3. Exterior Fasteners – All exterior fasteners, including all bonnet and seal plate bolts and nuts, plugs and external accessories shall be made from low zinc bronze or 300 series 18-8 stainless steel or approved equal corrosion resistant material.

3.12.2.4.4. All ductile iron (DI) shall conform to A536 Gr. 65-45-12. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

3.12.2.4.5. Stem Seal – The valve stem seal shall be O-rings in conformance with AWWA C515 and shall be so designed that the O-ring above the stem collar can be replaced while the valve is under pressure and in the fully open or fully closed position.

3.12.2.4.6. Valve Stem – Valve stem, stem nut and stem collar shall be made of low zinc bronze or approved equal material and shall be designed in accordance with Section 4.4.5 of AWWA C515. Stems shall have a minimum tensile strength of 60,000 psi, a minimum yield of 20,000 psi for a 20” valve. Valves 3” and 4” in diameter shall be designed for an input torque of 300 foot pounds at the fully opened or fully closed positions, without distortion of any kind to the valve or its components. Valves 6” thru 12” in diameter shall be designed for an input torque of 450 foot pounds at the fully opened or fully closed positions, without distortion of any kind to the valve or its components.

3.12.2.4.7. Direction to open – The valves shall open by turning the operating nut to the Left (counter-clockwise)

3.12.2.4.8. Gate and Valve Seats – Gate material may be gray iron, ductile iron or bronze. The valve gate shall be fully encapsulated in rubber, which shall be bonded or vulcanized to the gate in compliance with Section 4.4.2.1.1 of AWWA C515. Mechanical means of attaching the valve seat to the gate are not permitted. The gate and the rubber encapsulation shall be so designed as to provide a positive stop, without damaging rubber encapsulation or the epoxy.

3.12.2.4.9. Guides – Valve shall have guides in compliance with Section 4.4.3 of AWWA C515. Guide ‘Inserts’ made of suitable material, are optional.

3.12.2.4.10. Throttling Service - Valve shall be capable of being used for throttling without chatter, vibration or wear to the valve or to the water main.

3.12.2.4.11. Coating - Both inside and outside of the valve shall receive at least 5 mil thick fusion bonded epoxy coating in compliance with AWWA C 550.

3.12.3. Butterfly Valves

3.12.3.1. All butterfly valves shall be of the rubber-sealed, tight-closing type designated, manufactured and tested in conformance to AWWA Standard C504, latest revision. All valves shall be M&H style 4500 Class 250 butterfly valves, or approved equal by the City of Lebanon. All valves shall be National Standard Foundation (NSF) approved.

3.12.3.2. Valve Ends

3.12.3.2.1. Both ends shall be AWWA C111 mechanical joint or per flanged ANSI B16.1 (or as otherwise noted on plans and specs) per AWWA Standard C111.

3.12.3.3. Valve Shaft

3.12.3.3.1. Valve shafts shall be 18-8 Type 304 stainless steel. Each valve shaft shall be of a one piece design for valves 12" and smaller and a two piece design for valves 14" and larger. Valve shafts shall have a minimum diameter extending through the valve bearings and into the valve disc as specified in AWWA C504, Table 3. As well, all valve shafts must meet or exceed the minimum connection torque requirement set forth in AWWA C504, Section 4.5.3.2.

3.12.3.4. Valve Body and Disc

3.12.3.4.1. For valve sizes 3" - 16", valve body and disc shall be high strength cast iron to ASTM A 126, Class B or high strength ductile iron to ASTM A536 with ASTM A276 Type 304 stainless steel body seats.

3.12.3.4.2. Valves 18" and larger, Valve body shall be of high strength ductile iron to ASTM A536, Grade 65-45-12 with ASTM A276 Type 304 stainless steel body seat. Valve disc shall be high strength cast iron to ASTM A 126, Class B.

3.12.3.5. Valve Seat

3.12.3.5.1. Rubber valve seats shall be a full-circle 360-degree seat not penetrated by the valve shaft. Valve seat may be Buna-N or Buna-S for cold water applications and EPDM for high temperature applications.

3.12.3.5.2. The valve seat will be attached to the valve disc by ASTM A276 Type 304 stainless steel self-locking fasteners. The valve seat must be easily field adjustable and replaceable without any special tools or lengthy curing time.

3.12.3.6. Shaft Seals

3.12.3.6.1. Valve shaft seals shall be of the O-ring type and utilize the same elastomer as specified for the valve seats and for the intended service. Valves using self-compensating split V-type packing will not be accepted. All valve shaft seals must be easily field replaceable.

3.12.3.7. Valve Operator

3.12.3.7.1. Valve operators shall be of the traveling nut type, sealed , gasketed and lubricated for underground or in-plant service. Operator shall be capable of withstanding an overload input torque of 450 ft-Ibs. at full-open or full-closed position without damage to the valve operator. Operators for valves 14" and larger must have a 304 stainless steel external stop limiting device and travel adjustment. The travel adjustments must be able to be operated without removing the valve from the line or removing the actuator cover. No internal travel adjustment devices will be acceptable. All valve actuators must be sized per AWWA C504, Latest edition torque requirements. Certification of proof of design and torque requirements shall be submitted to the owner during shipment.

3.12.3.7.2. All manual operators for service other than underground shall have a position indicator and shall be totally enclosed and permanently lubricated. In any event, a maximum pull of 80 pounds on the crank or wheel shall produce full C50A Table 1 output torque throughout entire travel. Operators shall be of the "Traveling Nut" type.

3.12.3.8. Coatings

3.12.3.8.1. The valve interior and exterior surfaces shall be coated in accordance with the latest revisions of AWWA C504 and must be NSF 61 certified.

3.12.3.9. Miscellaneous Requirements

3.12.3.9.1. All valves shall close by turning the operator nut or handwheel in a clock-wise direction (open left). The operator shall be capable of meeting the torque requirements for opening and closing the valve against the pressure and flow rate specified.

3.12.3.9.2. All valves shall be tested for leakage at rated pressure, and tested hydrostatically at two times rated pressure-all in conformance with AWWA Standard C504, latest revision.

3.12.4. Tapping Sleeves and Valves

3.12.4.1. Tapping sleeves for connecting to existing water mains shall either be of the flanged type suitable for working pressures of 250 psi and shall be Mueller No. H - 615, American-Darling No. 1004, or approved equal, or stainless steel tapping sleeves with removable bolts and 360 degree gasket and shall be Ford Style FTSS, FST or equal approved by the City of Lebanon.

3.12.4.2. Resilient Wedge Tapping valves shall be of the flanged type suitable for working pressures of 250 psi and shall conform with the latest revision of AWWA Standard for Gate Valves for Ordinary Water Works Service, AWWA C515. Valves shall be manufactured by Clow, Darling, Kennedy, Waterous, or equal approved by the City of Lebanon.

3.12.5. Valve Boxes

3.12.5.1. Standard valve boxes shall be manufactured in the U.S.A. and shall be of 5.25-inch standard cast iron three-piece, screw type valve box with drop cover marked "WATER".

3.12.5.2. Valve Boxes shall be of the following type:

3.12.5.2.1. Tyler Union 6860 or approved equal by the City of Lebanon.

3.12.5.3. Valve boxes shall be accurately centered over the valve-operating nut, and backfill shall be compacted thoroughly about them. Valve box bases shall not rest on the valves but shall be supported on crushed stone fill, concrete block or brick for stabilization. The box shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk, yard or road surface.

3.12.5.4. All valve boxes not placed in paved areas shall have a circular concrete collar surrounding the top of the valve box. The collar shall extend a minimum of six inches (6”) past the outside of the valve box and shall be a minimum of six inches (6”) thick. The concrete collar and valve box shall be flush with final grade.

3.12.6. Corporation Stops

3.12.6.1. All corporation stops 2” and under shall be Ford Model FB1000 or an equal approved by the City of Lebanon.

3.12.6.2. All corporation stops shall have an AWWA/CC Taper thread inlet.

3.12.6.3. All corporation stops shall have a pack joint outlet.

3.12.6.4. All corporation stops shall be capable of withstanding 300 PSI working pressure.

3.12.7. Curb Stops

3.12.7.1. All curb stops 2” and under shall be Ford Model B44 or an equal approved by the City of Lebanon.

3.12.7.2. All curb stops shall have pack joint ends on both the inlet and outlet side.

3.12.7.3. All curb stops shall be capable of withstanding 300 PSI working pressure.

3.12.8. Curb Stop Boxes

3.12.8.1. All curb stop boxes shall be manufactured in the U.S.A. and shall be standard cast iron two-piece, screw type valve box with screw lock cover marked "WATER". The inside diameter shall be 2-1/2".

3.12.8.2. The curb stop box shall be properly centered over the curb stop as to allow operation of the curb stop via a standard key.

3.12.9. Fire Hydrants

3.12.9.1. Fire hydrants installed within the City of Lebanon shall comply with the latest published specifications of the City of Lebanon as to material type, performance and placement.

3.12.9.2. Hydrants shall be provided at each street intersection and at intermediate points between intersections as recommended by the Insurance Services Office of Ohio and the City of Lebanon. Fire hydrant spacing shall not exceed 400 feet in residential areas, and shall not exceed 250 feet in commercial and industrial areas.

3.12.9.3. Fire hydrants installed outside of the City of Lebanon, but connected to the City of Lebanon water system shall comply with the requirements specified herein and be spaced as follows:

3.12.9.3.1. In commercial/industrial zones, fire hydrants shall be spaced or located not more than 250 feet apart.

3.12.9.3.2. In residential zones, fire hydrants shall be spaced or located not more than 400 feet apart.

3.12.9.4. The Contractor shall furnish and install fire hydrants where shown on the plans. Hydrant barrels shall have a safety breakage feature (traffic model) above the ground line. All hydrants shall have a six-inch (6") flanged shoe connection, two, two and one half inch (2.5") discharge nozzles national standard thread (NST) and one five inch (5") inside diameter (I.D.) Storz compatible pumper nozzle with caps fitted with cap chains. Connection threads and operation nuts shall conform to the National Standard Specifications as adopted by the National Board of Fire Underwriters.

3.12.9.5. The operation nut shall be pentagonal in shape and shall open by turning to the right (clockwise) (close left) with National Standard threads on the hydrant caps.

3.12.9.6. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure. Traffic feature shall be designed so that the nozzle section of the hydrant can be rotated (by degree) through a full 360-degree circle during field installations, if necessary.

3.12.9.7. The main valve opening shall not be less than five and one quarter inch (5.25") and be designed so that the seat, drain valve mechanism, internal rod and all working parts can be removed through the top of the hydrant. These parts shall be removable without disturbing the ground line joint or the nozzle section of the hydrant. The bronze seat shall be threaded into mating threads of bronze for easy field removal. The lower barrel section shall be made of ductile iron.

3.12.9.8. The draining system of the hydrant shall be bronze and shall be activated by the main stem without the use of an auxiliary rod, toggles, pins, etc. The drain mechanism shall be completely closed after no more than three turns of the operating nut in the opening direction. There shall be a minimum of two (2) inside ports and four (4) drain port outlets to the exterior of the hydrant. Drain shut-off shall be by direct compression closure. Sliding drain seals are not acceptable.

3.12.9.9. The operating nut, main stem, coupling, and main valve assembly shall be capable of withstanding input torque of 200 ft/lbs, in opening or closing directions. There shall be an internal top housing with triple O-Rings to seal operating threads from the waterway and accommodate an anti-friction washer.

3.12.9.10. Hydrant bonnet assembly shall be provided with a grease reservoir and lubrication system that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated. Downward stem travel shall be limited by a travel stop located in the upper housing of the hydrant.

3.12.9.11. Nozzle sections of the hydrant shall be designed to permit field replacement of damaged threads without special tools, excavation, or disturbance of the ground line joint. Bronze nozzles are to be locked into hydrant barrel with locking lugs and be sealed by a heavy duty O-Ring. The threading of nozzles and the shape of operating nuts are to be of National Standard.

3.12.9.12. Fire Hydrants shall be located not more than six feet (6') nor less than two feet (2') from the back side of the curb or from the edge of existing or proposed edge of pavement unless otherwise approved by the City Engineer. Hydrants shall be installed with a vertical distance from the center of the pumper nozzle to the ground of sixteen to eighteen inches (16" - 18"). All fire hydrants shall be provided with no less than a six-inch (6") resilient wedge gate valve attached to no less than a six-inch (6") ductile iron hydrant branch connected to the water main. No water service or water testing line shall be permitted between the fire hydrant watch valve and the fire hydrant. Fire Hydrant set-backs shall be determined by the City Engineer at the time when improvement plans are submitted by the Owner/Developer, and are reviewed by the City of Lebanon.

3.12.9.13. The fire hydrant watch valve shall be attached directly to an anchor tee, unless approved otherwise, in writing, by the City of Lebanon.

3.12.9.14. Fire hydrants shall be secured to the shut off valve by AWWA approved restraint joints, rodding with four (4) equally spaced all thread rods and Mega-Lugs or another method approved by the City of Lebanon. Where fire hydrant branches exceed one (1) pipe length, Field-LOK gaskets shall be required.

3.12.9.15. Hydrants shall be American Darling B-62-B and shall be painted white with green caps.

3.12.9.16. Fire hydrant watch valve boxes shall be of 5.25 inch standard cast iron, three-piece, screw type valve box with a drop cover marked “water”, East Jordan Iron Works Series 6860 or approved equal by the City of Lebanon. Valve boxes shall be accurately centered over valve operating nut, with backfill thoroughly compacted around them. The valve box base shall not rest on the valves but shall be supported on crushed stone fill or block footers. Valve boxes shall be set vertically and properly cut and/or adjusted so that the top of the boxes will be at grade in any paving, walk, or road surface.

3.12.10. Air Release Valves and Boxes

3.12.10.1. Air release valves shall be the combined vacuum and air release type and shall be equipped with cast iron body and cover, stainless steel float, Buna-N seat and bronze linkage. Valve shall have one inch threaded inlet and be suitable for 150 psi working pressure. Valve shall be APCO No. 200-A or equal approved by the City of Lebanon.

3.12.10.2. Air release valves shall be installed at the high point on the water main as shown on the approved plans. They shall be connected to the main by a corporation stop with inside IPS threaded outlet. The inlet pipe to the air release valve shall be ASTM B43 extra strong seamless red brass pipe with IPS male threaded ends and isolation valve.

3.12.10.3. Outside of the Right-of-Way, the air release valve box shall be 24 inch reinforced concrete pipe conforming to ASTM C76, Class II, Wall B, and shall be set on a round, washed, crushed stone or gravel base. The cover shall be cast iron, heavy duty, perforated and of the size to fit the bell of the pipe.

3.12.10.4. Inside of the Right-of-Way, the air release valve shall be housed in a City of Lebanon Standard Valve Vault. A detail of this vault can be found in the Appendix.

3.12.11. Blow offs

3.12.11.1. Blow-offs shall only be installed at the direction of the City of Lebanon. Approved fire hydrants shall be used in place of blow-offs wherever possible. The City Engineer shall have the final determination for the application of blow-offs and the substitution of blow-offs with approved fire hydrants.

3.12.12. Fire Protection Lines

3.12.12.1. All fire suppression systems shall utilize a standard City of Lebanon fire meter pit or a Domestic/Fire Line split located within the structure. Separate taps for the domestic and fire service lines shall not be permitted. A copy of the Fire Meter Pit and Domestic/Fire Line standard drawings are included in the Appendix.

3.12.12.2. water service lines to be used for private fire protection systems (i.e., sprinkler systems) shall have an OEPA approved backflow preventer installed at the point of entry (POE) to the building.

3.12.12.2.1. An ASSE 1015 Double Check Detector Check is acceptable with written guarantee that no chemicals will be added to the fire line.

3.12.12.3. All fire protection service lines shall be constructed of Class 53 ductile iron pipe and ductile iron fittings to the structure.

3.12.12.4. Fire suppression systems are to be tested and installed by licensed fire protection system contractors.

3.12.13. Sampling Stations

3.12.13.1. Permanent water quality sampling stations shall be installed with each section of a development at a location determined by the City Engineer.

3.13. TRENCH EXCAVATION

3.13.1. Unless specifically directed otherwise by the City Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of trench shall be allowed to remain open behind the work.

3.13.2. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

3.13.3. Trenches in which pipes are to be laid shall be excavated via open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8”). Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

3.13.4. Unless specifically authorized by the City Engineer, trenches shall in no case be excavated or permitted to become wider than two feet six inches (2' - 6 "), plus the nominal diameter of the pipe at the level of or below the top of the pipe.

3.13.5. All excavated materials shall be placed a minimum of two feet (2’) back from the edge of the trench.

3.13.6. Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage of work.

3.13.7. It is the Contractor’s sole responsibility to maintain safe working conditions on the job site and to conform to "Specific Safety Requirements Relating to Construction of the Industrial Commission

of Ohio", "Construction Safety and Health Regulations, Part 1926, Subpart P "Occupational Safety and Health Administration", U. S. Department of Labor, and all local laws, ordinances, and regulations.

3.13.8. Trenches shall be kept free of water during the laying of pipe until the pipeline has been backfilled.

3.14. OBSTRUCTIONS

3.14.1. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or disturbed unless necessary, in which case, they shall be replaced as approved by the City of Lebanon, as quickly as possible.

3.15. SHORING, SHEETING, AND BRACING

3.15.1. The shoring, sheeting, and bracing of excavations shall be performed by the Contractor in compliance with applicable safety codes and OSHA requirements.

3.15.2. Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides shall be sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the City Engineer may require the submission of shoring plans (accompanied by supporting computations) for review prior to the Contractor undertaking any portion of the work. All submitted calculations shall be performed by, and signed and stamped by a professional Engineer registered in the State of Ohio.

3.15.3. Excavations to be made below the depth of an existing foundation shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter, if required to insure the stability of the structure supported by the foundation. The Contractor shall be held strictly responsible for any damage to said foundation.

3.15.4. Solid sheeting will be required for wet or unstable material.

3.15.5. Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirements that the width of the ditch at the level of the crown of the pipe be no more than two feet six inches (2'-6") plus the nominal diameter of the pipe shall be strictly observed.

3.15.6. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

3.15.7. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

3.16. PIPE BEDDING

3.16.1. In all cases, the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and so that none of the load will be carried on the bells.

3.16.2. Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated.

3.16.3. Supporting of pipe shall be as set out herein before, and in no case shall the supporting of pipe on blocks be permitted.

3.16.3.1. Bedding shall be in accordance with the current City of Lebanon standard drawings.

3.16.3.2. Special Bedding - In wet, yielding, mucky locations, where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that the movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the City Engineer, yielding and mucky material in sub-grades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Approved granular material shall be used to replace poor sub-grade material and shall be classified as "Special Pipe Bedding".

3.17. LAYING PIPE

3.17.1. All pipe shall be laid with ends abutting true to line and grade as shown on the plans. Supporting of pipe shall be as specified under "Pipe Bedding" specified herein and in no case shall be supported on blocks.

3.17.2. Fittings for the water mains shall be provided and placed as shown on the plans. All open ends of pipes and branches shall be sealed or plugged at the end of each working day.

3.17.3. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned and inspected for defects. Any piece of pipe or fitting which is known to be defective shall not be laid or placed. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth edge at right angles to the horizontal axis of the pipe.

3.17.4. Granular bedding material as specified herein, shall be used to correct irregularities in the earth trench sub-grade.

3.17.5. The interior of the pipe shall be maintained clean. When the laying of any pipe is stopped for any reason, the exposed end of such pipe shall be closed with an appropriate AWWA approved plug device fitted into the pipe bell, so as to exclude earth or other material.

3.17.6. No backfilling (except for securing pipe in place) over pipe will be allowed until the City of Lebanon has made an inspection of the joints, alignment and grade in the section laid.

3.17.6.1. Inspections shall not relieve the Contractor of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are identified later.

3.17.7. The Contractor shall install a four inch by four inch (4"x 4") wood location post at the ends of all water lines, including water mains and water service connections, so as to identify the termination point of the line. The location posts shall be painted blue and marked so as to identify the line as a water pipe and be extended a minimum of 4’ above existing grade. The curb shall be stamped with a “W” to mark the location of the water service line.

3.17.8. When a water main will be extended in the future, pipe shall be laid for a minimum of three pipe lengths beyond the last valve and capped. This additional pipe will be utilized for the future water main extension and will reduce the amount of disturbance the line in service will experience. Field-LOK gaskets shall be used.

3.18. JOINTING PIPE

3.18.1. Pipe joints described herein shall be installed in accordance with the manufacturer's recommendations.

3.19. BACKFILLING PIPELINE TRENCHES

3.19.1. All backfilling shall be accomplished in accordance with the details shown on the Standard Drawings and the requirements of this Section. Any variances must be approved in writing by the City Engineer.

3.19.2. When directed by the City of Lebanon, the Contractor shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a

maximum density of the material when it is compacted. The Contractor shall obtain a compaction of the backfill of at least 95 percent of standard Proctor density (ASTM D698) where mechanical compaction of backfill is required. Compaction testing may be required by the City of Lebanon. Such testing shall be performed by a professional geotechnical firm. Copies of all testing reports shall be provided to the City.

3.19.3. In all cases, walking or working on the completed pipelines, except as may be necessary in compaction procedures or backfilling, will not be permitted until the trench has been backfilled to a point one foot (1') above the top of the pipe. The filling of the trench and the compaction of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

3.20. SETTLEMENT OF TRENCHES

3.20.1. The Contractor shall be responsible for any trench settlement and subsequent damage as a result of such settlement. The Contractor shall restore all settled areas as directed by the City of Lebanon.

3.21. CONCRETE CRADLE, ANCHORS OR ENCASEMENT

3.21.1. Concrete cradle anchors or encasement of water mains and fittings shall be placed where shown on the plans. Concrete shall be Lebanon Standard Concrete and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. While placing concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

3.21.2. Water mains shall have concrete thrust or "kicker" blocks at all pipe intersections and changes of direction to resist forces acting on the pipeline.

3.21.3. In places where concrete will be poured at a flanged fitting, polyethylene (plastic) sheets having a minimum thickness of 8-10 mils, shall be wrapped around the fitting to prevent the concrete from coming in contact with the fitting's bolts and nuts. The accessibility of mechanical joints shall be maintained for future maintenance and/or repair.

3.22. HIGHWAY AND RAILROAD CROSSINGS

3.22.1. Steel encasement pipe for road and railroad crossing shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. The encasement pipe shall be installed without bends. The water main pipeline shall be installed after the encasement pipe is in place.

3.22.2. Stainless steel casing spacers (Cascade Waterworks, Mfg.) or their approved equal will be installed on the water main in the encasement pipe per the manufacturer's recommendations. After the water main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with brick or concrete block masonry and the encasement pipe shall be filled completely with sand in a manner acceptable to the City of Lebanon.

3.22.3. All street cutting, street boring, highway boring, or railroad boring permits will be the responsibility of the Contractor.

3.23. HYDROSTATIC/LEAKAGE TESTING OF MAINS

3.23.1. Upon completion of the construction of water mains and the connection of customer service connections, but prior to Final Inspection, all water mains and appurtenances shall be tested for leaks as specified herein. The City of Lebanon shall be notified at least 48 hours in advance of the scheduled test time and, at its own discretion, will have an inspector present during the performance of the test.

3.23.2. Where practicable, pipelines shall be tested between main valves or plugs in lengths of not more than 1,500 feet.

3.23.3. The City of Lebanon or its designee shall be the only person(s) allowed to open or close a water valve to the Public Water Supply.

3.23.4. The City of Lebanon or its designee shall slowly fill the completed water main until all air has been expelled through the water main and all its appurtenances.

3.23.5. The Contractor shall perform both a hydrostatic pressure test and a leakage test on the installed water main under the supervision of the City of Lebanon. The tests shall be a minimum of two hours.

3.23.6. The two tests shall be conducted after the trench has been backfilled, but must be completed before replacement of pavement and final restoration.

3.23.7. The Contractor shall use an approved supply of water and furnish the pump, pipe connection corporation stops in the pipe, and water meters used for leakage measurement.

3.23.8. The Contractor shall furnish the pressure gauges and meters for the test. Pressure gage accuracy certification reports shall be provided to the City upon request.

3.23.9. The Contractor shall be responsible for all labor and equipment necessary to conduct the tests including excavating and backfilling the test pit at the locations selected by the City of Lebanon.

3.23.10. When taps for testing are required on an installed main they shall be made by the Contractor at Contractor's sole expense.

3.23.11. The test pressure for the hydrostatic pressure test shall be 200 psi, or 1.5 times the operating pressure, whichever is greater, based on the elevation of the lowest point in the section under test and corrected to the elevation of the test gauge unless otherwise directed by the City of Lebanon.

3.23.12. The allowable leakage rate is given in Table 1:

Table 1 – Allowable Leakage

Allowable Leakage per 1000 ft. of pipeline (gallons per hour)									
Average Test Pressure (PSIG)	**Nominal Pipe Diameter (inches)**								
	6	**8**	**10**	**12**	**16**	**20**	**24**	**30**	**36**
200	0.64	0.85	1.06	1.28	1.70	2.12	2.55	3.19	3.82
175	0.59	0.80	0.99	1.19	1.59	1.98	2.38	2.98	3.58
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21	2.76	3.31
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80	2.25	2.70

3.23.13. The exposed pipe and/or the top of the trench shall be carefully inspected after the pressure test for any signs of leakage.

3.23.14. Any cracked or defective pipe, fittings, valves or hydrants discovered in consequence of the pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory results are obtained.

3.23.15. The Contractor is responsible for locating, excavating and backfilling the water main trench in addition to replacing the defective material at his expense.

3.23.16. Measurement of the leakage shall be conducted in conjunction with the pressure test.

3.23.17. The Contractor shall maintain the required hydrostatic pressure at all times during the leakage test through his test pump.

3.23.18. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air has been expelled and the pipe has been filled with water.

3.23.19. No pipe installation will be accepted if the amount of leakage is greater than specified in Table 1.

3.24. DISINFECTION OF WATER MAINS

3.24.1. New potable water mains shall not be placed into service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the City of Lebanon.

3.24.2. Disinfection shall be carried out prior to connecting the newly constructed water main to the existing water distribution system.

3.24.3. Disinfection shall be done by the Contractor under the direction of the City of Lebanon.

3.24.4. The practices and procedures for disinfecting the water mains and the chemicals to be used shall be in accordance with the requirements of AWWA C 651 (latest edition).

3.24.5. The City of Lebanon preferred method for disinfection is as follows:

3.24.5.1. Liquid Chlorine

3.24.5.1.1. Water from the existing distribution system shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. At the point of entry (POE) of the new water line into the distribution system, there shall be installed a valve chamber assembly for the purpose of feeding a chlorine solution. There shall be an approved RPZ backflow device installed on the water feed line. The cost of the water for the disinfection will be the responsibility of the Contractor.

3.24.5.1.2. There shall be a positive displacement pump and water meter for pumping and maintaining an accurate control of the chemical feed ratio for the chlorine mixture.

3.24.5.2. Solid Chlorine

3.24.5.2.1. Water shall be introduced into the water main in a slow, controlled manner to prevent washing the solid chlorine-bearing material down the water main. Air shall be released at the downstream end of the main to allow for the main to be completely filled.

3.24.5.3. An application of 25 PPM (mg/L) is required for proper disinfection to produce a minimum chlorine residual of 10 ppm (mg/L) after 24 hours.

3.24.5.4. A mixture of water and a chlorine-bearing compound of known chlorine content shall be used.

3.24.5.4.1. Approved types are calcium hypochlorite or sodium hypochlorite.

3.24.5.4.2. Commercial types of calcium hypochlorite are known as HTH, Perchloron and Pittchlor.

3.24.5.4.3. Sodium hypochlorite (12%-15%) is known commercially as liquid laundry bleach (3%-5%).

3.24.5.5. Following the disinfection of the main, the strong chlorine solution shall be flushed until the chlorine residual is consistent with the standard residuals of the Public Water System. Two consecutive sets of tests (each set of test consists of a total coliform and a chlorine residual test), taken 24-hours apart shall be collected and analyzed in accordance with the requirements of the EPA Standards. Sets of tests shall be taken at maximum distances of 1,200 feet apart, and separate tests shall be performed on all branch lines. When the samples have been tested and reported safe from contamination, the tested water main may be connected to the system. The City of Lebanon shall keep on record written documentation that the water sample passed the bacteriological test and is safe. The cost for the initial purity testing shall be paid by the City of Lebanon. If a retest is required, the cost of the retest and any subsequent tests shall be at the cost of the Contractor.

3.25. CONNECTING TO THE WATER SYSTEM

3.25.1. Unless otherwise directed by the City Engineer, the Contractor shall be responsible for providing the connection of the new water main to the existing water system. Unless otherwise approved by the City Engineer, all connections between a new water main and the existing water distribution system shall be made via wet tap. The Contractor shall notify the City of Lebanon when the connection is to be made so that representatives of the City of Lebanon may operate existing valves and witness the connection. A minimum notice of 24 hours in advance of the connection shall be given to the City of Lebanon.

3.25.2. In all cases where a wet tap is to be made to connect to the existing system, the tapping sleeve, resilient wedge gate valve and box, valve chamber, and all other necessary material and labor shall be provided and performed by the Contractor at the Contractor's expense.

3.26. CUSTOMER SERVICE CONNECTIONS

3.26.1. Services up to one inches (1") to be installed outside of new developments shall be installed by the City of Lebanon.

3.26.2. The City of Lebanon shall install the service connection tap on the water main, service line from the water main to a curb stop and curb box, water meter pit assembly, and a ten foot tail piece (where applicable), upon application for water service and payment of the appropriate tap fee.

3.26.2.1. New developments, subdivisions, or expansions by Developers will require the customer service connections to be part of the development and are required to be installed by the Contractor. The Contractor shall be required to install the corporation stop, copper service line, curb stop, curb box, and the water meter pit assembly (where applicable) with a 4"x 4" painted blue wooden stake marking the service with minimum height above existing grade of four feet (4'). If curb and gutter exists or is installed, a stamped "W" must be incorporated into the face of the curb.

3.26.3. Sleeving of customer service connection lines by use of PVC or any other material shall only be done with the approval and specifications of the City Engineer.

3.26.4. All customer service connections shall be installed prior to the hydrostatic and leakage testing of the water main.

3.27. CROSS CONNECTION CONTROL

3.27.1. There shall be no connection between the water distribution system and any pipes, pumps, hydrants, or other material that may be discharged or drawn into the public water system.

3.28. LAWN SPRINKLER SYSTEMS

3.28.1. Lawn sprinkler systems and/or equipment shall not be installed within the Public Right-of-Way or easements without a permit.

3.28.2. No lawn sprinkler system shall be installed without a permit from the City of Lebanon. An application for a lawn sprinkler system permit shall be submitted to the Office of the City Engineer and shall contain the following information:

3.28.2.1. A completed Comprehensive Permit form.

3.28.2.2. A site plan drawing at a scale of not less than one inch to 30 feet, showing the following information:

3.28.2.2.1. The location of every existing and proposed building or structure, including dimensions.

3.28.2.2.2. All property lines, including the shape and dimensions of the lot.

3.28.2.2.3. Locations and dimensions of all easements and building setback lines.

3.28.2.2.4. Location and dimensions of all access points, driveways, off-street parking spaces.

3.28.2.2.5. Location of all existing and proposed streets, including rights-of-way and pavement widths.

3.28.2.2.6. All sidewalks, walkways and open spaces.

3.28.2.2.7. All water, sanitary, and storm sewer facilities to serve the lot, indicating all pipe sizes, types, and grades.

3.28.2.2.8. The locations of all sprinkler system components, sprinkler heads, and piping.

3.29. RESPONSIBILITY FOR MAINTENANCE

3.29.1. Prior to formal acceptance of the Improvements by the City of Lebanon, the Contractor and/or Owner/Developer shall be responsible for the maintenance and repair of the Improvements in compliance with these specifications for a period of two years after construction completion and acceptance by the City of Lebanon.

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4.1. PURPOSE

4.1.1. The purpose of this section is to outline requirements for design, construction, inspection, and final acceptance of sanitary sewer mains, house service connections, manholes, and appurtenances.

4.2. DESIGN REQUIREMENTS

4.2.1. When an existing sanitary sewer main needs to be extended to the Owner/Developer's property, the same size line shall be extended by the Owner/Developer unless a larger size line is needed. In all cases the sanitary sewer line shall be extended to the furthest of each boundary of the property to allow future extensions. Sanitary sewer extensions shall be located in areas as determined by the City Engineer.

4.2.2. In cases where the expected flow from a proposed development will require a larger size line than already exists, the Owner/Developer shall be responsible, at his sole expense, for upgrading the existing system to an increased size that will handle the additional flow. Any cost sharing for these improvements between the Owner/Developer and the City of Lebanon will be determined on a case by case basis through a written request to the City Manager from the Owner/Developer.

4.2.3. It shall be the Owner/Developer's responsibility to determine the downstream critical section of the existing sanitary sewer system. Should this section not be able to handle the additional flow, it shall be upgraded at the sole expense of the Owner/Developer. Copies of all calculations shall be provided to the office of the City Engineer for review and approval. A sample set of calculations is included in the Appendix. All calculations shall be signed and stamped by a

Professional Engineer registered in the State of Ohio. Flow rates shall be determined using the wastewater generation guidelines found in the Appendix.

4.2.4. In cases where sanitary sewer is not available to a site, it shall be the Owner/Developer's sole responsibility and cost to extend the sanitary sewer to the site.

4.2.4.1. Sewer lines shall be sized to carry upstream future flows and in accordance with the most current City of Lebanon Sanitary Sewer Master Plan. Copies of all calculations shall be provided to the office of the City Engineer for review and approval. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio. Flow rates shall be determined using the guidelines found in the Appendix.

4.2.5. Septic tanks and leaching beds for single- family residences may be permitted, provided both the City Planning Commission and the Warren County Department of Health specifically authorize their use for a particular subdivision and provided further that all requirements of such health agency are complied with. If a septic tank system is used, it shall be approved by the Warren County Department of Health.

4.2.6. Pipe and joint materials shall conform in all respects to the material requirements outlined in this section.

4.2.7. When, in the opinion of the City of Lebanon, the proposed sewer pipe material is or will be incompatible with the wastewater to be transported, the City of Lebanon reserves the right to specify sewer pipe material which is compatible with the wastewater.

4.3. PROTECTION OF PUBLIC WATER SUPPLIES

4.3.1. There shall be no physical connection between a public or private potable water system and a sanitary sewer or its appurtenances, which would permit passage of any sewage into the potable water supply system.

4.3.2. Sanitary sewers and manholes shall be laid at least ten feet (10') horizontally from any existing or proposed water main. When local conditions prevent a separation of ten feet (10'), a sewer main may be laid closer than ten feet (10') to a water main if it is laid in a separate trench; if it is laid in the same trench, the water main must be located at one side on a bench of undisturbed earth. In either case, the elevation of the crown of the sewer must be at least eighteen inches (18") below the invert of the water main.

4.3.2.1. When it is not possible to obtain proper horizontal and vertical separation as stipulated above, the sanitary sewer shall be constructed of Class 53 ductile iron pipe. The sewer main shall be pressure tested and shall withstand a 50 psi pressure test for a distance of ten feet (10') on each side of the water main. One full length of sewer main shall be centered over the water main so that both joints will be as far from the water main as possible.

4.4. STORM WATER PROHIBITED

4.4.1. Storm drainage and subsurface drainage, including foundation drains, shall not be permitted to empty into any sanitary sewer.

4.4.2. The following two notes shall appear on all sanitary sewer plans submitted for review and approval:

4.4.2.1. Roof drains, foundation drains, sump pump drains, and all other clean water connections to the sanitary sewer system are prohibited.

4.4.2.2. No buildings shall be connected to a sanitary sewer lateral until the building is under roof or as directed by the City Engineer.

4.5. SANITARY SEWER MAIN PIPE MATERIAL

4.5.1. Pipe must be delivered to the job site by means that will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe shall be stored on the job site in accordance with the manufacturer's recommendations. Any pipe that has been left uncovered and has subsequently been allowed to discolor, (this discoloration represents an indication of a possible reduction in pipe impact strength) may be subject to rejection by the City of Lebanon.

4.5.2. The depth of cover shall determine the required type of pipe to be installed. The City of Lebanon shall determine the type of pipe to be installed based on the depth of cover and the manufacturer's recommendation.

4.5.3. Sewer mains larger than eighteen inches (18") in diameter require special design considerations and shall be given special design criteria. An Owner/Developer anticipating construction of sewer mains larger than eighteen inches (18") in diameter shall meet with the City of Lebanon to establish design criteria.

4.5.4. The following pipe materials shall be used at the following depths:

4.5.4.1. 14 feet or less – SDR-35 Polyvinyl Chloride (PVC) Pipe, Fittings and Joints

4.5.4.2. Greater than 14 feet through 25 feet – SDR-26 Polyvinyl Chloride (PVC) Pipe, Fittings and Joints

4.5.4.3. Greater than 25 feet – Class 53 Ductile Iron Pipe, Fittings and Joints

4.5.4.4. Gasketed ABS or PVC Composite Pipe (8"-15") ODOT Item 707.47, Fitting and Joints may be permitted on a case-by-case basis with written permission by the City Engineer.

4.5.5. PVC Pipe

4.5.5.1. PVC pipe shall meet the requirements for Poly Vinyl Chloride (PVC) gravity sewer pipes with integral bell and spigot gasketed joints. Nominal sized 4", 6", 8", 10", 12" and 15" are manufactured to meet requirements of American Society for Testing and Materials standard ASTM D-3034, *Standard Specification for Type PSM Poly (Vinyl Chloride)(PVC) Sewer Pipe*. Nominal sized 18", 21", 24", 27" and 30" comply with ASTM F-679, *Standard Specification for PVC Large Diameter Plastic Gravity Sewer Pipe*.

4.5.5.2. All pipes used shall be manufactured for use in gravity flow applications, such as sanitary sewer lines. These pipes shall be produced with wall thickness corresponding to dimension ratio SDR-35 for pipes with 14 feet or less of cover and SDR-26 for pipes with 25 feet or less of cover. The pipe shall possess a pipe stiffness value of 46 psi for SDR-35 and 115 psi for SDR-26 when tested in accord with ASTM D-2412, *Standard Test Methods for Determination of External Loading of Plastic Pipe by Parallel Plate Loading*. Standard laying length is 13 feet; however, twenty-foot (20') lengths will be acceptable.

4.5.5.3. All pipe shall utilize a "locked in" integral gasket joint design meeting the requirements of ASTM D-3212 *Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.* The gaskets shall be reinforced with a steel band and conform to the requirements of ASTM F-477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipes.*

4.5.5.4. The pipe shall be manufactured from PVC compound meeting the requirements of cell class 12454-B as defined by ASTM D-1784, *Standard Specification for Rigid Poly (Vinyl Chloride)(PVC) Compounds.* These materials are classified as type T-I in ASTM F-679.

4.5.5.5. Pipe markings shall be as specified in ASTM D-3034 and ASTM F-679.

4.5.5.6. Quality assurance testing shall be as required by ASTM D-3034 and ASTM F-679.

4.5.6. Gasketed ABS or PVC Composite Pipe (8”-15”) ODOT Item 707.47, Fitting and Joints

4.5.6.1. Gasketed ABS or PVC composite pipe shall conform to the requirements of ASTM Designation D2680-90 (or latest revision). Pipe and fitting shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Minimum pipe stiffness, when measured in accordance with ASTM Test Method D2412, shall be 200 psi. The thermoplastic material shall be a rigid ABS or PVC plastic and shall meet or exceed the requirements of ASTM Specification D1784 for a minimum cell classification of 12454B or 12454C. The other component for semi-rigid pipe shall be Portland cement, Mearlcrete concrete or other inert filler material that essentially fills the truss annulus to form a composite pipe.

4.5.6.2. All fittings for PVC composite pipe shall conform to ASTM D2680-90 Section 7.1 and Tables 5 and 6. To insure compatibility, the pipe manufacturer shall furnish all fittings.

4.5.6.3. All joints shall be made with gasketed bell coupling connections. The manufacturer shall provide documentation showing no leakage when gasketed pipe joints are tested in accordance with ASTM D2680 Section 10.4.2 and ASTM Test Method D3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM Designation F477.

4.5.7. Ductile Iron Pipe, Fittings and Joints

4.5.7.1. Ductile iron pipe shall be Class 53 unless otherwise approved in writing by the City Engineer. Ductile iron pipe shall conform to ANSI A21.51 and AWWA C151. All ductile iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C 151 requirements.

4.5.7.2. Ductile iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coat on the inside in accordance with ANSI 21.4 requirements. Pipe and fittings shall have a standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil thick.

4.5.7.3. All ductile iron pipe shall be protected by an eight-mil thick polyethylene encasement meeting the requirements of ANSI A21.5.

4.5.7.4. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE". Shop inspection and testing shall be in accordance with the AWWA Specifications cited above and shall be certified by an independent laboratory.

4.5.7.5. Fittings for ductile iron pipe shall be flanged Class 50 gray iron conforming to ANSI A21.10 and AWWA C110 for short body cast iron fittings or as approved by the City Engineer. Fittings shall have bituminous seal coat on the inside as specified herein.

4.5.8. Steel Encasement Pipe

4.5.8.1. Encasement pipe shall be steel, plain end, uncoated and unwrapped, have minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 of ASTM A130 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot (18’) lengths.

4.5.8.2. The diameter and wall thickness of the pipe shall conform to the requirements of the American Railway Engineering Association for railroad crossings, and the requirements of ODOT for highway crossings.

4.6. SEWER LINES (COLLECTORS, MAINS AND TRUNK LINES)

4.6.1. Sizing

4.6.1.1. All public sanitary sewers conveying raw sewage shall be at least eight inches (8") in diameter. New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day (gpd). This figure is assumed to cover

normal infiltration, but an additional allowance shall be made when conditions are unfavorable or as directed by the City Engineer.

4.6.1.2. Sanitary sewers shall be designed on a peak flow basis using a peak factor of four (4) times the total calculated average daily wastewater flow for sewer mains, and a peak factor of 2.5 for trunk sewers. The peak flow for areas which do not have a 24 hour run-off period shall be calculated as follows:

Equation 1 - Peak Factor Determination

Peak Factor * (Calculated Wastewater Flow * 24 Hrs.) / (Run - Off Period (In Hours)) = GPD

Peak Factors are found in Table 2.
Run-Off Periods are found in Table 3.

Table 2 - Peak Factors

Type of Sewer	Peak Factor
Main	4.0
Trunk	2.5

Table 3 - Run-Off Periods

Entity	Run - Off Period
Municipality	24 Hours
Factories	Length of Shift
Subdivisions (over 250 homes)	24 Hours
Subdivisions (under 250 homes)	16 Hours
Hospitals	12 - 24 Hours
Schools	8 Hours
Restaurants	4 Hours
Mobile Home Parks	12 Hours
Apartments	12 Hours
Motels	4 Hours
Other	Use of other run - off periods must be justified

4.6.1.3. A complete set of computations that indicate expected flow for sizing of sewers, depth of flow and velocities at minimum, average, and maximum daily waste flows for the different sizes of sewers proposed shall be provided to the City of Lebanon. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

4.6.2. Depth

4.6.2.1. In general, sewers shall be deep enough to prevent freezing and to receive sewage from basements and cellars. In no case shall mains be less than sixty inches (60") deep. Unless otherwise approved, all homes within a new development shall be serviced by gravity flow to the sanitary sewer main.

4.6.3. Location

4.6.3.1. Unless otherwise approved by the City Engineer, public sanitary sewer mains shall be installed in the centerline of the street or, upon approval, in a public utility easement granted to the City of Lebanon. A sanitary sewer maintenance area shall be provided. This sanitary sewer maintenance area width shall be no less than twenty feet (20') and shall be totally within the public right-of-way or public utility easement. It shall be centered on the sanitary sewer main.

4.6.3.1.1. In situations in which a sanitary sewer is deeper than ten feet, the City Engineer reserves the right to require an easement greater than 20 feet in width.

4.6.3.2. No sewer main shall run between residential or commercial structures unless authorized by the City Engineer.

4.6.3.3. The Contractor shall install a four-inch by four-inch (4"x 4") wood location post at all sanitary sewer plugs, including sanitary sewer main termination points. The location post shall be painted green and marked so as to identify the sanitary sewer line.

4.6.4. Alignment

4.6.4.1. The sanitary sewer mains shall be laid at uniform grade and in straight alignment. Proper grade and alignment shall be verified for each section of pipeline using appropriate instrumentation and methodology.

4.6.5. Flow Velocity

4.6.5.1. All sanitary sewers shall be designed to give a mean velocity of at least two feet per second (2 FPS) when flowing full. This is based on Manning's formula using an "n" factor of 0.013 for design. When velocities greater than twelve feet per second (12 FPS) are expected, provisions shall be made to protect against displacement and erosion of the pipe.

4.6.6. Slope

4.6.6.1. All sewers shall be laid with uniform slope and straight alignment between manholes. Table 4 lists the minimum slopes which shall be provided, however, slopes greater than these are desirable.

Table 4 - Minimum Sanitary Sewer Pipe Slopes

Sewer Size (In.)	Minimum Slope
8	0.50
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046
39	0.041
42	0.037
48	0.030

4.6.7. Changes in Pipe Size and Grade

4.6.7.1. All changes in pipeline size and grade shall occur in a manhole. Inverts of pipes shall be matched in manholes.

4.7. SANITARY SEWER SERVICE LINES (LATERALS)

4.7.1. The City of Lebanon shall approve the location of the sanitary sewer service laterals on the sewer main. The Contractor shall lay the sanitary sewer service lateral from the sanitary sewer main to a point along the Right-of-Way line, installing a cleanout with a screw out cap and a Ford metallic lid assembly marked “sewer”.

4.7.1.1. In general, locating a sanitary sewer service lateral under a walkways or driveways should be avoided.

4.7.1.2. Cleanouts shall be the responsibility of the Developer. The developer may install the cleanouts at the time of utility installation, or the Developer may elect to have the cleanouts installed at the time of home construction. In either case bonds will not be released until properly installed cleanouts are in place.

4.7.2. All sanitary sewer service laterals shall be gasketed SDR-35, SDR-26 PVC, or Class 53 Ductile Iron as specified herein unless otherwise specified by the City of Lebanon. Glued joints are not acceptable. Trenching, pipe laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with standard plugs to the satisfaction of the City of Lebanon.

4.7.2.1. Laterals installed on mains with cover less than 14 feet shall be gasketed SDR-35 PVC.

4.7.2.2. Laterals installed on mains with cover between 14 and 25 feet shall be gasketed SDR-26 PVC.

4.7.2.3. Laterals installed on mains with cover 25 feet or more shall be Class 53 Ductile Iron.

4.7.3. All sewer laterals shall be bedded with a minimum of six inches (6”) of compacted #9’s (grits), or washed round stone and shall be backfilled to a minimum of twelve inches (12") above the top of the sanitary sewer lateral with compacted #9’s (grits).

4.7.4. The installation of sewer laterals shall follow immediately or be concurrent with the construction of the sanitary sewer main.

4.7.5. Size

4.7.5.1. The size of sanitary sewer laterals shall be subject to the approval of the City of Lebanon, but in no case shall the diameter be less than six inches (6") from the sanitary sewer main to the required cleanout assembly.

4.7.5.2. The sewer cleanout shall be covered at grade level by an approved Ford Type A cover marked “SEWER”. Sewer laterals shall tie directly to the building sewer.

4.7.5.3. The transition coupling from the building sewer to the cleanout will be accomplished by the use of a rigid coupling (PVC, rubber/stainless steel) or a flexible rubber boot (Fernco or approved).

4.7.6. Slope

4.7.6.1. The general requirements for the slope of sanitary sewer laterals shall be one quarter (1/4) inch per linear foot (2% slope).

4.7.7. Location

4.7.7.1. No sanitary sewer lateral shall be laid parallel to or within five feet (5') of any load-bearing wall that might thereby be weakened.

4.7.7.2. Whenever a sanitary sewer service line crosses a concrete street curb, the Contractor shall clearly mark the location of the sewer service line with an "S" cut or imprinted into the concrete curb near the top.

4.7.8. Depth

4.7.8.1. Sanitary sewer laterals shall be deep enough to receive sewage from basements and cellars.

4.7.8.2. The minimum sewer lateral depth shall be twenty-four inches (24").

4.7.9. Alignment

4.7.9.1. The sanitary sewer lateral shall be laid in a uniform grade and in alignment from the main to meet the probable building sewer grade at the cleanout assembly so that no bends will be required.

4.7.9.2. Sanitary laterals are to run perpendicular to the sanitary sewer main from the utility standard cleanout assembly. Any deviation from this standard must have the written approval of the City Engineer.

4.7.10. Cleanouts

4.7.10.1. Cleanouts for sanitary sewer laterals shall be built at all horizontal or vertical changes of direction and shall consist of a six-inch (6") directional tee and wye. Along straight segments of pipe outside the right-of-way, cleanouts shall be installed as required by the Ohio Plumbing Code. A copy of the City of Lebanon standard cleanout detail is contained in the Appendix.

4.7.10.2. The cleanout cap/plug shall have a protruding operating nut.

4.7.10.3. When within the Right-of-Way, cleanouts shall be covered by a Ford Type A twenty inch (20") single lid cover lettered "SEWER" with an 11 1/2" locking lid to be flush with final ground level. Installation of cleanouts in traffic areas shall be covered by an "extra heavy cover" Ford Type A twenty-inch (20") single lid cover lettered "SEWER" with an 11-1/2" locking lid; flush to the grade of the pavement.

4.7.11. Lateral Connections

4.7.11.1. Lateral connections to the sanitary sewer main shall only be located at an existing "wye" connection on the main. When none exist on the main, an approved manufactured saddle wye shall be installed at the sanitary sewer main cut in a neat, even manner. The connection shall be rendered watertight by means of commercial fittings and/or a rubber gasket seal. (Examples are Fernco, Indiana Seal, Mission, or manufactured products of equal standards approved by the City of Lebanon). Concrete encasement shall only be permitted by special written authorization by the City of Lebanon.

4.7.11.2. All connections between the sanitary sewer main and sanitary sewer lateral, as well as the connection between the sanitary sewer lateral and the building connection, shall be inspected by the City of Lebanon prior to backfilling.

4.7.11.3. Under no circumstances shall the lateral be connected to the sewer main at the top of the pipe.

4.7.12. Maintenance

4.7.12.1. The owner of a premises served by a sanitary lateral shall be responsible for the operation, maintenance, repair and reconstruction of the sanitary lateral from the building to the point of connection with the public sanitary sewer main. (§1311.17)

4.8. SANITARY GRINDER/LIFT PUMPS

4.8.1. Sufficient depth of sewer mains shall be provided to allow gravity flow for all sanitary sewer lateral connections. The use of grinder/lift pumps for sanitary sewer laterals is not permitted within new developments unless approval is granted, in writing, by the City Engineer.

4.9. TRENCH EXCAVATION

4.9.1. Unless specifically directed otherwise by the City Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

4.9.2. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall

be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

4.9.3. Trenches in which pipes are to be laid shall be excavated via open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8”). Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

4.9.4. Unless specifically authorized by the City Engineer, trenches shall in no case be excavated or permitted to become wider than two feet six inches (2' - 6 "), plus the nominal diameter of the pipe at the level of or below the top of the pipe.

4.9.5. All excavation materials shall be placed a minimum of two feet (2’) back from the edge of the trench.

4.9.6. Where conditions exist that may be conducive to slides or cave ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage of work.

4.9.7. It is the Contractor’s sole responsibility to maintain safe working conditions on the job site and to conform to "Specific Safety Requirements Relating to Construction of the Industrial Commission of Ohio", "Construction Safety and Health Regulations, Part 1926, Subpart P "Occupational Safety and Health Administration, U. S. Department of Labor, and all local laws, ordinances, and regulations.

4.9.8. Trenches shall be kept free of water during the laying of pipe until the pipeline has been backfilled.

4.9.9. Obstructions

4.9.9.1. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or disturbed unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

4.9.10. Shoring, Sheeting, and Bracing

4.9.10.1. The shoring, sheeting and bracing of excavations shall be performed by the Contractor in compliance with applicable safety codes and OSHA requirements.

4.9.10.2. Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides shall be sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the City Engineer may require the submission of shoring plans (accompanied by supporting computations) for review prior to the Contractor undertaking any portion of the work. Submitted plans shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

4.9.10.3. Excavations to be made below the depth of an existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation. The Contractor shall be held strictly responsible for any damage to said foundation.

4.9.10.4. Solid sheeting will be required for wet or unstable material.

4.9.10.5. Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirements that the width of the ditch at the level of the crown of the pipe be no more than two feet six inches (2'-6") plus the nominal diameter of the pipe shall be strictly observed.

4.9.10.6. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

4.9.10.7. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

4.10. PIPE BEDDING

4.10.1. All sanitary sewer pipe shall be bedded in accordance with the standard detail contained in the Appendix.

4.10.2. In all cases, the foundation for sanitary sewer mains shall be prepared so that the entire load of the backfill on top of the sewer pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.

4.10.3. The depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated. Supporting of sewer pipe shall be as set out herein, and in no case shall the sewer pipe be supported on blocks.

4.11. LAYING PIPE

4.11.1. All pipe shall be laid with ends abutting true to line and grade as shown on the plans. Supporting of pipe shall be as specified under 4.10. specified herein and in no case shall be supported on blocks.

4.11.2. Fittings for the sewer mains shall be provided and placed as shown on the plans. All open ends of pipes and branches shall be sealed or plugged.

4.11.3. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned and inspected for defects. Any piece of pipe or fitting which is known to be defective shall not be laid or placed. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth edge at right angles to the longitudinal axis of the pipe.

4.11.4. Granular bedding material as specified herein, shall be used to correct irregularities in the earth trench subgrade.

4.11.5. The interior of the pipe shall be maintained clean. When laying pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plug fitted into the pipe bell, so as to exclude earth or other material.

4.11.6. No backfilling (except for securing pipe in place) over pipe will be allowed until the City of Lebanon has made an inspection of the joints, alignment and grade in the section laid.

4.11.6.1. Inspections shall not relieve the Contractor of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are identified later.

4.11.7. Upon the completion of a section of sanitary sewer, inverts and slopes shall be checked and the results shall be provided in writing to the City of Lebanon. The information , at minimum, shall include:

4.11.7.1. Upstream junction information (manhole number, etc.)

4.11.7.2. Upstream plan invert

4.11.7.3. Upstream installed invert

4.11.7.4. Downstream junction information (manhole number, etc.)

4.11.7.5. Downstream plan invert

4.11.7.6. Downstream installed invert

4.11.7.7. Plan Slope

4.11.7.8. Installed Slope

4.11.7.9. Pipe Material

4.11.7.10. Bedding Material

4.11.7.11. Backfill Material

4.11.7.12. Contractor certification indicating that the information shown is true and correct.

4.12. BACKFILLING PIPELINE TRENCHES

4.12.1. All backfilling shall be accomplished in accordance with the details shown on the Standard Drawings and the requirements of this Section. Any variances must be approved in writing by the City Engineer.

4.12.2. When directed by the City of Lebanon, the Contractor shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is compacted. The Contractor shall obtain a compaction of the backfill of at least 95 percent of standard Proctor density (ASTM D698) where mechanical compacting of backfill is required. Copies of all testing reports shall be provided to the City Engineer.

4.12.3. In all cases, walking or working on the completed pipelines except as may be necessary in compacting or backfilling will not be permitted until the trench has been backfilled to a point one foot (1') above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

4.13. SETTLEMENT OF TRENCHES

4.13.1. The Contractor shall be responsible for any trench settlement that occurs within two years from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor. Repair of settlement damage shall meet the approval of the City of Lebanon.

4.14. MANHOLES

4.14.1. Manholes shall be of the pre-cast concrete type. Manhole lift holes and grade adjustment rings shall be sealed with non-shrinking grout or other material approved by the City of Lebanon. Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place. Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. Vented lids shall be provided when the manhole is located within four feet of the street centerline. Locked manhole covers may be desirable in isolated easement locations or where vandalism may be a problem.

4.14.2. Manholes shall be installed: at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 350 feet for sewers 30 inches or less, or as approved by the City Engineer. Greater spacing may be permitted in larger sewers. Cleanouts may be used only for special conditions and shall not be substituted for manholes.

4.14.3. The minimum diameter of manholes shall be 48 inches (48”). Larger diameter manholes are preferable for large diameter sewers. A minimum access diameter of 24 inches (24”) shall be provided.

4.14.4. The flow channel straight through a manhole shall be made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance, inspection or flow in the sewers.

4.14.5. A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench shall be sloped no less than 1/2 inch per foot (4 percent). No lateral sewer, service connection, or drop manhole pipe shall discharge onto the surface of the bench.

4.14.6. A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches (24") or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches (24"), the invert shall be filleted to prevent solids deposition. Drop manholes shall be constructed with an outside drop connection. Due to the unequal earth pressures that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete. Drop manholes shall be constructed in accordance with the standard drawing contained in the Appendix.

4.14.7. Where corrosive conditions due to septicity or other causes are anticipated, consideration shall be given to providing corrosion protection on the interior of the manholes.

4.14.8. Manhole steps shall be constructed and installed as shown in the Standard Drawings.

4.14.9. Only concrete grade rings shall be used. Plastic grade rings are not permitted.

4.14.10. Adjustable riser rings shall not be used on new manholes. Adjustable riser rings shall only be used on existing manholes with written permission from the City Engineer.

4.15. TESTING OF SEWER MAINS AND MANHOLES

4.15.1. The City of Lebanon will require a prior notice of not more than 48 hours and not less than 24 hours to schedule an inspection of all applicable sanitary sewer appurtenances.

4.15.2. Sanitary sewer pipe joints shall be watertight and all leakage shall be repaired in a manner approved by the City of Lebanon.

4.15.3. All sanitary sewer mains, constructed as part of the Improvements, shall be tested for leakage and pipe deflection.

4.15.4. The City of Lebanon may require the Contractor to perform additional infiltration and/or exfiltration tests to demonstrate the quality of the sewer main Improvements.

4.15.5. After the Improvements have been completed but prior to performing any test herein specified, the Contractor shall clean the sewer line constructed in the Improvements by high-pressure flushing or other approved method. The Contractor shall ensure that gravel and debris is not flushed into the existing sanitary sewer system.

4.15.6. Prior to the first layer of blacktop the Contractor shall be responsible for having an inspection of the sewer main and laterals with the use of a video camera performed by a professional inspection firm. Copies of all videos and written reports shall be provided to the office of the City Engineer for review and approval. All defects will be corrected by the Contractor as directed by the City Engineer.

4.15.7. All lines or section of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.

4.15.8. Pipe Deflection Test

4.15.8.1. Deflection tests shall be performed by the Contractor on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system.

4.15.8.2. No pipe shall exceed a deflection of 5 percent (5%). If deflection exceeds 5 percent (5%), replacement or corrections shall be as directed by the City of Lebanon.

4.15.8.3. The rigid ball or mandrel used for the deflection test shall have a diameter not less than 95 percent (95%) of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, including the appendix of said ASTM Specification, to which the pipe is manufactured. The test shall be performed without mechanical pulling devices.

4.15.9. Air test

4.15.9.1. The air test shall, as a minimum, conform to the test procedure described in ASTM F-1417 for plastic pipe, and for other material test procedures approved by the City of Lebanon.

4.15.9.2. All air tests shall be done prior to Final Inspection by the Contractor in the presence of the City of Lebanon who will determine if the tested pipe span is acceptable. The air test is conducted between two consecutive manholes. All pipe outlets must be plugged in the section being tested using suitable test plugs. One of these plugs must be tapped and used for filling the test section with compressed air.

4.15.9.3. At the time of the test, each manhole shall be inspected by the City of Lebanon to determine possible leaks. Questionable manholes shall be vacuum tested.

4.15.10. Vacuum Test

4.15.10.1. Each manhole shall be tested immediately after assembly and prior to backfilling.

4.15.10.2. All lift holes shall be plugged with an approved non-shrink grout.

4.15.10.3. No grout will be placed in the horizontal joints before testing, unless prior approval is granted by the City of Lebanon.

4.15.10.4. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.

4.15.10.5. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.

4.15.10.6. A vacuum of ten inches (10”) of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to not drop below nine inches (9”) of mercury. The manholes shall pass if the time meets or exceeds the following table.

Table 5 - Minimum Test Time for Various Manholes

Depth of Manhole	48" Diameter	60" Diameter	72"Diameter
0-10 feet	40 seconds	90 seconds	120 seconds
11-20 feet	80 seconds	120 seconds	150 seconds
21-30 feet	120 seconds	150 seconds	180 seconds

4.15.10.7. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout. Retesting shall proceed until a satisfactory test is obtained.

4.15.11. Air Test

4.15.11.1. The air test shall, as a minimum, conform to the test procedure described in ASTM C-828-76T.

4.15.11.2. The air test will be made after backfilling has been completed and compacted.

4.15.11.3. All tees and ends of sewer services shall be plugged with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and shall provide a socket suitable for making a flexible jointed lateral connection or extension.

4.16. VIDEO INSPECTION

4.16.1. A video inspection of the all sanitary and storm sewer mains shall be conducted in accordance with the requirements set forth in Section 2.13. Copies of the video and written reports shall be provided to the City Engineer prior to the acceptance of the improvements or the release of bonds.

4.17. CONNECTIONS TO EXISTING LINES

4.17.1. The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sanitary sewer main to an existing sanitary sewer main or manhole as shown on the approved drawings. A representative of the City of Lebanon must be present while the connection is being made. The City of Lebanon will require a prior notice of not more than 48 hours and not less than 24 hours advance notice before the connection is made.

4.18. CONCRETE CRADLE, ANCHORS OR ENCASEMENT

4.18.1. Concrete cradles, anchors or encasement of sanitary sewer mains and/or fittings shall be placed as shown on the plans. In areas requiring concrete encasement, Class 53 ductile iron shall be used unless waived by the City Engineer. Concrete shall be ODOT Class C and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. While placing the concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

4.18.2. Concrete encasement shall completely surround the pipe and shall have a minimum thickness at any point of one fourth (1/4) of the outside diameter of the pipe or four inches (4"), whichever is greater. In addition, four (4) reinforcing bars of a size shown on the approved plans shall be evenly spaced around the pipe and have length equal to the length of the encasement. Wherever the strength of the pipe is not sufficient to support the external loads, the encasement shall be designed to provide the necessary additional strength.

4.19. HIGHWAY AND RAILROAD CROSSINGS

4.19.1. Steel encasement pipe for road and railroad crossings shall be bored and/or jacked into place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth, non-obstructing joint inside. The sanitary sewer pipe shall be installed after the encasement pipe is in place. Installation of the sanitary sewer main in the encasement pipe shall be as per the manufacturer's recommendations. After the sanitary sewer main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with a rubber gasketed donut, brick, or concrete block masonry in a manner acceptable to the City of Lebanon and the encasement pipe shall be filled with sand.

4.19.2. Encasement pipe shall be steel, plain end, uncoated and unwrapped, have minimum yield point strength of 35,000 psi, and conform to ASTM A252 Grade 2 of ASTM A130 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot (18’) lengths. The diameter and wall thickness of the pipe shall conform to the requirements of the American Railway Engineering Association for railroad crossings and the requirements of ODOT for highway crossings.

4.20. SANITARY SEWER PUMP STATIONS

4.20.1. General

4.20.1.1. Design Requirements

4.20.1.1.1. All sanitary sewer pump stations shall be subject to the approval of the Director of Water and Wastewater and the City Engineer.

4.20.1.1.2. Sanitary sewer pump stations shall be designed in accordance with the latest edition of the *Recommended Standards for Wastewater Facilities* (Ten States Standards). Unless waived by the City of Lebanon, pump stations are to be of the suction lift or submersible type, designed for meeting the peak hourly flow with the largest pump out of service, and shall meet the guidelines presented herein.

4.20.1.1.3. All pump stations shall be provided with a portable generator and transfer switch and all related appurtenances. The portable generator and appurtenances shall be subject to the approval of the Director of Water and Wastewater, the Director of Electric and the City Engineer.

4.20.2. Equipment

4.20.2.1. In order to unify responsibility for proper operation of the complete pumping station, all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

4.20.2.2. Manufacturer

4.20.2.2.1. Equipment and materials shall be manufactured by The Gorman-Rupp Company or an approved equal.

4.20.3. Accessories

4.20.3.1. Each Pump Station shall be provided with the following Accessories:

4.20.3.1.1. Station Heater:

4.20.3.1.1.1. Pump station shall be provided with a 1300/1500 watt, 115 volt electric heater with cord and grounding plug. The heater shall be provided with an adjustable thermostat. Ungrounded heaters shall not be acceptable.

4.20.3.1.2. Drain Kit:

4.20.3.1.2.1. Pumps to be supplied with a drain kit for ease of maintenance. The kit to contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

4.20.3.1.3. Spare Parts Kit:

4.20.3.1.3.1. The following minimum spare parts shall be furnished with the pump station:

4.20.3.1.3.1.1. One spare pump mechanical seal (complete with shaft sleeve).

4.20.3.1.3.1.2. One cover plate O-Ring.

4.20.3.1.3.1.3. One rotating assembly O-Ring.

4.20.3.1.3.1.4. One set of impeller clearance adjustment shims.

4.20.3.1.4. Volute Casing Heater:

4.20.3.1.4.1. Pump shall be provided with a thermostat mounted to the exterior of the volute casing, and a 115 volt electric heater inserted into the interior of the volute by means of a dedicated port. The heater shall be energized at 43+/-3 degrees F to provide heat to the casing and eliminate the possibility of freezing. Heater probes that must be installed through a pump drain port shall not be acceptable. Heater probes that must be installed through a pump drain port shall not be acceptable.

4.20.3.1.5. Gauge Kit

4.20.3.1.5.1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

4.20.3.1.5.2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

4.20.3.1.6. UL Label Requirement:

4.20.3.1.6.1. Pump station components and controls shall conform to third party safety certification. The station shall bear a UL label listed for “Packaged Pumping System”. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The pump station components, panel enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

4.20.3.1.7. Transient Voltage Surge Suppressor:

4.20.3.1.7.1. A transient voltage surge suppressor shall be furnished to minimize damage to pump motors and control as result of transient voltage surges. The suppressor shall utilize metal-oxide varistors encapsulated in a non-conductive housing. The arrester shall be rated 480 volts RMS nominal with a discharge capability of 2000 amps.

4.20.3.1.7.2. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.

4.20.3.1.8. Phase Monitor:

4.20.3.1.8.1. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

4.20.3.1.9. Stepdown Transformer:

4.20.3.1.9.1. The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer shall be protected by a thermal magnetic circuit breakers, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until primary circuit breaker is in "OFF" position.

4.20.3.1.10. Alarm Light (External):

4.20.3.1.10.1. Station manufacturer will supply one 115 VAC alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe

4.20.3.1.11. Emergency Bypass Pumping Connections

4.20.3.1.11.1. Provisions shall be made within the header piping and wet well of the pump station for connection of a 4" portable engine driven emergency bypass pump.

4.20.3.1.11.2. Piping modifications to accommodate the portable bypass pump shall include isolation plug valves and aluminum quick-disconnect fittings to match the existing hose sections of the City of Lebanon Wastewater Department. Connection fittings shall be 4" camlock fittings, type A or F, by Allen Machine Company, or equal.

4.20.4. Standby Power System

4.20.4.1. General

4.20.4.1.1. Each pump station shall be provided with an electrical power system that has been tested during design verification, production and at the final job site. All finished equipment shall be of the lasted commercial design and will be complete with all of the necessary accessories for complete installation. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm that manufactures generator sets and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

4.20.4.1.2. The power system shall be finished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.

4.20.4.1.3. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

4.20.4.1.4. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production, installation, and service of their complete product line.

4.20.4.1.5. All equipment shall be approved by the City Engineer, The Director of Water and Wastewater, and the Director of Electric of the City of Lebanon.

4.20.4.1.6. Each standby power system shall consist of the following minimum items:

4.20.4.1.6.1. Generator set

4.20.4.1.6.2. Transfer switch

4.20.4.1.6.3. Monitoring and communication equipment.

4.20.4.2. Specific requirements for the standby power system will be determined on a project-by-project basis.

4.21. FORCE MAINS

4.21.1. General

4.21.1.1. Sanitary sewer force mains shall be designed so that the minimum velocity of two feet (2') per second (fps) is maintained when the sewage pumps are operating their design pumping rate.

4.21.1.2. There shall be at least a minimum of 48 inches cover over the top of the sanitary sewer force main pipe.

4.21.1.3. Installation shall be in accordance with Sections 4.9, 4.10, 4.11, 4.12, and 4.15 of this Manual.

4.21.2. Air release valves shall be required every 600 feet and at all high points along the force main.Pipe Materials

4.21.2.1. Ductile Iron Pipe, Fittings and Joints

4.21.2.1.1. Ductile iron pipe, fittings and joints used for the construction of sanitary sewer force mains shall comply with section 4.5.7 of this Manual.

4.21.2.2. Steel Encasement Pipe

4.21.2.2.1. Steel encasement pipe used for the construction of sanitary sewer force mains shall comply with section 4.5.8 of this Manual.

4.21.3. Testing Of Sanitary Sewer Force Mains

4.21.3.1. As a minimum, all sewer force mains shall be tested in accordance with the Hydrostatic Testing Requirements of AWWA C600.

4.21.3.1.1. All force mains shall be given a hydrostatic test of at least 1.5 times the shutoff head of the connected pumps or 150 psi, whichever is greater. Loss of water pressure during test shall not exceed 5 psi in a 2 hour period.

4.21.3.1.2. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.

4.21.3.1.3. The pump, pipe connection, and all necessary apparatus, including the gauges, shall be furnished by the Contractor. Copies of gauge accuracy reports shall be provided upon request.

4.21.3.1.4. The pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City of Lebanon.

4.21.3.1.5. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

4.21.3.1.6. Duration of test shall not be less than two hours.

4.21.3.1.7. The test pressure shall not exceed the rated pressure of the valves in the pipeline.

4.21.3.1.8. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the Contractor shall repair the joints, retighten the bolts, relay the pipe, or replace the pipe until the leak is eliminated – regardless of total leakage as shown by the hydrostatic test. Polyethylene encasement damaged from repairs must also be properly repaired or replaced to the satisfaction of the City Engineer.

4.21.3.1.9. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

4.21.3.1.10. Lines that fail to meet test shall be repaired and retested as necessary until test requirements are complied with.

4.21.3.1.11. The City of Lebanon may provide water for testing the force mains; however, the Contractor will be responsible for piping or hauling the water if necessary. If water is to be used from fire hydrants, the Contractor shall be familiar with and shall comply with the

City of Lebanon's Fire Hydrant Meter Rental Rules and Regulations. The City of Lebanon may waive all fees except the security deposit for approved uses on City of Lebanon projects. The Contractor shall not operate any valves on existing water mains. All valves shall be operated by the City of Lebanon.

4.21.3.1.12. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

Equation 2 - Allowable Leakage

$$L = \frac{SD*(P)^{1/2}}{133,200}$$

Where:
L is the allowable leakage, in gallons per hour
S is the length of pipeline tested, in feet
D is the nominal diameter of the pipe, in inches
P is the average test pressure during the leakage test, in pounds per square inch gauge.

4.21.3.1.13. Allowable leakage at various pressures and pipe sizes are shown in Table 6 (from AWWA C600 – Table 6A).

Table 6 - Allowable Leakage Per 1000 Feet Of Pipeline

Allowable Leakage Per 1000 Feet Of Pipeline* In Gallons Per Hour														
Avg. Test Pressure (psi)	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**	**42**
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

4.22. CONNECTING FORCE MAIN TO MANHOLE

4.22.1. All sanitary sewer force mains must connect to manholes at the flow channel elevation. The Design Engineer shall show the method of connecting force mains to manholes in the plan's details.

4.23. CONCRETE THRUST BLOCKS

4.23.1. Concrete thrust blocks shall be provided at all bends on the sanitary sewer force main. Concrete cradles, anchors, or encasement of force mains and fittings shall be placed where shown on the plans. Concrete shall be ODOT Class C and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. While placing concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. In places where concrete will be poured at a mechanical joint or fitting, a polyethylene (plastic) sheet having a minimum thickness of 8 mil, shall be wrapped around the fitting to prevent the concrete from coming in contact with the fitting's bolts and nuts.

4.23.2. Force mains constructed under creeks or drainage waterways shall be encased in concrete to a point at least ten feet (l0') beyond the edge of the creek or drainage ways.

4.24. MISCELLANEOUS REQUIREMENTS

4.24.1. All sewer main repairs shall be made utilizing shear couplings with stainless steel bands.

4.25. RESPONSIBILITY FOR MAINTENANCE

4.25.1. Prior to formal acceptance of the Improvements by the City of Lebanon, the Contractor and/or Owner/Developer shall be responsible for the maintenance and repair of the Improvements in compliance with these specifications for a period of two years after construction completion and acceptance by the City of Lebanon.

SECTION 5 - ROADWAY

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5.1. PURPOSE

5.1.1. The purpose of this Section is to specify the methods for the design of roadways and pavements for public roadway improvements.

5.2. DESIGN REQUIREMENTS

5.2.1. Due to the abundance of poor soil types found in the City of Lebanon, pavement designs are necessary for each new development within the City. The design shall be based upon the requirements set forth in the Ohio Department of Transportation Pavement Design and Rehabilitation Manual.

5.2.1.1. Design calculations, including boring logs shall be submitted to the City Engineer. All calculations shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

5.2.2. If a developer elects to non perform a geotechnical subsurface investigation and pavement design calculations, the pavement shall be installed as per the minimum standard found in the Standard Drawings in the Appendix and as described in Paragraph 5.5.

5.3. ROADWAY DESIGN

5.3.1. Conformity to the Thoroughfare Plan

5.3.1.1. The arrangement, character, extent, width, grade and location of all streets shall conform to the Official Thoroughfare Plan and shall be considered in their relation to existing and planned streets, to topographical conditions, to public convenience and safety, and in their appropriate relation to the proposed uses of the land to be served by such streets. Where not shown on the Official Thoroughfare Plan, the arrangement and other design standards of streets shall conform to the provisions found herein and shall be subject to the approval of the Planning Commission.

5.3.2. Arrangement not under thoroughfare plan.

5.3.2.1. Where such is not shown in The Thoroughfare Plan, the arrangement of streets in a subdivision shall either:

5.3.2.1.1. Provide for the continuation or appropriate projection of existing streets in surrounding areas; or

5.3.2.1.2. Conform to a plan for the neighborhood to meet a particular situation where topographical or other conditions make continuance or conformance to existing streets impracticable.

5.3.3. Street Arrangement

5.3.3.1. Unless approved otherwise by the City Engineer, when subdivisions and/or PUDs have appropriate frontage to separate access points by the distances provided in the Access Management section of the City of Lebanon Zoning Code, two entrances, which are remotely located, shall be provided.

5.3.3.1.1. Where a subdivision and/or PUD is able to provide access on the frontage road and with an established subdivision, the subdivision and/or PUD will be considered to have met this requirement.

5.3.3.1.2. Smaller developments and/or oddly-configured developments will be evaluated on a case-by-case basis.

5.3.3.2. Street layouts for subdivisions/PUDs shall incorporate effective traffic calming measures to prohibit excessive speed on the streets. Lengthy straight-aways shall be avoided and the streets shall be in general conformity with a plan for the most advantageous development of adjoining areas and the neighborhood.

5.3.3.3. Where appropriate, proposed streets shall be continuous and in alignment with existing, planned or platted streets with which they are to connect.

5.3.3.4. Proposed streets shall be extended to the boundary lines of the tract to be subdivided, unless prevented from topography or other physical conditions, or if such extension is not necessary for the coordination of the layout of the subdivision, with the existing layout, or the most advantageous future development of adjacent tracts.

5.3.3.5. Minor streets shall be so laid out that their use by through traffic will be discouraged.

5.3.4. Driveway and Curb Cut Access Conditions

5.3.4.1. The City Engineer may impose conditions in the permit upon the construction of the driveway approach/curb cut/sidewalks, which conditions are designed to facilitate the safe movement of pedestrian traffic and the safe and expeditious movement of motor vehicles on the public streets or ways affected by the driveway approaches/curb cuts. The conditions imposed upon driveway approaches/curb cuts/sidewalks under this section shall take into consideration the design speed limit and sight distance at the location and may include, but are not limited to, the following:

5.3.4.1.1. Limitations of the number, size and location of driveway approaches/curb cuts for any premises to which the permit applies.

5.3.4.1.2. Requiring the use of alternative means of access such as service or private drives or frontage roads, to run parallel to the public street or way, rather than direct connection to the public street or way where such alternate means are accessible to the premises to which the permit applies and/or requiring that direct connection of driveway approaches/curb cuts to the public street or way be limited and used only until alternative means of access such as service or private drives or frontage roads are made accessible to the permit premises.

5.3.4.1.3. Limiting the construction of driveway approaches/curb cuts to only one Public Street or way where the premises to which the permit applies abuts more than one Public Street or way.

5.3.4.1.4. Requiring that driveway approaches/curb cuts be marked and/or constructed to allow only entrance to or only exit from the permit premises.

5.3.4.1.5. Requiring the construction of safety islands to separate two driveway approaches/curb cuts.

5.3.4.1.6. Requiring the construction of right hand and/or left hand deceleration/acceleration and/or storage lanes which shall be required to be a minimum of a length in feet of double the speed limit (ex. 70 feet for a 35 MPH roadway) each way with a one hundred (100) foot taper, or as determined by the most current edition of the Ohio Department of

Transportation's Location and Design Manual. Such lanes may be permitted to be decreased, based on the physical conditions, characteristics and use of the property. Such lanes shall meet the requirements of the City Engineer and include the appropriate traffic control devices, including, but not limited to yield signs, stop signs, or traffic signals, as necessary.

5.3.4.1.7. Requiring the construction of driveway turnaround facilities so that vehicular traffic can change direction on the permit premises and enter the roadway in a forward direction.

5.3.4.1.8. Requiring the consolidation of access points. Major access points on opposite sides of roadways shall be located opposite each other. If not so located, turning movement restrictions may be imposed as determined necessary by the City Engineer. In addition, in order to maximize the efficient utilization of access points, access drives shall be designed, located, and constructed in a manner to provide and make possible the coordination of access with and between adjacent properties developed (present or future) for similar or compatible uses. As a condition of approval for construction, use, or reuse of any access point, the City Engineer may require that unobstructed and unencumbered access, in accordance with the provisions of these regulations, be provided from any such access point to adjacent properties.

5.3.4.1.9. Requiring the consolidation of existing access points. Whenever the use of a parcel of land changes, or two or more parcels of land are assembled under one purpose, plan, entity, or usage, the existing driveway permits shall become void and the new permit shall be based upon the owner/developer's plans to use some existing driveways and/or close or relocate other driveways. Any such new or reauthorized access point must be in compliance with all applicable sections of this regulation.

5.3.5. Required Existing Roadway Improvements

5.3.5.1. Where a proposed development abuts an existing non-improved roadway (any roadway not meeting current City of Lebanon standards regarding width and/or does not have curb & gutter, storm sewer, and/or sidewalks), the roadway will need to be brought up to City standards by the Owner/Developer. The improvements shall include, at a minimum:

5.3.5.1.1. Roadway widening

5.3.5.1.1.1. The minimum width of the roadway pavement shall be based upon the widths found in Table 8.

5.3.5.1.1.1.1. Additional turning and/or deceleration/acceleration lanes may be required by the TIS or the City Engineer.

5.3.5.1.1.2. A minimum of one foot of pavement from the existing roadway edge shall be saw cut and removed to provide a solid butt joint. The saw-cut pavement shall be inspected by the City of Lebanon to determine if a solid cross-section has been obtained. Additional pavement removal may be required if existing pavement is in poor condition.

5.3.5.1.2. Any required pavement repairs to the centerline of the Public Right-of-Way,

5.3.5.1.3. Curb and gutter

5.3.5.1.4. Storm sewer

5.3.5.1.5. Any required turning lanes

5.3.5.1.6. Public sidewalk

5.3.5.1.7. Any other improvements required by the City Engineer.

5.3.6. Curb and Gutter

5.3.6.1. All streets shall have curb and gutter. Curb and gutter is not included in the pavement width.

5.3.6.1.1. Collectors and arterial streets shall have chairback or barrier curb, as determined by the City Engineer.

5.3.6.1.2. Local streets shall have rollback curb.

5.3.6.2. All curb and gutter shall conform to SECTION 6 of this manual.

5.3.7. Sidewalks

5.3.7.1. All streets shall be provided with sidewalks on both sides of the street. All sidewalks shall conform to the requirements found in SECTION 6 of this manual.

5.3.8. Reverse Curves

5.3.8.1. A tangent at least 100 feet long or suitable transition curves shall be introduced between reverse curves on arterial and collector streets.

5.3.9. Street Surfaces

5.3.9.1. All streets shall be surfaced with asphaltic concrete.

5.3.9.1.1. Under special circumstances, Portland Concrete pavement will be reviewed for heavy industrial usages.

5.3.10. Angle of Intersection

5.3.10.1. Streets shall be laid out so as to intersect as nearly as possible at right angles and no street shall intersect any other at less than 80 degrees. Any proposed intersection that is not at right angles is subject to approval by the City Engineer.

5.3.11. Radius of intersection

5.3.11.1. Street intersections shall be rounded with the radius found in Table 7, based upon street classifications, measured at curb lines when the intersection occurs at right angles. Where two roads of different classifications meet, the larger radius shall be used. If an intersection occurs at an angle other than a right angle, it shall be rounded with a curve of a radius acceptable to the City Engineer.

5.3.12. Radius of property corner lines

5.3.12.1. The corner of property lines at all street intersections shall be rounded with the minimum radius as found in Table 7, based upon the street classification. Where two roadways of different classifications meet, the larger radius shall be used.

5.3.13. Dead-End Streets

5.3.13.1. Dead end streets shall not be permitted in any case.

5.3.13.2. In the case of a temporary dead-end street for phasing of a development, a temporary turnaround shall be installed for all temporary dead end streets greater than one lot in length. The temporary turnaround shall be installed as per the Standard Drawing found in the Appendix.

5.3.14. Cul-De-Sac Streets

5.3.14.1. Cul-de-sacs shall not be longer than 900 feet, measured from the center line of the intersecting street to the center point of the cul-de-sac and serve no more than 25 lots. The closed end of a cul-de-sac shall be provided with a turn around which has a minimum Right-of-Way radius of 60 feet and a minimum radius to the back of curb of 50 feet. Larger diameter turnarounds may be required in special traffic areas, as deemed necessary by the City Engineer. Cul-de-sacs longer than 900 feet may be approved by the City Engineer only

when extreme geographic and topographic conditions exist and feasible alternatives are not possible. Mid-block turnaround may be required where cul-de-sacs exceed 900 feet.

5.3.15. Temporary Turn-Around

5.3.15.1. A temporary paved turn around shall be required for streets with temporary dead-ends that are greater than one lot in depth.

5.3.16. Street Jogs

5.3.16.1. Street jogs shall not be allowed unless permitted in writing by the City Engineer.

5.3.17. Street Names

5.3.17.1. No street names shall be used which will duplicate or be confused with the names of existing streets. Street names shall be subject to approval of the City of Lebanon Planning Commission and/or the City Engineer.

5.3.18. Grading and Paving

5.3.18.1. All streets shall be graded to their full right-of-way widths so as to provide adequate shoulders and pedestrian walkways. All streets shall be paved and drainage courses and other structures installed according to City standards. Driveways shall meet the sidewalk grade at the property line.

5.3.19. Street Name Signs

5.3.19.1. Reflectorized street name signs shall be provided at all street intersections or where a change of direction of a street requires a street name sign. The signs shall be of a size and type approved for use by the City Engineer. Normally, one sign will be required at each residential intersection. However, more may be required, dependent upon the character and/or width of streets. Refer to the standard street sign detail found in the Appendix.

5.3.20. No Parking Signs

5.3.20.1. Where required, reflectorized No Parking signs shall be on every third shared lot line, however, more may be required, dependent upon the character and/or width of streets. The signs shall be of a size and type approved for use by the City Engineer. Refer to the standard street sign detail found in the Appendix.

5.3.21. Traffic Control Signs

5.3.21.1. Traffic control signs shall be installed along all roadway improvements. All signs and sign locations shall be consistent with the latest edition of the Ohio Department of Transportation *Manual of Uniform Traffic Control Devices.*

5.3.22. Underdrains

5.3.22.1. Underdrain systems shall be provided for all roadways unless otherwise approved by the City Engineer. The underdrain system design shall be indicated on the plans and shall be approved by the City Engineer.

5.3.23. Alleys:

5.3.23.1. Alleys shall be provided in commercial and industrial districts, except that the City Engineer may waive this requirement where other definite and assured provisions are made for services access, such as off-street loading, unloading and parking consistent with and adequate for the uses proposed.

5.3.23.2. Alley intersections and sharp changes in alignment shall be avoided; but, where necessary, corners shall be cut off sufficiently to permit safe vehicular movement. Dead-end alleys shall not be permitted.

5.3.24. City of Lebanon Roadways are broken down into the following classifications with the design characteristics shown in Table 7 and Table 8:

Table 7 - Minimum Roadway Design Standards

Type Of Street	Major Arterial	Minor Arterial(U.S. and State Highways Commercial and Industrial Streets)	Minor/Major Collector (Commercial and Industrial Streets)	Local Streets	Alleys
Curbing	Yes	Yes	Yes	Yes	No
Sidewalks	Both Sides	Both Sides	Both Sides	Both Sides	No
Minimum Sight Distance (Feet)	500	500	300	200	N/A
Minimum Curb Return Radius (Feet)	45	40	35	30	N/A
Minimum Property Corner Radius (Feet)	30	30	25	20	N/A
Minimum Public Utility Easement Width (Each Side)	20	20	20	15	5
Maximum Grade (%)	6.00	6.00	8.00	10.00	N/A
Minimum Grade (%)	0.75	0.75	0.75	0.75	N/A
Minimum rate of Vertical Curvature (K)	50	50	50	20	15
Minimum Radius of Horizontal Curvature Along Centerline (Feet)	475	475	300	100	N/A
Minimum Design ADT	As Determined by TIS	As Determined by TIS	As Determined by TIS	2000	N/A

Table 8 - Minimum Right-Of-Way and Pavement Width Standards

Type Of Street	Major Arterial	Minor Arterial	Collector	Local Streets	Alleys
Minimum Right-of-Way Width (Feet)	120	100	70 (Minor) 120 (Major)	50	20
Minimum Number of Lanes	5	4	3	2	1
Minimum Pavement Width (Feet)	60	48	36	24	20

5.3.25. All the design criteria shown in Table 7 and Table 8 are subject to the discretion and approval of the City Engineer. Improvements in addition to the above criteria may be required depending on the situation.

5.3.26. Vertical Curves

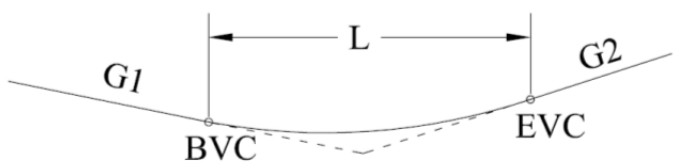
5.3.26.1. All changes in street grade in excess of 1.00% shall be connected by vertical curves. Vertical curve lengths shall be determined using Equation 3:

Equation 3 - Vertical Curve Length

$$L = K * AD$$

Where:
L is the curve length
K is the rate of vertical curvature as found in Table 7
AD is the algebraic difference in grades
$|G1-G2|$ (absolute value)

Figure 1 - Length of Vertical Curve



5.4. PAVEMENT DESIGN

5.4.1. Pavement design shall be carried out for each development in the following manner:

5.4.1.1. Geotechnical investigations shall be conducted in all areas where roadways are to be placed. Geotechnical investigations are to be conducted as instructed in the latest edition of the Ohio Department of Transportation *Specifications for Subsurface Investigation* manual. Borings shall be taken at a maximum interval of 500 feet. The data retrieved is to be used in determining the Liquid Limit (LL), Plasticity Index (PI), California Bearing Ratio (CBR) and the percentage of the sample passing a No. 200 sieve. A copy of the completed geotechnical investigation shall be provided to the City Engineer.

5.4.1.2. Using the data from the geotechnical investigations, the structural number required based upon the soils in the area of the roadway is to be determined using the methods set forth in the latest edition of the Ohio Department of Transportation *Pavement Design and Rehabilitation Manual*. Copies of all calculations shall be provided to the City Engineer.

5.4.2. Pavement designs shall be performed in accordance with current ODOT guidelines. Minimum and maximum course thicknesses for various materials shall be observed.

5.4.3. In subdivisions that will have future sections, the City Engineer may require a stronger pavement section on entrance roads and main thoroughfares through the subdivision to help prevent damage to the roadway by heavy loads and construction traffic.

5.4.4. In no case will less than four inches (4”) of ODOT Item 304 be permissible in any pavement section.

5.5. MINIMUM PAVEMENT SECTIONS

5.5.1. For a complete asphalt pavement section, refer to the City of Lebanon minimum street sections standard drawing found in the Appendix.

5.5.2. The following pavement sections shall be used unless a thorough pavement design in accordance with current ODOT standards, procedures and regulations is carried out based upon a thorough geotechnical investigation:

5.5.2.1. Local Streets (SN= 4.145)

5.5.2.1.1. 1-1/2" ODOT Item 448 Asphalt Concrete Surface Course, Type 1, PG64-22

5.5.2.1.2. 2" ODOT Item 448 Asphalt Concrete Intermediate Course, Type 2, PG64-22

5.5.2.1.3. 5" ODOT Item 301 Bituminous Aggregate Base

5.5.2.1.4. 6" ODOT Item 304 Aggregate Base (crushed limestone only)

5.5.2.2. Minor/Major Collector (SN=5.285)

5.5.2.2.1. 1-1/2" ODOT Item 448 Asphalt Concrete Surface Course, Type 1, PG64-22

5.5.2.2.2. 2" ODOT Item 448 Asphalt Concrete Intermediate Course, Type 2, PG64-22

5.5.2.2.3. 7" ODOT Item 301 Bituminous Aggregate Base

5.5.2.2.4. 9" ODOT Item 304 Aggregate Base (crushed limestone only)

5.5.2.3. Minor/Major Arterial (SN=6.280)

5.5.2.3.1. 1-1/2" ODOT Item 442 Asphalt Concrete Surface Course, 12.5mm, Type A (448)

5.5.2.3.2. 2-1/2" ODOT Item 442 Asphalt Concrete Intermediate Course, 19mm, Type A (448)

5.5.2.3.3. 8" ODOT Item 302 Bituminous Aggregate Base

5.5.2.3.4. 12" ODOT Item 304 Aggregate Base (crushed limestone only)

5.6. PLACEMENT OF ASPHALT

5.6.1. The placement of asphalt shall be in accordance with the provisions found in ODOT Item 401 as found in the *Ohio Department of Transportation Construction and Material Specifications* (latest edition) with the following exceptions:

5.6.1.1. The City of Lebanon will not participate in Asphalt Binder Price Adjustment.

5.6.1.2. Slag shall not be permitted in any asphaltic concrete mix.

5.6.2. In addition to the provisions found in ODOT Item 401, the following shall apply:

5.6.2.1. Asphalt shall not be placed unless all curbing has cured and has been sufficiently backfilled with compacted material.

5.6.2.2. Minimum and maximum lift thicknesses for various materials shall be observed. Minimum and maximum lift thicknesses shall be as defined by the Ohio Department of Transportation.

5.6.2.3. Asphalt shall not be placed during a rain event, nor shall placement activities be started when rain is eminent.

5.6.2.4. Copies of all load tickets shall be provided to the office of the City Engineer at the time of asphalt delivery.

5.6.3. In no case shall asphalt be placed unless the following conditions are met:

5.6.3.1. The ambient air temperature shall be a minimum of 40 degrees Fahrenheit and shall be rising.

5.6.3.2. The receiving surface temperature shall be in accordance with Table 9:

Table 9 - Minimum Receiving Surface Temperatures

Course Thickness	Minimum Surface Temperature
3.0” and over	36 °F and Rising
1.5” to 2.9”	40 °F and Rising
1.0” to 1.4”	50 °F and Rising
Less than 1.0”	60 °F and Rising

5.7. TRAFFIC IMPACT STUDIES

5.7.1. Purpose and Intent

5.7.1.1. Traffic access and impact studies are intended to determine the need for any improvements to the adjacent and nearby roadway system to maintain a satisfactory level of service and the appropriate access provisions for a proposed development.

5.7.1.2. The primary objectives of a traffic study are as follows:

5.7.1.2.1. Provide a basis for assessing the transportation impacts of a new development or expansion of an existing development; identify the need for any improvements to the supporting roadway system to provide satisfactory levels of service; and, to address safety issues.

5.7.1.2.2. Address relevant transportation issues associated with development proposals that may be of concern to neighboring residents, businesses, and property owners.

5.7.1.2.3. Determine the appropriate location, spacing, and design of the access system for the proposed development in compliance with City standards.

5.7.1.2.4. Evaluate the internal circulation and connectivity systems of the proposed development to provide safe and efficient internal traffic flow and access to/from the adjacent and nearby roadway system.

5.7.1.2.5. Allow compliance with the most current edition of the City’s Thoroughfare Plan (or other applicable thoroughfare plans).

5.7.1.2.6. Provide a basis for improvement and funding discussions in conjunction with zoning, special permit, and subdivision plat approvals.

5.7.1.3. The guidelines found in Sections 5.7.2. through 5.7.8. establish the requirements and guidelines for achieving responsive and consistent traffic impact and access studies for proposed developments. The City Engineer has determined it to be befitting to require the submission of an appropriate traffic study for all planned/proposed development.

5.7.2. Traffic Study Warrants

5.7.2.1.1. The need for either a detailed traffic impact study or a limited traffic operations analysis will be identified when rezoning, variance, or plan approval petitions are filed (or discussed with public officials). The City Engineer may also identify the need for a traffic impact study or operations analysis in response to an access permit application.

5.7.2.1.2. Study Warrants for a Traffic Impact Study

5.7.2.1.2.1. A complete traffic impact study (TIS) will be requested for any proposed development or redevelopment that meets one or more of the following criteria:

5.7.2.1.2.1.1. Significantly-sized project. A development meets this criterion if it generates more than 100 trip ends (i.e., two-way vehicle-trips) during any one hour of an average weekday. These trip ends shall be calculated using the latest edition of *Trip Generation* as published by the Institute of Transportation Engineers (or upon special studies of unique land-uses as approved by the reviewers).

5.7.2.1.2.1.2. Modifications to roadways. This criterion is met when the proposed development is expected by the reviewers to significantly impact a roadway segment, or roadway segments, identified in thoroughfare plans and/or improvement programs of the City, County, State, or other jurisdictions. This criterion is also met when access for the proposed development occurs on a public road that may be widened or improved in accordance with adopted thoroughfare plans.

5.7.2.1.2.1.3. Nearby congestion. A development meets this criterion if the proposed development is expected, in the opinion of City staff, to significantly impact surrounding roadways, intersections, or sets of intersections which are already operating at level of service "D" or worse during any hour (on a design day, or days, selected for analysis purposes). The level of service will be determined by an analysis prescribed in the current edition of the *Highway Capacity Manual* (Transportation Research Board) using data that reflects the current traffic conditions.

5.7.2.1.2.1.4. High traffic impact area. This criterion is met when, in the opinion of City staff, the proposed development is located in a high traffic impact area. Such reflects special sensitivity to traffic condition changes due to existing congestion, problematic circulation patterns, burgeoning traffic operations problems, or other traffic conditions of special concern. A traffic impact study will be requested for any proposed new development or modifications to existing development within a high traffic impact area

5.7.2.1.3. Study Warrants for a Traffic Operations Analysis

5.7.2.1.3.1. A traffic operations analysis may be requested for petitions which do not meet the warrants for a detailed traffic impact study. A traffic operations analysis will be requested for any one of the following conditions:

5.7.2.1.3.1.1. Requests for a driveway (or driveway modification) on any public road.

5.7.2.1.3.1.2. Existing sight distance limitations or high accident experience adjacent to the subject site.

5.7.2.1.3.1.3. Modifications to a site plan for an existing development where the parking layout and/or internal circulation system could affect traffic operations on the external roadway system.

5.7.2.1.3.1.4. Requests or probable need for a new traffic signal to control driveways serving a proposed or existing development.

5.7.2.1.3.2. Examples of traffic operations analyses include studies of proposed driveway locations, resulting sight distances, driveway and intersection geometry and control, turn lane needs and design, accommodation of projected queuing conditions, accident experience and safety, and traffic signal warrant and progression analysis.

5.7.3. Pre-Meeting and Memorandum of Understanding

5.7.3.1. Prior to commencing the preparation of a Traffic Impact Study, the preparer shall schedule a meeting with appropriate City staff. Other participants in this pre-meeting shall be representatives of other jurisdictions and agencies as deemed appropriate by City personnel. The participants at the meeting shall identify and agree upon the following issues and needs prior to the preparation of the TIS:

5.7.3.1.1. Study area

5.7.3.1.2. Study years

5.7.3.1.3. Development phasing, if applicable

5.7.3.1.4. Field data collection requirements

5.7.3.1.5. Acceptable data associated with traffic volumes, accident history, and signal operations

5.7.3.1.6. Peak traffic hours (analysis hours)

5.7.3.1.7. Trip generation, trip distribution, and assignment methods

5.7.3.1.8. Applicable planning documents (including the City's Thoroughfare Plan and Access Management Plan)

5.7.3.1.9. Other traffic impact studies prepared for developments in the study area

5.7.3.1.10. Utilization of travel demand models

5.7.3.1.11. Background traffic and growth factors

5.7.3.1.12. Acceptable levels of service (LOS)

5.7.3.1.13. Analyses methodology and software (capacity, signal warrants, etc.)

5.7.3.1.14. Cycle lengths at signalized intersections

5.7.3.1.15. Safety issues (sight distances, accident data, etc.)

5.7.3.1.16. Committed and planned roadway improvements and schedule

5.7.3.1.17. TIS submittal date

5.7.3.2. The preparer shall submit a Memorandum of Understanding (MOU) which details the assumptions and methodologies agreed upon regarding the items above – and the preparer shall request City staff concurrence with the contents of the MOU. The MOU shall be submitted to the City within one week subsequent to the pre-meeting. The MOU will be approved by City staff within one week of receipt – assuming that all items are properly addressed.

5.7.3.3. If not addressed in the MOU, the preparer shall make a separate submission regarding traffic growth rates, vehicle-trip generation rates, and directional distributions of site generated traffic to the City for concurrence and City staff will respond to the preparer on these items within one week of receipt.

5.7.4. Preparer Qualifications

5.7.4.1. Traffic Impact Studies shall be prepared by professionals with training and experience in traffic engineering/transportation planning and under the supervision of a registered professional engineer in Ohio with training and experience in traffic engineering (operations and safety analysis experience). The preparer shall not be a member of the TIS review team; neither shall the preparer be related to a review team member nor hold a financial interest in the project under study. The final document shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

5.7.5. Study Guidelines

5.7.5.1. Study Areas

5.7.5.1.1. Any complete transportation study analyzing off-site access needs and impacts will include at least all site access points and major intersections (signalized and unsignalized) adjacent to the site. Beyond this area, the review team will determine any additional area to be included based on local or site specific deficiencies, development size, traffic conditions, or local policy potentially affected by the proposed development. The study area will also encompass vacant parcels of land believed to impact the intersections being analyzed so as to analyze the proposed project in the context of other previously approved or anticipated developments in the surrounding area. Generally, the study area must be large enough to

encompass the critical intersections to be analyzed. In high traffic impact areas, the study area may include the entire zone in order to capture the cumulative impact of future development within the area.

5.7.5.1.2. The following shall be included in the study area conditions section of the report:

5.7.5.1.2.1. Study area boundaries.

5.7.5.1.2.2. Study area land-uses (existing and anticipated future development).

5.7.5.1.2.3. Site accessibility (existing and future roadway system; document basic features to include jurisdiction, functional classification, pavement widths, lane usages, traffic control devices, speed limits, etc.).

5.7.5.1.2.4. TIS intersections (defined in the Memorandum of Understanding):

5.7.5.1.2.4.1. Lane usages and traffic control devices.

5.7.5.1.2.4.2. Sight distances (compare existing distances with established criteria).

5.7.5.1.2.4.3. Accident experience (if requested).

5.7.5.2. Study Years

5.7.5.2.1. Beyond the assessment of current conditions, traffic impact studies are to address conditions in the anticipated build-out year of the proposed development and the design year – which is 20 years beyond the anticipated build-out year. Some general guidelines are as follows:

5.7.5.2.1.1. All the study intersections shall be analyzed with respect to existing conditions.

5.7.5.2.1.2. For site access points (and immediately adjacent intersections as appropriate), analyses shall be performed for both build-out and design year conditions. Such driveways and intersections shall be configured to meet design year requirements. Analyses of build-out conditions shall define what elements of the long-term configuration need to be made to yield acceptable conditions in the build-out year.

5.7.5.2.1.3. For all other study intersections, analyses shall be performed (with and without the proposed development) for the build-out year. The impacts associated with site generated traffic must be appropriately mitigated at these intersections.

5.7.5.2.1.4. If the proposed development is to be implemented in phases, it may be appropriate to analyze each major phase (e.g., initial phase, an intermediate phase, and full project build-out) in order to define the potential for staging defined roadway improvements/modifications.

5.7.5.3. Study Days and Hours

5.7.5.3.1. For each defined horizon year, specific time periods are to be analyzed. In most cases, only analyses of weekday street peak hours will be required. However, land-use classifications which experience their highest trip generation levels during periods other than street peak hours may require analyses for such periods to determine proper site access and turn lane storage requirements. Examples of land-use classifications which typically have substantially higher site trip generation peaks at times other than weekday street peak hours are: shopping centers, discount stores, recreational uses (e.g., theaters, zoos, theme parks, stadiums, and arenas), restaurants, schools, churches, and garden centers.

5.7.5.3.2. The analysis time period (and condition) shall be discussed and designated by the reviewers at the initial meeting. The objective is to designate the design day(s) and time period(s) so as to cause evaluation of conditions during the design hour or design hours. The selection of the proper design day and hour is particularly important for a development which exhibits significant seasonal variations in trip generation (such as shopping centers).

Special consideration must also be given to a development located in a zone that experiences (or will experience) significant seasonal variations in traffic volumes due to unique land-uses.

5.7.5.3.3. The design hour(s) to be used in a TIS will be discussed and designated by the reviewers at the initial meeting. At a minimum, all studies must include assessments of conditions during both the AM and PM peak commuter hours (unless otherwise directed by City staff).

5.7.5.4. Traffic Counts

5.7.5.4.1. Unless otherwise approved, traffic counts shall be conducted for a minimum of seven days.

5.7.5.5. Traffic Volume Projections

5.7.5.5.1. The total anticipated transportation infrastructure requirements in the study horizon year(s) depend on traffic projections and are needed so that the City can accurately evaluate implications associated with the applicant's request for development approval. However, the impacts and infrastructure needs will be assessed separately for the baseline condition (horizon year development excluding site) and total development (horizon year development including site).

5.7.5.5.1.1. Non-Site Traffic

5.7.5.5.1.1.1. Non-Site (background) traffic volumes are composed of existing volumes, accepted general growth of traffic, and traffic generated by previously-approved new developments in the study area.

5.7.5.5.1.1.2. *Non-Site Development within Study Area.* The impacts of the anticipated non-site development shall be assessed to aid both the City and the applicant in the determination of sources of transportation infrastructure needs. All significant developments within the study area that have been approved or are likely to occur by the specific horizon years shall be identified and incorporated into the study. The land-use type and magnitude of the probable future developments in the horizon years shall be identified in conversations with staff of the City and other relevant public agencies.

5.7.5.5.1.1.3. *Non-Site Development Outside Study Area.* In some cases, the City may request the applicant to specifically consider and include traffic generated by large developments located outside the defined study area. In such cases, a TIS prepared for the identified development will be provided to the applicant by the City to permit the inclusion of relevant traffic volumes within the subject TIS. The applicant will not be required to undertake vehicle-trip generation and trip distribution for developments outside the study area.

5.7.5.5.1.2. Site Traffic

5.7.5.5.1.2.1. *Site Development.* Development proposed to be located on the site under study shall be categorized by specific land-use type consistent with classifications contained in the latest edition of *Trip Generation* (Institute of Transportation Engineers). The proposed number of development (building) units (e.g., gross square feet of building area, dwelling units, hotel rooms, etc.) shall be provided. Land area is insufficient to provide a basis for analysis. If the proposed land-use or density is inconsistent with the current land-use plan, comparison of the proposed land-use and the land-use plan recommendation shall be made using classifications contained in the *Trip Generation* report.

5.7.5.5.1.2.2. Trips generated by the proposed development shall be calculated using the most current edition of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. Methodologies contained in the ITE *Trip Generation Handbook* shall be

used for internal trips and pass-by trips calculations.

5.7.5.5.1.2.3. Distribution and assignment of site traffic shall be based on engineering judgment and the method shall be pre-approved by the City. The directions from which traffic will access the site will depend on various factors, including:

5.7.5.5.1.2.3.1. Type of proposed development and the area from which it will attract traffic,

5.7.5.5.1.2.3.2. Size of proposed development,

5.7.5.5.1.2.3.3. Competing developments (if applicable),

5.7.5.5.1.2.3.4. Surrounding land uses and population, and

5.7.5.5.1.2.3.5. Conditions on surrounding roadway system.

5.7.5.6. Capacity Analysis

5.7.5.6.1. Level of Service

5.7.5.6.1.1. The standard criterion used to define quality of traffic flow is "level of service" (LOS). This is a qualitative assessment of factors such as speed, volume, geometry, delays, and ease of maneuvering. All analysis techniques specify the quality of operations as a letter (such as those shown in Table 1) – with 'A' representing the best operating condition and 'F' representing the worst.

Table 10 - LOS Criteria for Intersections

	Control Delay per Vehicle (Seconds)	
Level of Service	**Unsignalized Intersections**	**Signalized Intersections**
A	≤ 10.0	≤ 10.0
B	> 10.0 and ≤ 15.0	> 10.0 and ≤ 20.0
C	> 15.0 and	> 20.0
D	> 25.0 and	> 35.0
E	> 35.0 and	> 55.0
F	>50.0	>80.0

Source: Transportation Research Board, *Highway Capacity Manual*, Special Report 209, Third Edition, National Research Council, Washington, DC, 2000.

5.7.5.6.1.2. The minimum acceptable design level of service (LOS) in the City is 'C'. At intersections, analyses should show an overall LOS of 'C' with no individual movement operating at less than 'D' to be acceptable. Where unacceptable levels of service are calculated for background or "no-build" conditions, the applicant is responsible for only maintaining the same level of service when site traffic is added to the roadway element.

5.7.5.6.2. Methodology

5.7.5.6.2.1. The use of HCS or Synchro software is acceptable for capacity analyses. When using Synchro, reports from HCM module shall be used.

5.7.5.6.2.2. In general, a Peak Hour Factor (PHF) of 0.90 shall be used for horizon year analyses. (A different PHF may be more appropriate for certain land uses (e.g., a school); such conditions will be discussed at the initial meeting.)

5.7.5.6.2.3. Capacity and level of service calculations shall be performed for each site drive intersection for build-out year and design year conditions. Site driveway intersections shall be configured for design year conditions.

5.7.5.6.2.4. Capacity and level of service calculations shall be performed for all other study intersections for:

5.7.5.6.2.4.1. Existing conditions (i.e., current volumes on existing roadway system).

5.7.5.6.2.4.2. Build-out year 'No-build' (non-site) traffic volumes on existing (or planned and programmed) roadway system.

5.7.5.6.2.4.2.1. If improvements/modifications to the existing roadway system are planned and programmed, City staff will provide this information to the applicant and the improved roadway system will be used as a base for testing horizon year traffic conditions – as appropriate.

5.7.5.6.2.4.2.2. If roadway improvements or modifications beyond those formally planned or programmed are assumed in the 'no-build' analysis, then these improvements or modifications will be considered to be the responsibility of the applicant. If this is not the case, then the rationale for considering such improvements must be clearly described.

5.7.5.6.2.4.3. Build-out year 'Build' (i.e., non-site plus site) traffic volumes on existing (or planned and programmed) roadway system.

5.7.5.6.2.4.4. Build-out year 'Build' traffic volumes on improved/modified roadway system that mitigates the traffic impacts of the proposed development.

5.7.5.6.2.4.4.1. Produce a table for each intersection, study period, and study horizon year listing the level of service and delay (or v/c ratio) by (1) individual movement, and (2) overall intersection for:

5.7.5.6.2.4.4.1.1. Existing conditions.

5.7.5.6.2.4.4.1.2. No-Build conditions.

5.7.5.6.2.4.4.1.3. Build conditions on existing roadway system.

5.7.5.6.2.4.4.1.4. Build conditions on proposed roadway system.

5.7.5.6.3. Mitigation

5.7.5.6.3.1. Recommendations shall be made in the TIS for the site access points and external roadway improvements (such as additional through lanes, turn lanes, and traffic control devices) necessitated as a result of the proposed development. The traffic impacts of the proposed/planned development must be properly mitigated.

5.7.5.6.3.2. Suggested improvements/modifications must be practical and acceptable to the appropriate agency/jurisdiction.

5.7.5.6.3.3. A scaled concept sketch or (at least a schematic figure) shall be provided illustrating the improvements/modifications that properly mitigate the traffic impacts of the proposed development.

5.7.5.7. Turn Lane Criteria

5.7.5.7.1. Turn lanes at signalized intersections (existing or warranted upon on build-out day) and at off-site unsignalized intersections shall be provided based on capacity analyses (as part of mitigation).

5.7.5.7.2. Left turn lanes shall be provided at site access points under the following conditions:

5.7.5.7.2.1. On major and minor arterial roadways with speed limits greater than 40 mph, or

5.7.5.7.2.2. On major and minor collector roadways with speed limits greater than 40 mph and more than 10 left turning vehicles during the peak hour of the development, or

5.7.5.7.2.3. Per graphs 401-5aE, 401-5bE and 401-5cE, which are the left turn lane warrants contained in the ODOT *Location and Design Manual Volume I.* (These are Graphs 1, 2, and 3 in the ODOT State Highway Access Management Manual.)

5.7.5.7.2.3.1. Note that the warrants apply <u>only to the free flow approach</u> of the unsignalized intersection. Turn lanes on the minor approach (under stop-sign control) shall be provided based on capacity analyses.

5.7.5.7.3. Right turn lanes shall be provided at site access points per graphs 401-6aE, 401-6bE, 401-6cE and 401-6dE, which are the right turn lane warrants contained in ODOT *Location and Design Manual Volume I.* (These are Graphs 4, 5, 6 and 7 in the ODOT *State Highway Access Management Manual*.)

5.7.5.7.4. Left or right turn lanes may also be required when deemed necessary for safety purposes by the City Engineer.

5.7.5.7.5. The length of left and right turn lanes shall be based on the criteria contained in the *ODOT Location and Design Manual Volume I* Section 401-9E and 401-10E or, where appropriate, on the results of queuing analyses associated with the capacity calculations. The length of turn lanes shall be based on a design speed five miles per hour above the posted speed limit. For roadways with an unposted speed limit, a design speed of 55 MPH shall be used.

5.7.5.8. Traffic Signal Warrant Criteria

5.7.5.8.1. Warrant analyses for the installation of a traffic signal shall be required if a signal is recommended as a mitigating measure.

5.7.5.8.2. Signal warrants, as contained in the latest edition of the Ohio Manual of Traffic Control Devices (OMUTCD), shall be used for any formal request associated with the installation of a traffic signal.

5.7.5.8.3. In general, the City does not permit the installation of a traffic signal unless the criteria specified in Warrant 1 (Eight-Hour Vehicular Volume) are met.

5.7.5.8.4. Table 11 provides a general guideline derived from this warrant.

5.7.5.8.5. If a signal is shown to be warranted in a horizon year, but is not warranted in the build-out year, estimates shall be made regarding the year that the signal may become warranted.

5.7.5.8.6. Signal warrant analyses may be conducted using projected traffic volumes to identify the potential need for the installation of traffic signals. However, traffic signals will not be installed unless: (1) the subject intersection is unquestionably projected to meet warrants on build-out day of the development, or (2) actual counts at the intersection meet warrant thresholds.

5.7.5.8.7. Any intersection that meets signal warrant thresholds must also be evaluated in terms of location and spacing based on the standards noted in the City's Access Management Regulations or in the ODOT State Access Management Manual (if applicable) for the access category assigned by the City's Thoroughfare Plan.

Table 11 - General Guidelines for Warranting a Traffic Signal based on Average Daily Traffic Volumes as Derived from Warrant 1 (Eight-Hour Vehicular Volume)

Condition A: Minimum Vehicular Volume			
Number of Approach Lanes		**Average Daily Traffic**	
MAJOR	**MINOR**	**MAJOR**	**MINOR[1]**
1	1	8,300	5,000
2 or more	1	10,000	5,000
2 or more	2 or more	10,000	6,700
1	2 or more	8,300	6,700
Condition B: Interruption of Continuous Traffic			
Number of Approach Lanes		**Average Daily Traffic**	
MAJOR	**MINOR**	**MAJOR**	**MINOR[1]**
1	1	12,500	2,500
2 or more	1	15,000	2,500
2 or more	2 or more	15,000	3,300
1	2 or more	12,500	3,300

[1] For 'T' intersections, the required ADT values on the minor approach are 50% of the values listed.
Note: When the 85th percentile speed of major street traffic exceeds 40 mph in either an urban or rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the warrants are 70% of the guidelines above.

5.7.5.9. Site Access, Circulation, Parking and Roadway Plans

5.7.5.9.1. The following shall also be addressed in the TIS:

5.7.5.9.1.1. On-site parking needs.

5.7.5.9.1.2. Ease of internal circulation.

5.7.5.9.1.3. On-site queuing provisions.

5.7.5.9.1.4. On-site traffic operations and control(as they may affect traffic operations on the external roadway system).

5.7.5.9.1.5. Design of site driveways to include pavement widths, lane usages, proposed median widths, traffic control devices, etc.

5.7.5.9.2. Plans showing site access and any roadway improvements/modifications shall be submitted with all requested traffic impact studies and/or traffic operations analyses. These plans shall be to a practical scale.

5.7.5.9.3. The site access and roadway plan(s) shall be of sufficient detail to show:

5.7.5.9.3.1. Location and spacing of all site access points and driveways (including relationships to other nearby roadways, intersections, and driveways),

5.7.5.9.3.2. External roadway improvements/modifications,

5.7.5.9.3.3. Lane configurations and control,

5.7.5.9.3.4. Queuing and vehicle storage distances,

5.7.5.9.3.5. Spacing of traffic signals to permit proper traffic progression on the adjacent roadway system,

5.7.5.9.3.6. Sight distances,

5.7.5.9.3.7. Adequate pedestrian, bicycle, and public transit provisions (if applicable),

5.7.5.9.3.8. Sufficient emergency and service/delivery access, and

5.7.5.9.3.9. Proper on-site circulation and parking layout so as not to affect traffic flow and operations on the external street system.

5.7.6. Report Contents

5.7.6.1. All traffic impact studies and traffic operations analyses must be documented in a report. The results of traffic operations analyses can be summarized in a memorandum type report – while the results of traffic impact studies must be submitted in standard report formats. Such traffic impact reports shall be complete and concise and shall include the following:

5.7.6.1.1. Cover

5.7.6.1.1.1. Development name and location

5.7.6.1.1.2. Applicant's name

5.7.6.1.1.3. Preparer's name

5.7.6.1.1.4. Report date

5.7.6.1.2. Title Page

5.7.6.1.2.1. Development name and locations

5.7.6.1.2.2. Applicant's name, address, and telephone number

5.7.6.1.2.3. Preparer's name, address, and telephone number, engineering registration seal and signature

5.7.6.1.2.4. Report date

5.7.6.1.3. Table of Contents

5.7.6.1.4. List of Figures

5.7.6.1.5. List of Tables

5.7.6.1.6. List of Appendices

5.7.6.1.7. Executive Summary

5.7.6.1.7.1. Site location and study area

5.7.6.1.7.2. Development description

5.7.6.1.7.3. Types of studies undertaken (impacts, signal warrants, site access, etc.)

5.7.6.1.7.4. Principal findings

5.7.6.1.7.5. Conclusions and Recommendations

5.7.6.1.8. Summary of Revisions (for revised reports)

5.7.6.1.9. Introduction

5.7.6.1.9.1. Site Description

5.7.6.1.9.2. Study Area Conditions

5.7.6.1.9.3. Study Hours and Study Years

5.7.6.1.10. Traffic Volumes

5.7.6.1.10.1. Existing Traffic Volumes

5.7.6.1.10.2. No-Build Traffic Volumes

5.7.6.1.10.3. Site-Generated Traffic Volumes

5.7.6.1.10.4. Build Traffic Volumes

5.7.6.1.11. Traffic Analyses

5.7.6.1.11.1. Site Access Point(s) Evaluation

5.7.6.1.11.1.1. Signal warrant analyses

5.7.6.1.11.1.2. Turn lane warrants

5.7.6.1.11.1.3. Turn lane length computations

5.7.6.1.11.1.4. Capacity Analyses

5.7.6.1.11.1.5. Sight distances

5.7.6.1.11.2. Off-Site Public Road Intersection Analyses

5.7.6.1.11.2.1. Signal warrant analyses

5.7.6.1.11.2.2. Accident analyses (if requested)

5.7.6.1.11.2.3. Capacity analyses

5.7.6.1.11.2.3.1. Existing conditions (current volumes)

5.7.6.1.11.2.3.2. No-Build conditions (build-out year)

5.7.6.1.11.2.3.3. Build Conditions (build-out year)

5.7.6.1.11.2.3.4. Mitigation (build-out year)

5.7.6.1.12. Conclusions and Recommendations

5.7.6.1.13. Appendix

5.7.6.1.13.1. Memorandum of Understanding

5.7.6.1.13.2. Site Plan

5.7.6.1.13.3. Traffic Count Data

5.7.6.1.13.4. Traffic Analyses/Worksheets (capacity analyses, signal warrants, turn lane warrants and length) Worksheets

5.7.6.1.14. Additional Information

5.7.6.1.14.1. The following exhibits shall be included in reports (where applicable)

5.7.6.1.14.1.1. Site Location Map

5.7.6.1.14.1.2. Existing Conditions (current lanes and traffic control at study intersections)

5.7.6.1.14.1.3. Existing Traffic Volumes

5.7.6.1.14.1.4. No-Build Traffic Volumes

5.7.6.1.14.1.5. Directional Distribution of Site Traffic

5.7.6.1.14.1.6. Site Generated Traffic Volumes

5.7.6.1.14.1.7. Build Traffic Volumes

5.7.6.1.14.1.8. Proposed Traffic Control and Lane Usages

5.7.6.1.14.2. The following tables shall be included in reports (where applicable)

5.7.6.1.14.2.1. Site Trip Generation Factors

5.7.6.1.14.2.2. Site Trip Generation Volumes

5.7.6.1.14.2.3. Level of Service Summary

5.7.7. Submittal Requirements

5.7.7.1. All reports will be reviewed by City staff and those requiring additional information or revision will be discussed with the preparer and returned for revisions.

5.7.7.2. Four copies of the report shall be submitted to the City.

5.7.8. Public Record

5.7.8.1. All submitted documents, including both reports and data, become public record upon submittal. Information contained in these submittals may be used by agency staff or other study preparers in subsequent studies. The original sources of data and information shall be cited when taken from prior submittals.

5.8. ACCESS MANAGEMENT STANDARDS AND GUIDELINES

5.8.1. Purpose and Intent

5.8.1.1. Access Management is an efficient way of dealing with the problems associated with traffic congestion and safety caused by motorists turning at driveways and intersections. Congestion and the threat of accidents become greater as the number of driveways and intersections increase and the distance between them decreases. Without Access Management, roadways and intersections can become dangerous.

5.8.1.2. The City of Lebanon has adopted an Access Control Code based on the following principles:

5.8.1.2.1. To promote public safety by minimizing accidents.

5.8.1.2.2. To improve the driving experience by increasing mobility and decreasing delay.

5.8.1.2.3. To provide necessary and safe access to property.

5.8.1.2.4. To minimize costs by making more efficient use of existing and proposed roads.

5.8.1.3. All highways, roads and streets form a hierarchy according to the function they theoretically should serve. They serve traffic mobility, land access, or some combination of these two. Interstates and expressways are at the highest level; their primary function is mobility, so they have the strictest access controls. At the other end of the scale are local streets serving low traffic volumes at low speeds over short distances. Their primary purpose is to give frequent, direct access to adjacent land, so restrictions are minimal.

5.8.1.4. Between these extremes are the classes of arterials and collectors that make up the bulk of the system. They include many of the most important roadways in the Lebanon area -- and they are often expected to perform multiple and conflicting traffic services. They must serve both the demand for mobility and the demand for land access.

5.8.1.5. The City Access Control Code considers: (1) modifications to existing roadways to provide better access management, (2) proper access management along all new roadways, and (3) proper management and design of the site access and circulation systems associated with planned new developments. The following sets forth the guidelines associated with the location and design of access points.

5.8.2. Road Access Categories and Characteristics

5.8.2.1. The roadways located in Lebanon have been categorized according to their functional and operational intent. The categories are based on maintaining the roadway's function in terms of capacity, traffic flow, property access, and safety. The functional descriptions of the six basic categories are as follows:

5.8.2.1.1. Category I: Designed and intended to provide mobility for high volumes of traffic at high speeds over long distances. Highways in this category are typically designed and intended to achieve a minimum posted speed of 55 mph. All interstate and freeway facilities are included in this category.

5.8.2.1.2. Category II: Designed and intended to provide mobility for relatively high speed, high volume, and long distance through traffic. Highways in this category are typically designed and intended to achieve a minimum posted speed of 50 mph in areas without signals and 45 mph in areas with signals. This category includes arterials of state-wide significance and this is the highest category allowing at-grade intersections.

5.8.2.1.3. Category III: Designed to provide mobility at moderate to high speeds and volumes. Typically, Category III highways provide for a minimum posted speed of 45 mph in areas without signals and a minimum of 35 mph in areas with signals. Arterials outside the urbanized area are included in this category.

5.8.2.1.4. Category IV: Designed and intended to provide access and mobility at moderate to high speeds and volumes for moderate to short distances in rural areas and low to medium speeds and volumes in urban areas. Low to moderate speed arterials within the urbanized area and major collectors are included in this category. Typically, Category IV highways provide for a minimum posted speed of 35 to 55 mph in undeveloped areas and 25 to 45 mph in developed areas.

5.8.2.1.5. Category V: This category applies to roads and streets designed and intended to take traffic from local roads, carry it a short distance, and distribute it to higher category roadways. Minor collectors are included in this category. Typical posted speeds are 25 to 35 mph.

5.8.2.1.6. Category VI: This category applies to local streets that provide access to individual properties that abut the street.

5.8.2.2. The following table provides the general assignment of the functional classifications depicted in the City's Thoroughfare Plan to the access management categories.

Table 12 - Roadway Functional Classifications

Access Management Category	Road Functional Classification	Examples
Category I	Freeway	I-71
Category II	Major Arterial of State-wide Significance	State Route 48
Category III	Major and Minor Arterials outside the urbanized area of Lebanon	US Route 42, State Routes 63 and 123
Category IV	Major Collectors as well as Major and Minor Arterials within the urbanized area of Lebanon	
Category V	Minor Collectors	
Category VI	Local Roads	

5.8.3. Driveway Types

5.8.3.1. A driveway is a point of access connecting an adjacent property to a public roadway. There are five types of driveways, as follows:

5.8.3.1.1. Farm or Field Drives: A driveway providing access to an agricultural tract of land.

5.8.3.1.2. SF Residential: A driveway providing access to a single-family residence.

5.8.3.1.3. Residential: A driveway providing access to multiple single-family residences or to multi-family dwelling units.

5.8.3.1.4. Commercial: A driveway providing access to an office, business, commercial, or institutional building or buildings, or to an industrial facility (that services fewer than ten trucks per day).

5.8.3.1.5. Industrial/Retail: A driveway serving a retail center (such as a community shopping center) or an industrial facility (that services ten or more trucks per day).

5.8.3.2. For Access Management purposes, driveways are also classified by traffic volumes as follows:

5.8.3.2.1. Low Volume Driveway (LVD): greater than 5 and up to 100 two-way vehicle-trips in one or more 60-minute periods of a day.

5.8.3.2.2. Medium Volume Driveway (MVD): greater than 100 and up to 200 two-way vehicle-trips in one or more 60-minute periods of a day.

5.8.3.2.3. High Volume Driveway (HVD): greater than 200 two-way vehicle-trips in one or more 60-minute periods of a day.

5.8.4. Driveway Location and Spacing

5.8.4.1. The number of driveways afforded any one site shall be minimized. (The need for more than one driveway must be substantiated by a Traffic Impact Study.)

5.8.4.2. Access for multiple properties shall be combined, where feasible.

5.8.4.3. Driveways shall be located in accordance with applicable sight distance requirements (Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD) as contained in Section 200 of the ODOT Location and Design Manual).

5.8.4.4. Minimum driveway spacing (centerline to centerline) which is based on posted speed limits, shall be determined using the values for high speed roadways (greater than 40 mph) and low speed roadways (equal to or less than 40 mph) as follows:

Table 13 - Minimum Driveway Spacing

High Speed Road		Low Speed Road	
Posted Speed (MPH)	**Minimum Distance (Ft.)**	**Posted Speed (MPH)**	**Minimum Distance (Ft.)**
45	500	25	150
50	550	30	200
55	600	35	250
		40	325

5.8.4.5. Driveway spacing shall consider the location of driveways on both sides of a roadway.

5.8.4.6. Driveways shall be located where they will not cause problems with movements to and from an existing or planned street, highway, or driveway on the opposite side of the roadway.

5.8.4.7. Driveways shall be located a sufficient distance from an adjacent public road intersection so as not to interfere with the traffic operations at the intersection. The following table provides the minimum acceptable distances between drive locations and adjacent intersections. For all access categories, where two roads of different access levels intersect, the restrictions and distances of the higher level roadway will apply along the lower classified roadway. (The defined distances are measured from the centerline of the intersecting road to the centerline of the proposed driveway.)

Table 14 - Recommended Drive Distances from Intersection By Classification

Higher Roadway Classification	Distance from Intersection
Intersecting Category I, II, or III Roadway	600 feet
Intersecting Category IV or V Roadway	300 feet

5.8.5. Access Management Standards

5.8.5.1. This section defines the standards and specifications to be used in conjunction with the access categories and driveway types to protect the functional integrity of roads in and near the City. The following describes the access standards to be applied for each access category.

5.8.5.1.1. *Category I and II Roadways*: Reference the latest version of the ODOT State Highway Access Management Manual.

5.8.5.1.2. Category III, IV, and V Roadways: Refer to the following table.

5.8.5.1.3. *Category VI Roadways*: Full access permitted per parcel or lot.

Table 15 - Access Standards for Category III, IV, and V Roadways

Roadway	Driveway	Permitted?	Minimum Spacing *(a)(b)*	Traffic Control	Movements
Category III					
	HVD	Yes *(c)*	½ mile *(d)*	Signal if warranted	All *(e)*
	MVD	Yes *(c)*	SSD/ISD & Table *(f)*	Stop	All *(e)*
	LVD	Yes *(c)(g)*	SSD/ISD & Table *(f)*	Stop	All *(e)*
Category IV					
	HVD	Yes *(c)*	¼ mile *(h)*	Signal if warranted	All *(e)*
	MVD	Yes *(c)*	SSD/ISD & Table *(f)*	Stop	All *(e)*
	LVD	Yes *(c)(g)*	SSD/ISD & Table *(f)*	Stop	All *(e)*
Category V					
	HVD	Yes *(c)*	¼ mile *(h)*	Signal if warranted	All *(e)*
	MVD	Yes *(c)*	SSD/ISD	Stop	All *(e)*
	LVD	Yes *(c)*	SSD/ISD	Stop	All *(e)*

Where:
HVD = High Volume Drive,
MVD = Medium Volume Drive,
LVD = Low Volume Drive
SSD/ISD = Stopping Sight Distance and Intersection Sight Distance

(a) These are desirable minimum distances. It is recognized that site frontage and property limits may, by necessity, alter these dimensions. At the same time, the City reserves the right to call for greater spacing distances.

(b) Spacing requirements shall properly consider driveways on both sides of the highway.

(c) One direct private access shall be permitted per parcel or contiguous parcels under common ownership. Additional access may be permitted if: (1) the access will not adversely affect the safety and operation of the highway, (2) such access is necessary for the safe and efficient use of the property, and (3) such access will not adversely affect access to adjacent or nearby properties.

(d) ½ mile is recommended, however, ¼ mile may be allowed when there is no reasonable alternative access to the general street system. If these cannot be achieved, then the restrictions of SSD, ISD, and minimum spacing based on posted speed limit shall apply

(e) All movements permitted if not deemed detrimental; certain movements may be restricted due to operational and safety considerations.

(f) Spacing shall be determined using the greatest value identified for SSD, ISD, and minimum driveway spacing based on posted speed limit (reference table in Section 5.8.4.4.).

(g) Low volume driveways shall be discouraged on roadways with speed limits greater than 50 mph. Where there is an opportunity, low volume drives should be consolidated and combined using appropriate means such as service roads, cross easements, and joint access to reduce the number of access points.

(h) ¼ mile is recommended, however, one-eighth mile may be allowed when there is no reasonable alternative access to the general street system. If these cannot be achieved, then the restrictions of SSD, ISD, and minimum spacing based on posted speed limit shall apply.

5.8.6. Driveway Geometrics and Design

5.8.6.1. Driveway widths and turning radii are determined by the number and use of lanes on the driveway and the design vehicle chosen for the driveway. The width and radii of the driveway shall permit vehicles to enter and exit with a minimum of interference to through traffic, yet be restrictive enough to discourage erratic maneuvers. The following table provides guidelines for driveway dimensions based on driveway type and design vehicle.

Table 16 - Driveway Design Standards

Driveway Type	**Residential**		**Commercial**		**Industrial/Retail**	
Design Vehicle	P		SU-30		WB-50/WB-67	
Nominal Width 1/	Min. (feet)	Max. (feet)	Min. (feet)	Max. (feet)	Min. (feet)	Max. (feet)
One-way Drive	10	14	14	20	14	26
Two-way Drive	20	24	26	32	26	38
Corresponding RT Radius	25	15	35	25	75	50

Where:
1/Driveway throat width measured parallel to highway and clear of the turn radii.
P: Passenger car
SU-30: Single-unit truck; 30 feet in length
WB-50: Large semi-trailer truck; 55 feet in length
WB-67: Interstate semi-trailer truck; 74 feet in length
RT Radius: Right turn radius (Note: the smaller the drive width, the larger turn radius required to accommodate the path of the vehicle.)

5.8.6.2. Driveways or other access points that enter a public roadway at traffic signals shall have the number of lanes as determined by a capacity analysis. In this case, 12-foot wide lanes shall be utilized and turn templates shall be used to ensure adequate radius-throat width combinations.

5.8.6.3. Two-way driveways shall intersect the highway at an intersection angle between 80º and 90º. An angle less than 80º will not be permitted on new two-way driveways. One-way operation driveways (right in only or right out only) shall not have an angle less than 45º

5.8.6.4. Driveway radii may be reduced on a roadway with on-street parking. The turn radius, in such a case, is measured from the edge of the through lane.

5.8.6.5. The profile of a driveway shall be designed to provide a smooth transition for its users.

5.8.6.6. Drives shall not be obstructed within the right-of-way by gates, or similar obstacles. Any access with a gate shall be designed so that the longest vehicle can completely clear the traveled way when the gate is closed and as it is opened.

5.8.6.7. The need for traffic signals shall be determined by warrant analyses using the Ohio Manual of Uniform Traffic Control Devices.

5.8.6.8. High volume driveways that do not meet signal warrants may be denied certain traffic movements if traffic volumes and conditions on the highway would make the full movement operation unsafe.

5.8.7. Driveway Islands

5.8.7.1. In some situations, it is desirable to prohibit certain movements through the use of median or channelizing islands. Median islands can be used to separate inbound and outbound traffic. It is a curbed island which prevents egressing traffic from encroaching on the side of the drive used by ingress traffic. Channelizing islands further designate the correct turning path

and define the merge area thus reducing conflicting movements. The geometry shall physically define the permitted movements and block the prohibited movements.

5.8.7.1.1. Median islands shall be at least 4 feet wide -- with a maximum of 6 feet at the intersection. Median widths exceeding 6 feet are undesirable because they create turning problems, expand the intersection, and make it difficult to provide proper lane alignments with opposing existing or future driveways or roadways.

5.8.7.1.2. Median islands shall be at least 25 feet in length.

5.8.7.1.3. An island median shall be used to prevent encroachment on other driveway lanes whenever any combination of egress and ingress lanes exceeds three lanes.

5.8.7.1.4. A median island shall be offset at least 12 feet from the edge of the traveled lane on the main road.

5.8.7.1.5. The nose of a median island shall taper in height from 2” to 6” over a distance of 4 feet.

5.8.7.1.6. Standard yellow edge lines shall be used at the divisional island. Also, white pavement markings shall be used to delineate traffic lanes when there are two or more lanes in the same direction. At high volume driveways, reflectorized pavement markers shall be used to provide greater delineation.

5.8.7.1.7. Channelizing islands shall be used on arterials and network collectors without a median where left turns are restricted and on one-way streets to discourage wrong way turns.

5.8.7.1.8. Channelizing islands shall have a surface area of at least 75 square feet.

5.8.7.1.9. All channelizing islands shall be offset at least 4 feet from the edge of the traveled lane to the face of curb or the width of the paved curbed shoulder whichever is greater on high-speed roadways or where the approach roadway is uncurbed. A mountable curb, no more than 4 inches high, shall be used on the channelizing island if approach roadways are uncurbed.

5.8.7.1.10. A turning radius of between 75 feet and 100 feet shall be used for channelizing islands in order to make it more difficult for a driver to make a maneuver which the design is intended to discourage. (Radii larger than 100 feet shall not be used on egress unless an acceleration lane is provided because of the large angle a driver must rotate in order to see vehicles approaching from the left; the acceleration lane allows the driver to use the rear view mirror to select a gap).

5.8.7.1.11. Applicable driveway widths and turning radii shall be determined based on the number and use of lanes on the driveway and the design vehicle chosen for the driveway. Signage shall be based upon the regulatory signs defined in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

5.8.8. Auxiliary Turn Lanes

5.8.8.1. The requirement for separate left and/or right turn lanes on the main roadway at site access points shall be based on the guidelines defined in Section 5.7. associated with Traffic Impact Studies.

5.8.9. Exceptions for Access Requests

5.8.9.1. Exceptions will grant permission to depart from the standards and requirements of the Access Control Code based on unique circumstances or existing special conditions.

5.8.9.1.1. The request for an exception shall specify, in writing, why the exception is appropriate and necessary and shall document the unique conditions or special circumstances that make it impractical and infeasible to comply with the applicable standards and/or requirements of the Access Control Code. The documentation shall show that the applicant has considered

all practical and reasonable alternatives to mitigate the unique conditions or special circumstances, that the alternatives are not feasible or practical, and that, without the exception, the applicant will be deprived of reasonable access.

5.8.9.1.2. In considering a request for an exception, the City shall determine if:

5.8.9.1.2.1. The exception meets minimum applicable City standards including geometric design, operation, and safety elements – and if the exception is shown to be beneficial to the traveling public.

5.8.9.1.2.2. The exception is not detrimental to the public health, safety, and welfare.

5.8.9.1.2.3. The exception does not degrade the planned or intended operation of the roadway system.

5.8.9.1.3. A exception approval shall be consistent with the guiding principles of the Access Control Code and Section 5.8 herein.

5.8.9.1.4. When an exception is granted, the documentation of the reason(s) for approving the exception shall be included in the records and files pertaining to the permit.

5.8.10. Use of Access

5.8.10.1. It is the responsibility of the property owner to ensure that the use of the access to the property is not in violation of the permit terms and conditions. The terms and conditions of any permit are binding upon all assigns, successors-in-interest, heirs, and occupants. If any changes are made or will be made in the use of the property, which will affect access operation, traffic volume, or vehicle type, the applicant or property owner shall contact the City to determine if a new access permit and modifications to the access point are required.

5.9. ON-STREET PARKING GUIDELINES

5.9.1. On-street parking in residential areas will be permitted under the conditions found in Table 17.

Table 17 – On-Street Parking Standards

Pavement Width (Face of Curb to Face of Curb)	Allowable Parking	Minimum R/W Required for Residential Street
<26 feet	No on-street parking	50 feet
≥26 feet but <34'	One side of roadway (opposite of fire hydrants)	50 feet
≥34 feet	Both sides of roadway	60 Feet

5.9.2. On streets with parking on only one side of the street, parking shall be prohibited on the side of the street with fire hydrants.

5.10. MISCELLANEOUS REQUIREMENTS

5.10.1. Plating

5.10.1.1. All road plates shall be recessed so as to be flush with the existing road surface. Wedging of plates shall not be permitted unless otherwise approved by the City Engineer

5.10.2. Pavement Markings

5.10.2.1. All pavement markings shall be ODOT Item 644 thermoplastic with glass beads.

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SECTION 6 - CONCRETE

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6.1. PURPOSE

6.1.1. The purpose of this section is to specify the methods for the installation and replacement of sidewalk, drive aprons, driveways, and curb and gutter.

6.2. GENERAL

6.2.1. In areas with chairback curb, sawcutting of the curbing to create depressed curb is not permitted. The curbing in the area of a drive apron or a curb ramp shall be removed in its entirety and replaced with modified (depressed) curb and gutter.

6.3. LEBANON STANDARD CONCRETE

6.3.1. Lebanon Standard Concrete is ODOT Class C Portland cement concrete possessing the following qualities:

6.3.1.1. Minimum water to cement (w/c) ratio of 0.50.

6.3.1.2. No fly ash.

6.3.1.3. Minimum compressive strength of 4,000 psi.

6.3.1.4. Air entrainment of 6% ±2%.

6.3.2. All concrete exposed to the elements shall be Lebanon Standard Concrete.

6.4. PERMIT REQUIRED

6.4.1. No person, corporation or firm, other than an authorized employee of the City, shall construct a driveway, driveway approach connecting to a public street or right-of-way, or cut, break out or remove any curb along any street or other public way, or construct any new sidewalks located within the public right-of-way without first obtaining a permit. Each day of such violation shall constitute a separate offense. The City Engineer or his/her designate may require such construction plans or drawings with the permit application as he/she deems necessary to:

6.4.1.1. Permit all reviewing authorities to make an intelligent and conclusive review of the application.

6.4.1.2. Enable the contractor to construct the proposed facility in accordance with the terms of the permit.

6.4.1.3. Enable the individual responsible for inspection to insure that the facility is constructed in accordance with the terms of the permit.

6.4.1.4. Serve as a record of the construction authorized by the permit.

6.5. ADA COMPLIANCE

6.5.1. All newly constructed, repaired, or replaced sidewalk and/or curb ramps shall be made completely compliant with the latest edition of the American with Disabilities Act (ADA). This includes providing proper slopes and cross-slopes of all sidewalk and curb ramps and the provision of truncated dome paver warning devices at all curb ramps.

6.6. RESPONSIBILITY OF MAINTENANCE AND REPAIR

6.6.1. As regulated by Chapter 903 of the City of Lebanon, Codified Ordinances, each property owner within the City has the responsibility of maintaining in good repair the sidewalk and driveway aprons abutting their property.

6.6.2. The construction and repair of all curb and gutter and handicap ramps along public roadways within the City of Lebanon shall be the responsibility of and shall be done at the expense of the City of Lebanon. Curb and gutter shall be repaired/replaced based on a field inspection by the City Engineer in coordination with the annual street resurfacing program. As part of the City of Lebanon's annual street resurfacing program, the City Engineer shall designate improvement areas. In these improvement areas, new curb and gutter may be installed and/or defective curb and gutter shall be repaired or replaced at the expense of the City of Lebanon. Only the defective curb and gutter within the defined improvement areas will be replaced at the expense of the City of Lebanon. The property owner may elect to repair and/or replace defective curb and gutter that is not within the annual improvement areas at the property owner's sole expense.

6.7. CRITERIA FOR REPAIRING SIDEWALK, CURBING AND DRIVEWAY APRONS

6.7.1. The objectives for the repair of sidewalk, curb & gutter, and driveway aprons are as follows: pedestrian safety, proper drainage, coordination with other City of Lebanon street projects, and maintaining property values. In all cases, the views and concerns of the property owner will be taken into consideration and in all marginal cases; the decision shall be to the benefit of the property owner.

6.7.2. The following three sections indicate the checklist of the determination of replacement for sidewalks, curb & gutter, and driveway aprons:

6.7.2.1. Sidewalks

6.7.2.1.1. Any block having a crack or cracks. Generally, if more than one crack, the block shall be replaced, if single crack is one eighth (1/8) inch or more in width, the block shall be replaced.

6.7.2.1.2. Adjoining blocks or portions thereof whose edges differ vertically by more than one half (1/2) of an inch or create a tripping hazard.

6.7.2.1.3. Blocks that have holes in them one (1) inch or more in diameter or are cracked or broken in such a manner that pieces of concrete are missing or loose.

6.7.2.1.4. Blocks having depressions, reverse cross slope (sloping away form the street), or below back of curb grade causing the impoundment of mud or water.

6.7.2.1.5. Sidewalk that has a twenty-five (25) percent or larger area that is generally deteriorated as evident by spalling, raveling, or irregular surfaces.

6.7.2.1.6. Blocks that cause an abrupt change in the slope of the sidewalk.

6.7.2.1.7. Sidewalks that have settled due to utility installation.

6.7.2.2. Curb and Gutter

6.7.2.2.1. Any section that has horizontal cracks or cracks causing spalling or breaking away of the curb section.

6.7.2.2.2. Any section having vertical cracks. Following guidelines are followed:

6.7.2.2.2.1. If vertical crack in center of ten-foot section (± ½”), the crack may be saw cut and grouted.

6.7.2.2.2.2. If vertical crack located in ten-foot section in any area other than the center of the section, half of the section shall be removed and replaced.

6.7.2.2.3. Adjoining sections or portions whose edges differ vertically by more than one-half (1/2) inch.

6.7.2.2.4. Any section in which the concrete has deteriorated leaving aggregate exposed.

6.7.2.2.5. Sections where the gutter impounds water.

6.7.2.2.6. Any section having material (asphalt, concrete, mortar, etc.) added to the gutter so as to impede normal flow.

6.7.2.2.7. Sections that cause an abrupt change in slope.

6.7.2.3. Driveway Aprons

6.7.2.3.1. Driveway apron sections that have multiple cracks or a single crack with a width of one-quarter (1/4) inch or more in width.

6.7.2.3.2. Driveway apron sections that differ vertically by one-half (1/2) inch or more above or below the sidewalk and/or the back of the curb abutting the drive apron.

6.7.2.3.3. Driveway apron sections that are cracked or broken in such a manner that pieces of concrete are missing or loose or will cause a situation where pieces can become missing or loose.

6.7.2.3.4. Driveway aprons that are dipped across the sidewalk in such a manner that creates an abrupt change of grade in the sidewalk.

6.7.2.3.5. Abandoned driveway aprons shall be removed and curbing replaced.

6.8. CONCRETE SIDEWALK, DRIVEWAY, AND DRIVE APRON CONSTRUCTION SPECIFICATIONS

6.8.1. General

6.8.1.1. Description

6.8.1.1.1. This work shall consist of constructing concrete sidewalks, driveways, and driveway aprons on a prepared base course in accordance with these specifications, Item 608 of the most recent edition of the Ohio Department of Transportation Construction and Material Specifications Manual and to the line, grades, and dimensions shown on the plans or established by the City Engineer.

6.8.1.2. Included work

6.8.1.2.1. The work shall encompass removal of existing sidewalks, driveways, and drive aprons located in the area of the new work, excavation to grade, and excavation of unsuitable sub-grade materials, furnishing and placing of backfill and bedding material and any pavement repairs related to the removal and replacement of existing sidewalks, driveways, and drive aprons.

6.8.2. Widths

6.8.2.1. Sidewalks

6.8.2.1.1. In residential areas, the width of sidewalks shall be a minimum of four feet.

6.8.2.1.2. In commercial areas, the width of sidewalks shall be a minimum of five feet.

6.8.2.2. Driveways

6.8.2.2.1. In residential areas, no access point width shall be less than nine feet, or more than 20 feet at right-of-way line, or more than 30 feet at curb line unless otherwise approved by the City Engineer in coordination with the City of Lebanon Planning Commission.

6.8.2.2.2. In all other areas, access point widths shall not be less than 12 feet, nor more than 36 feet in width at right-of-way line, nor more than 48 feet at curb line unless otherwise approved by the City Engineer in coordination with the City of Lebanon Planning Commisison.

6.8.3. Materials

6.8.3.1. Base Course Material

6.8.3.1.1. Material for the base course shall consist of four (4) inches of clean ODOT Item 304 crushed limestone aggregate (no slag).

6.8.3.2. Concrete

6.8.3.2.1. All concrete shall be Lebanon Standard Concrete.

6.8.3.3. Incidentals

6.8.3.3.1. Preformed joint filler shall conform to the requirements of ASTM D994.

6.8.4. Construction

6.8.4.1. Base Course

6.8.4.1.1. Excavation shall be carried to the depth required for the thickness of the concrete in addition to the four (4) inches of ODOT Item 304. The foundation shall be shaped to the proper section and thoroughly compacted. If soft or unsuitable sub-grade material is encountered, it shall be removed to a depth as directed by the City Engineer and backfilled with acceptable material. If suitable granular sub-grade material, as determined by the City Engineer, is encountered at the grade of the sidewalk and compaction not disturbed, the base course need not be placed.

6.8.4.2. Forms

6.8.4.2.1. Sidewalk forms shall be wood, at least one and three-quarters inches (1-3/4”) (2-by lumber) in thickness or steel of equal rigidity. The height of the forms shall be the same as the thickness of the concrete sidewalk. Flexible strips may be used on curbs. Forms shall be held securely in place by stakes or braces, in such a manner to keep the form top of edges true to line and grade. Sidewalks shall be sloped at one quarter (1/4) inch per foot toward the curb.

6.8.4.2.1.1. In no case shall 2 x 4 lumber forms be used for driveways or drive aprons. If 2 x 4 lumber is used, the inspection will be failed and the concrete shall not be placed.

6.8.4.3. Expansion Joints

6.8.4.3.1. City of Lebanon approved expansion joints shall be placed to within one quarter (1/4) inch below the surface of the concrete. Expansion joints (3/4 inch thick) shall be placed at intervals of 40 feet for new sidewalk construction. Expansion joints shall also be placed between the sidewalk and driveway approaches, intersection sidewalks, and buildings; between the sidewalk and all structures (fire hydrants, light standards, and poles which extend through the sidewalk); at all points of curvature; and where new concrete abuts existing concrete.

6.8.4.3.2. Expansion joint material shall have the same height dimension as the concrete being poured.

6.8.4.3.3. Material

6.8.4.3.3.1. All expansion joint material shall be of the following types:

6.8.4.3.3.1.1. Vinyl

6.8.4.3.3.1.2. Recycled rubber

6.8.4.3.3.2. Asphaltic or fiber expansion joint material is not acceptable.

6.8.4.4. Control Joints

6.8.4.4.1. The surface of the sidewalk shall be divided by control joints constructed at right angles to the centerline of the sidewalk. These control joints shall extend a minimum of one-fourth (1/4) the thickness of the slab in depth and shall be placed at intervals no greater than five (5) feet and be edged.

6.8.4.5. Placing and Finishing

6.8.4.5.1. **The sub-grade and forms shall be visually inspected by the City of Lebanon prior to the placement of the concrete**. Concrete shall be placed continuously for the entire width of the slab, and finished to a true and even surface with a straight float.

6.8.4.5.1.1. The concrete for sidewalks shall be four (4) inches thick except through driveways, which shall be six (6) inches thick in residential areas and seven (7) inches thick in commercial areas.

6.8.4.5.1.2. The concrete for driveways shall be five and one-half (5-1/2) inches thick in residential areas, and six (6) inches thick in commercial areas.

6.8.4.5.1.3. The concrete for drive approached shall be six (6) inches thick in residential areas and seven (7) inches thick in commercial areas.

6.8.4.5.2. **Sidewalks shall be kept at correct sidewalk grade when constructed within driveway aprons ramped in the gutter**. The surface shall be given a rough float finish or light transverse brooming as directed by the property owner or the City of Lebanon. Forms shall remain in place for a minimum of 24 hours after the concrete is placed. Sidewalk shall be cured with City of Lebanon approved curing compounds. After the concrete has set and the forms removed, the excavated areas shall be immediately backfilled.

6.8.4.5.3. Sidewalk finishing shall be consistent with neighboring sidewalk, i.e., if neighboring properties have edge marks, newly placed sidewalk shall receive edge marks.

6.8.4.6. Measurement

6.8.4.6.1. The square footage of sidewalk, driveway, or driveway apron shall be the actual number of square feet of sidewalk of the specified thickness, in place, completed and accepted by the City of Lebanon.

6.9. CONCRETE CURB AND GUTTER CONSTRUCTION SPECIFICATIONS

6.9.1. General

6.9.1.1. Description

6.9.1.1.1. This work shall consist of the construction of concrete curb and gutter on a prepared bed in accordance with these specifications and Item 609 of the most recent edition of the Ohio Department of Transportation Construction and Materials Specifications Manual and to the line, grades, and dimensions shown on the plans or established by the City Engineer.

6.9.1.2. Included Work

6.9.1.2.1. This work shall encompass excavation to grade, excavation of unsuitable sub-grade materials, furnishing and placing of backfill and bedding material, and removal of existing curb and gutter located in the area of new work.

6.9.2. Materials

6.9.2.1. Base Course Material

6.9.2.1.1. Material for the base course shall consist of ODOT Item 304 crushed limestone aggregate (no slag).

6.9.2.2. Concrete

6.9.2.2.1. All concrete shall be Lebanon Standard Concrete.

6.9.3. Construction

6.9.3.1. Base Course

6.9.3.1.1. Excavation shall be carried to the required depth and the sub-grade shall be shaped to the proper section and thoroughly compacted. The base course shall be four (4) inches thick of ODOT Item 304 crushed limestone aggregate (no slag) and shall be placed and compacted. If soft or unsuitable sub-grade material is encountered, it shall be removed to a depth as directed by the City of Lebanon and backfilled with acceptable material. If suitable granular sub-grade material, as determined by the City Engineer, is encountered at the grade of the curb and gutter and compaction not disturbed, the base course need not be placed.

6.9.3.2. Forms and Joints

6.9.3.2.1. If curbing is to be hand-installed, curb forms shall be held securely in place by stakes or braces, in such a manner to hold the top of the form edges to true line and grade. Forms shall and must be placed on all repair work abutting the existing street pavement. The existing pavement shall be removed to allow forms to be installed.

6.9.3.2.2. If the curbing is to be machine installed, guide stakes and lines shall be utilized to keep the curb lines and grades straight and true.

6.9.3.2.3. All curb and combination curb and gutter shall have control joints constructed at five-foot (5’) intervals with an average depth of at least one half of an inch (1/2”) or more in depth. City of Lebanon approved expansion joints shall be placed a minimum of one quarter (1/4) of an inch below the surface of the concrete. Control joints may also be saw cut into the concrete. Expansion joints shall be placed at intervals of 100 feet for new construction. Expansion joints shall also be placed where new curb & gutter abuts existing curb & gutter and between curb & gutter and sidewalk, at all curb ramps, and at all points of curvature.

6.9.3.3. Placing and Finishing

6.9.3.3.1. The sub-grade and forms shall be visually inspected by the City of Lebanon prior to the placement of the concrete. The gutter plate shall have a minimum slope of one inch (1”) per foot and a minimum thickness of nine inches (9”). The total thickness of the curb and gutter plate shall be as shown in the standard drawing found in the Appendix. The concrete shall be placed in the forms to permit thorough spading. The curb & gutter concrete shall be placed separately from driveway approach and sidewalk concrete. The concrete shall be spaded in such a manner as to eliminate all voids. The top of curb shall be floated in such a manner to thoroughly compact the concrete and produce a smooth and even surface. The finished surface shall be free of irregularities, waves, and shall be uniform in texture. Concrete curb, and combination curb and gutter shall be cured in accordance with Item 451 of the most recent version of the Ohio Department of Transportation’s Construction Material and Specifications Manual.

6.9.3.3.1.1. Forms for curb and combination curb & gutter shall remain in place for a minimum of 24 hours after the concrete is placed. Once the forms and spoil material have been removed, it shall be the contractor's responsibility to backfill and compact all voids between the new gutter and pavement with asphaltic concrete material as to eliminate any and all hazards.

6.9.3.4. Utility Markings

6.9.3.4.1. The location of any underground utility service lines that pass under curb shall be stamped into the curb.

6.9.3.4.1.1. Water service lines shall be marked with the letter 'W'.

6.9.3.4.1.2. Sanitary sewer laterals shall be marked with the letter 'S'.

6.9.3.4.1.3. Electric services shall be marked with the letter 'E'.

6.9.3.4.1.4. Telecommunication (telephone, cable, etc.) service lines shall be marked with the letter 'T'.

6.9.3.4.1.5. Utility crossovers shall be marked with the letter 'X'.

6.9.3.4.1.5.1. Electric crossovers shall be marked with the letters 'EX'.

6.9.3.4.1.5.2. Telecommunications crossovers shall be marked with the letters 'TX'.

6.9.3.4.2. Whenever a section of curbing is to be replaced in which the curb to be replaced has a utility marking, the new section of curb shall have the proper utility markings stamped into the new concrete.

6.9.3.5. Method of Measurement

6.9.3.5.1. The footage of curb length measured will be the actual number of lineal footage of curb or combination curb and gutter complete in place and accepted by the City of Lebanon. The measurement shall be taken along the front of curb.

6.10. COLD WEATHER PLACEMENT OF CONCRETE

6.10.1. ACI 306R (latest edition), published by the American Concrete Institute, shall be followed when cold weather is expected and/or encountered, as determined by the City Engineer.

6.10.1.1. Cold weather is determined as follows:

6.10.1.1.1. The average daily air temperature (average of the highest and lowest temperatures from midnight to midnight) is below 40 degrees Fahrenheit, and,

6.10.1.1.2. The air temperature is not greater than 50 degrees Fahrenheit for more than one half of any 24-hour period.

6.10.2. In no case will the placement of concrete be allowed to be placed on frozen (less than 33 degrees Fahrenheit) ground or sub base.

6.10.3. Prior to allowing placing any concrete during cold weather, the Contractor shall submit a formal written cold weather placement policy/procedures to the Office of the City Engineer.

6.10.4. Concrete shall be kept above freezing by the continuous use of blankets for a minimum of seven (7) days after being placed and finished.

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SECTION 7- STORM SEWER

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7.1. STORM SEWERS.

7.1.1. Storm sewers shall be designed such that they will not surcharge from runoff caused by the 10-year, 24-hour storm. The hydraulic grade line (HGL) of the storm sewer shall be below the gutter flow line of the overlying roadway throughout its entire length; or below the top of drainage structures outside the roadway, during a 25-year, 24-hour storm. HGL checks shall also be performed and submitted for 25-year events. The system shall be designed to handle the flow from the contributory area within the proposed development.

7.1.2. Stormwater systems shall be designed to accommodate sump drain systems.

7.1.3. Existing stormwater management features are to be shown a minimum of 250 feet downstream of the proposed development unless the ultimate outfall system is a lesser distance.

7.1.4. The minimum inside diameter of pipe to be used in public storm sewer systems shall be 12 inches.

7.1.4.1. The minimum recommended pipe size for private stormwater systems is 12 inches.

7.1.5. The minimum slopes shown in Table 18 apply when designing storm sewer systems.

Table 18 - Minimum Slopes for Storm Sewer Systems

Sewer Size (In.)	Minimum Slope (%)
12	0.44
15	0.32
18	0.25
21	0.21
24	0.17
27	0.15
30	0.13
36	0.10
42	0.08
48	0.07
54	0.06
60	0.05
72	0.04
78	0.04
84	0.03
90	0.03
96	0.03

7.1.6. In all practical cases, storm sewers shall meet crown-to-crown in manholes.

7.1.7. All piped storm sewer systems shall be designed and constructed to produce a minimum velocity of 3.0 feet per second (fps) when flowing full. No storm sewer system or portion thereof shall be designed to produce velocities in excess of 12 fps, unless approved by the City Engineer.

7.1.7.1. On a case-by-case basis, the City Engineer will review situations where flow velocities need to exceed 12 fps, however in such a case, the outlet ends shall have sufficient energy dissipaters and erosion protection to maintain downstream safety and erosion control.

7.1.8. Table 19 lists the maximum spacing that shall be used when locating access structures of any type.

Table 19 - Maximum Structure Spacing

Pipe Size	Structure Spacing
12 to 21 inches	300 feet
24 inches and larger	400 feet

7.1.9. All storm sewer systems shall be designed to account for the tailwater elevation of the receiving facility or body of water. The tailwater elevation used shall be based on the design storm frequency.

7.1.10. Only the following pipe materials shall be acceptable for use as public storm sewer pipe:

7.1.10.1. ODOT Item 706.02 Gasketed reinforced concrete pipe.

7.1.10.1.1. Pipe class shall be as per ODOT guidelines.

7.1.10.1.2. Required for all pipes located in the Public Right-of-Way.

7.1.10.1.3. Gaskets shall be in accordance to ODOT Item 706.11

7.1.10.2. ODOT Item 707.33 (ADS N-12 type) smooth interior double-walled corrugated polyethylene pipe may be allowed only when the following conditions are met:

7.1.10.2.1. Pipes outside of the Public Right-of-Way.

7.1.11. Unless otherwise approved by the City Engineer, the minimum cover for storm sewers within the right-of-way shall be three feet measured from the bottom of underdrain at the back of curb to the top outside of pipe. Should underdrains not be required or present, the minimum cover shall be three feet measured from the top of subgrade at the back of curb to the top outside of pipe. Outside rights-of-way, a minimum two feet of cover shall be provided measured from the top of finished ground surface to the top outside of pipe.

7.1.12. The inverts of all curb inlets, manholes, yard inlets, and other structures shall be formed and channeled to minimize turbulence.

7.1.13. Storm inlet or catch basin grates shall be of a type designed to permit safe crossing by bicycles as approved by the City Engineer.

7.1.14. The maximum distance for overland flow shall be 300 feet before entering a storm water structure; except that, in no case shall the maximum overland drainage area tributary to the storm water structure be greater than 1.5 acres.

7.1.15. The maximum spacing of curb inlets shall be the spacing that limits the spread of water flowing in the gutter to not more than the maximum permissible spread according to ODOT Drainage Design Manual, Volume Two, or 300 feet whichever is smaller.

7.1.16. Full headwalls are required at all storm sewer inlets and outlets to and from open channels, lakes, or other bodies of water. In some cases, half-height headwalls may be permissible. This will be reviewed on a case-by-case basis.

7.1.17. Prior to final acceptance, a video inspection of all storm sewers shall be conducted at the Contractor's expense by a professional inspection firm in accordance with the requirements set forth in Section 2.13. Copies of all video and written reports shall be provided to the City of Lebanon for review and approval prior to the acceptance of the improvements or the release of bonds.

7.2. SUMP DRAINS

7.2.1. Sump drains shall be provided in all residential developments and in commercial and industrial developments where deemed necessary by the City Engineer.

7.2.2. Sump drains shall be placed approximately one foot (1') behind the back of curb.

7.2.3. All sump drains shall be tied in to the nearest storm sewer structure. Sump drains shall not be tapped into storm sewer pipe unless the appropriate tapping saddle is used.

7.2.4. Sump drains shall be constructed of gasketed SDR-35 PVC pipe as described in Section 4.5.5.

7.2.5. Individual taps into the sump drain system shall be performed utilizing the appropriately sized gasketed PVC tee fitting.

7.2.6. Cleanouts shall be provided at the upstream end of the sump drain system, at 150 foot intervals and at all bends. Cleanouts shall be provided with a cleanout cover marked "Drain Cleanout". The cleanout cover shall be Model 1578 manufactured by East Jordan Iron Works, Model R-1976 manufactured by Neenah Foundary Company, or approved equal. Cleanout cover shall be installed flush with finished grade.

7.2.7. The following pipe sizes shall be utilized for sump drain systems:

7.2.7.1. Four inch (4") for a sump drain to serve an individual structure.

7.2.7.2. Eight inch or greater (≥8") for systems that will serve more than one structure.

7.3. CATCH BASINS

7.3.1. All catch basins shall be precast concrete.

7.3.2. Bottoms of catch basins shall be formed and channelized using concretre. Mortar is not acceptable.

7.3.3. Concrete collars shall be provided at all pipe penetrations.

7.3.4. All castings and grates shall be grey or ductile iron and shall be in accordance with ODOT Standards.

7.3.5. All castings shall have the standard fish logo stating "Dump No Waste Drains to Waterways" cast in raised letters on the top.

7.3.6. Curb inlets shall be ODOT CB-3 or CB-3A (regular or modified) unless otherwise approved by the City Engineer.

7.3.7. Field inlets shall be ODOT Standard types and shall be appropriately sized for the pipe sizes involved and for anticipated flows.

7.4. MANHOLES

7.4.1. Manholes shall be of the pre-cast concrete type. Manhole lift holes and grade adjustment rings shall be sealed with non-shrinking grout or other material approved by the City of Lebanon. Refer to the standard drawing found in the Appendix.

7.4.2. Inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place.

7.4.3. Concrete collars shall be provided at all pipe penetrations.

7.4.4. Locked manhole covers may be desirable in isolated easement locations or where vandalism may be a problem.

7.4.5. Manholes shall be installed: at all changes in grade, size or alignment; at all intersections; and at distances not greater than 300 feet for sewers 30 inches or less, or as approved by the City Engineer. Greater spacing may be permitted in larger sewers.

7.4.6. The minimum diameter of manholes shall be 48 inches (48"). Larger diameter manholes are preferable for large diameter sewers. A minimum access diameter of 24 inches (24") shall be provided.

7.4.7. The flow channel straight through a manhole shall be made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance, inspection or flow in the sewers. Only concrete shall be used in forming the bottom channel. Mortar is not acceptable

7.4.8. A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench shall be sloped no less than ½ inch per foot (4 percent).

7.4.9. Manhole steps shall be constructed and installed as shown in the Standard Drawings.

7.4.10. Only concrete grade rings shall be used. Plastic grade rings are not permitted.

7.4.11. Adjustable riser rings shall not be used on new manholes. Adjustable riser rings shall only be used on existing manholes with written permission from the City Engineer.

7.5. STORM SEWER CALCULATIONS

7.5.1. Storm sewer calculations shall be provided for all storm sewer systems. Calculations shall be conducted in the format shown in the appendix to this chapter.

7.5.2. The following Manning's 'n' values shall be used for stormwater calculations for public systems:

Reinforced concrete pipe	0.013
Closed profile ADS pipe	0.013

7.5.3. Mannings 'n' values for pipes in private storm sewer systems shall be documented and are subject to review and approval by the City Engineer.

7.5.4. Manning's 'n' values for existing pipe types not listed in Paragraph 7.5.2. are subject to the approval of the City Engineer.

7.5.5. The hydraulic grade line for the storm sewer system shall be computed with consideration for each of the following:

7.5.5.1. the design tailwater on the system as defined in the Stormwater Management Plan,

7.5.5.2. energy losses associated with entrance into and exit from the system,

7.5.5.3. friction through the system,

7.5.5.4. turbulence in the individual manholes, catch basins, and junctions within the system.

7.6. CULVERTS AND BRIDGES

7.6.1. Roadway stream crossings other than bridges shall be designed to convey the stream's flow for the 100-year, 24-hour storm such that the flow does not encroach upon the roadway pavement in accordance with the ODOT Location and Design Manual, Volume 2.

7.6.1.1. In the case of a one-way in/one-way out development, the roadway shall be treated as a freeway with limited access for the design year frequency selection.

7.6.2. The minimum inside diameter of pipes to be used for culvert installations under roadways, driveway crossings, or at any other required location shall be 15 inches.

7.6.3. The allowable maximum slope shall be a slope that produces a 10-fps velocity within the culvert barrel. Erosion protection and/or energy dissipaters shall be required to properly control entrance and outlet velocities.

7.6.4. All culvert installations shall be designed with consideration for the tailwater of the receiving facility or body of water. The tailwater elevation used shall be based on the design storm frequency.

7.6.5. The allowable headwater of a culvert installation shall be set by the designer to achieve an economical installation. When end walls are used, the headwater shall not exceed the top of the end wall at entrance. If calculations show that the top of the end wall is unavoidably inundated, special protection of the roadway embankment and/or ditch slope will be necessary for erosion protection.

7.6.6. The determination of the required size of a culvert installation may be accomplished by mathematical analysis or by the use of design nomographs.

7.6.7. Headwalls are required at all culvert inlets and outlets.

7.6.8. The minimum cover for culverts within the right-of-way shall be two feet measured from the bottom of underdrain at the back of curb to the top outside of pipe. Should underdrains not be required or present, the minimum cover shall be two feet measured from the top of subgrade at the back of curb to the top outside of pipe. Outside street rights-of-way, a minimum two feet of cover shall be provided measured from the top of finished ground surface to the top outside of pipe.

7.6.9. The structural design criteria for culverts and bridges shall be the same as that required by the Ohio Department of Transportation.

7.6.10. Bridges shall be designed so that the hydraulic profile through the bridge shall be one foot (1') below the bottom chord of the bridge for either the 100-year, 24-hour storm, or the 100-year flood elevation as determined by FEMA, whichever is more restrictive.

7.7. OPEN CHANNELS

7.7.1. Open channels shall be designed with erosion protected banks designed to carry the 10-year, 24-hour stormwater runoff from contributing upstream areas. The City Engineer may increase the design storm should conditions require it.

7.7.2. Channels within FEMA floodplains shall be designed according to the requirements of Chapter 1308 of the Lebanon Code of Ordinances.

7.7.3. Together with the other requirements contained in this chapter, all open channels shall be designed with one foot of freeboard above the design water surface elevation of the open channel flowing full.

7.7.4. Flood relief channels shall be designed to convey the runoff from the 100-year, 24-hour storm, so that a positive discharge of this runoff to an adequate receiving stream or conveyance system results, without encroachment into proposed or existing residential dwellings, places of business, other significant or valuable buildings or structures, or historical or environmentally sensitive areas.

7.7.5. The City Engineer may require that roadside ditches along existing roadways be enclosed, if ODOT standards for safety and maintenance cannot be satisfied.

7.7.6. The City of Lebanon assumes no legal obligation for the maintenance and upkeep of open channels. The maintenance and upkeep of open channels within developments shall be the responsibility of the Development (HOA, etc.). If no HOA exists, the maintenance and upkeep of open channels shall be the responsibility of the property owner.

7.8. TRENCH EXCAVATION

7.8.1. Unless specifically directed otherwise by the City Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

7.8.2. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

7.8.3. Trenches in which pipes are to be laid shall be excavated via open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8"). Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

7.8.4. Unless specifically authorized by the City Engineer, trenches shall in no case be excavated or permitted to become wider than two feet six inches (2' - 6 "), plus the nominal diameter of the pipe at the level of or below the top of the pipe.

7.8.5. All excavation materials shall be placed a minimum of two feet (2') back from the edge of the trench.

7.8.6. Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage of work.

7.8.7. It is the Contractor's sole responsibility to maintain safe working conditions on the job site and to conform to "Specific Safety Requirements Relating to Construction of the Industrial Commission

of Ohio", "Construction Safety and Health Regulations, Part 1926, Subpart P "Occupational Safety and Health Administration, U. S. Department of Labor, and all local laws, ordinances, and regulations.

7.8.8. Trenches shall be kept free of water during the laying of pipe until the pipeline has been backfilled.

7.8.9. Obstructions

7.8.9.1. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or disturbed unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

7.8.10. Shoring, Sheeting, and Bracing

7.8.10.1. The shoring, sheeting and bracing of excavations shall be performed by the Contractor in compliance with applicable safety codes and OSHA requirements.

7.8.10.2. Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides shall be sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the City Engineer may require the submission of shoring plans (accompanied by supporting computations) for review prior to the Contractor undertaking any portion of the work. Submitted plans shall be signed and stamped by a Professional Engineer registered in the State of Ohio.

7.8.10.3. Excavations to be made below the depth of an existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation. The Contractor shall be held strictly responsible for any damage to said foundation.

7.8.10.4. Solid sheeting will be required for wet or unstable material.

7.8.10.5. Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirements that the width of the ditch at the level of the crown of the pipe be no more than two feet six inches (2' - 6") plus the nominal diameter of the pipe shall be strictly observed.

7.8.10.6. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

7.8.10.7. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

7.9. PIPE BEDDING

7.9.1. All storm sewer pipe shall be bedded in accordance with the standard detail contained in the Appendix.

7.9.2. In all cases, the foundation for storm sewer mains shall be prepared so that the entire load of the backfill on top of the sewer pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.

7.9.3. The depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated. Supporting of sewer pipe shall be as set out herein, and in no case shall the sewer pipe be supported on blocks.

7.10. LAYING PIPE

7.10.1. All pipe shall be laid with ends abutting true to line and grade as shown on the plans. Supporting of pipe shall be as specified under 4.10. specified herein and in no case shall be supported on blocks.

7.10.2. Fittings for the sewer mains shall be provided and placed as shown on the plans. All open ends of pipes and branches shall be sealed or plugged.

7.10.3. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned and inspected for defects. Any piece of pipe or fitting which is known to be defective shall not be laid or placed. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth edge at right angles to the longitudinal axis of the pipe.

7.10.4. Granular bedding material as specified herein, shall be used to correct irregularities in the earth trench subgrade.

7.10.5. The interior of the pipe shall be maintained clean. When laying pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plug fitted into the pipe bell, so as to exclude earth or other material.

7.10.6. No backfilling (except for securing pipe in place) over pipe will be allowed until the City of Lebanon has made an inspection of the joints, alignment and grade in the section laid.

7.10.6.1. Inspections shall not relieve the Contractor of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are identified later.

7.10.7. Upon the completion of a section of storm sewer, inverts and slopes shall be checked and the results shall be provided in writing to the City of Lebanon. The information , at minimum, shall include:

7.10.7.1. Upstream junction information (manhole number, etc.)

7.10.7.2. Upstream plan invert

7.10.7.3. Upstream installed invert

7.10.7.4. Downstream junction information (manhole number, etc.)

7.10.7.5. Downstream plan invert

7.10.7.6. Downstream installed invert

7.10.7.7. Plan Slope

7.10.7.8. Installed Slope

7.10.7.9. Pipe Material

7.10.7.10. Bedding Material

7.10.7.11. Backfill Material

7.10.7.12. Contractor certification indicating that the information shown is true and correct.

7.11. BACKFILLING PIPELINE TRENCHES

7.11.1. All backfilling shall be accomplished in accordance with the details shown on the Standard Drawings and the requirements of this Section. Any variances must be approved in writing by the City Engineer.

7.11.2. When directed by the City of Lebanon, the Contractor shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is compacted. The Contractor shall obtain a

compaction of the backfill of at least 95 percent of standard Proctor density (ASTM D698) where mechanical compacting of backfill is required. Copies of all testing reports shall be provided to the City Engineer.

7.11.3. In all cases, walking or working on the completed pipelines except as may be necessary in compacting or backfilling will not be permitted until the trench has been backfilled to a point one foot (1') above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

7.12. SETTLEMENT OF TRENCHES

7.12.1. The Contractor shall be responsible for any trench settlement that occurs within two years from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor. Repair of settlement damage shall meet the approval of the City of Lebanon.

7.13. RESPONSIBILITY FOR MAINTENANCE

7.13.1. Prior to formal acceptance of the Improvements by the City of Lebanon, the Contractor and/or Owner/Developer shall be responsible for the maintenance and repair of the Improvements in compliance with these specifications for a period of two years after construction completion and acceptance by the City of Lebanon.

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8.1. FINDING OF FACT

8.1.1. Land development activities and associated increases in site impervious cover often alter the hydrologic response of local watersheds and increase stormwater runoff rates and volumes, flooding, stream channel erosion, or sediment transport and deposition.

8.1.2. This stormwater runoff contributes to increased quantities of water-borne pollutants, including siltation of aquatic habitat for fish and other desirable species.

8.1.3. Improper design and construction of stormwater best management practices (BMPs) can increase the velocity of stormwater runoff thereby increasing stream bank erosion and sedimentation.

8.1.4. Impervious surfaces allow less water to percolate into the soil, thereby decreasing groundwater recharge and stream base flow.

8.1.5. Substantial economic losses can result from these adverse impacts on the waters of the municipality.

8.1.6. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of stormwater runoff from land development activities.

8.1.7. The regulation of stormwater runoff discharges from land development activities in order to control and minimize increases in stormwater runoff rates and volumes, stream channel erosion, and nonpoint source pollution associated with stormwater runoff is in the public interest and will minimize threats to public health and safety.

8.1.8. Regulation of land development activities by means of performance standards governing stormwater management and site design will produce development compatible with the natural

functions of a particular site or an entire watershed and thereby mitigate the adverse effects of stormwater runoff from development.

8.1.9. Clearing and grading during construction tends to increase soil erosion and add to the loss of native vegetation necessary for terrestrial and aquatic habitat.

8.1.10. Illicit and non-stormwater discharges to the storm drain system can contribute a wide variety of pollutants to waterways, and the control of these discharges is necessary to protect public health and safety and water quality.

8.2. PURPOSE

8.2.1. The procedures and standards, as set forth in this manual for the regulation of stormwater in the City of Lebanon and its immediate environs (in which, under some circumstances, it may have influence and/or jurisdiction) are deemed necessary to promote the public health, safety, and general welfare of the citizens of Lebanon in and by the following methods:

8.2.1.1. To inhibit the deterioration of water resources resulting from development;

8.2.1.2. Regulating stormwater from areas of new development and redevelopment;

8.2.1.3. Defining appropriate stormwater management objectives for the quantity and quality of stormwater runoff in the City;

8.2.1.4. Providing requirements for the protection of water resources;

8.2.1.5. Requiring adherence to site stormwater management plans approved by the City Engineer;

8.2.1.6. Providing for maintenance of stormwater facilities and other City infrastructure that affects the quality and quantity of stormwater runoff;

8.2.1.7. Imposing application fees, establishing procedures for enforcement and penalties for violations, and providing for waivers where deemed appropriate in the opinion of the City Engineer.

8.2.1.8. Further, in order to protect, maintain, and enhance both the immediate and the long-term health, safety, and general welfare of the citizens of Lebanon, it is the intent of the City to accomplish the following objectives:

8.2.1.8.1. To provide drainage devices, structures, and systems that adequately convey stormwater runoff in the manner that best preserves and benefits properties within the City of Lebanon;

8.2.1.8.2. To prevent loss of life and property due to flooding;

8.2.1.8.3. To protect, restore, and maintain the chemical, physical, and biological quality of surface and ground waters;

8.2.1.8.4. To encourage the establishment, or reestablishment, and protection of a sustainable balance between the activities of the citizens of Lebanon and the natural environment in issues that affect stormwater runoff.

8.2.1.8.5. To prevent individuals, businesses, and governmental entities from causing harm to the community and its environment by activities which adversely affect water resources;

8.2.1.8.6. To encourage the protection of natural systems and the use of those natural systems in ways that will not impair their normal and beneficial functioning;

8.2.1.8.7. To minimize the transport of sediments and pollutants to surface waters and groundwater sources;

8.2.1.8.8. To protect and maintain habitat of and for fish and wildlife;

8.2.1.8.9. To help perpetuate natural groundwater recharge;

8.2.1.8.10. To encourage the use of natural drainage systems; and

8.2.1.8.11. To ensure the attainment of these objectives by requiring the approval and implementation of site stormwater management plans for all activities that may have an adverse impact upon surface waters and/or groundwater sources.

8.2.2. The City of Lebanon recognizes the establishment of design strategies and principles for Low Impact Development (LID). The City of Lebanon encourages owners/developers/designers to utilize these principles and strategies of LID within their development. These design elements will be reviewed by the City of Lebanon for possible inclusion into the development with the understanding the PUD process may need to be followed in order to incorporate comprehensive LID strategies and principles into the development.

8.3. JURISDICTION

8.3.1. The Stormwater Regulations shall apply in all areas within the development jurisdiction of the City of Lebanon.

8.4. AUTHORITY

8.4.1. The City Engineer, or his/her authorized designee, is authorized to administer the Stormwater Regulations. The City Engineer shall also maintain and update the Stormwater Management Plan. The City Engineer shall recommend to City Council, for adoption, modifications in the Stormwater Management Plan, detailed design studies, or modified procedures to reflect new construction and/or engineering design technology.

8.5. REQUIRED APPROVALS

8.5.1. Every development shall be provided with a storm drainage system that provides adequate, complete and satisfactory drainage service for the entire area being platted for all projected land uses and otherwise meeting the approval of the officials having jurisdiction. The system shall provide for draining the entire area of each and every lot. The drawing plans and specifications for such system, when finally approved by the City Engineer, shall be known as the Official Drainage Plan for such development.

8.5.2. The Official Drainage Plan shall be attached to, incorporated into by reference, and filed with the Final Plat of the subdivision or development in the Office of the Recorder of Warren County, Ohio, when such Final Plat is so recorded. The developer of the subdivision or other development shall thereafter include in each deed for the conveyance of such subdivision or development, or portion thereof, a covenant making such conveyance subject to the terms and conditions of the Official Drainage Plan. The Official Drainage Plan shall be signed and stamped by a Professional Engineer Registered in the State of Ohio.

8.5.3. The requirements of the Stormwater Regulations shall be implemented and shall be satisfied completely prior to final project approval by the City Engineer. No person shall conduct any development activity, or subdivide, or make any change in the use of land, or construct any stormwater management facility, system or structure, or change the size of an existing stormwater management facility, structure or system, except as may be exempted in Section 8.7. of this manual.

8.5.4. Any construction plans, specifications, or other documents approved by the City Engineer shall be constructed in accordance with all applicable local, state or federal permit requirements of the Ohio Environmental Protection Agency (OEPA), Ohio Department of Natural Resources (ODNR) and/or U.S. Army Corps of Engineers. No construction activity shall commence prior to obtaining applicable permits from these agencies.

8.6. EXPANSIONS/REDEVELOPMENT

8.6.1. If a site is redeveloped (demolition of existing structures and/or construction of new structures) or if the impervious area of any site is increased by an amount greater than or equal to 20 percent of

the original development of the site, the entire site shall be brought up to current stormwater standards.

8.6.1.1. Stormwater Detention

8.6.1.1.1. Stormwater detention must meet current standards. The calculations shall be based upon a virgin site, unless documentation can be provided indicating the amount of development that existed on the site prior to stormwater detention requirements.

8.6.1.2. Stormwater Quality

8.6.1.2.1. The entire site shall be treated for stormwater quality according to the regulations found in section 8.11. of this manual.

8.6.2. The exemptions found in section 8.7. of this manual apply to expansions and redevelopment.

8.7. EXEMPTIONS

8.7.1. With the approval of the City Engineer, the following activities may be exempted from on-site stormwater runoff control. An exemption shall apply only to the requirement for on-site stormwater detention or retention facilities. All other design elements such as the storm sewer system, road culverts, erosion and sedimentation control, and runoff quality shall not be exempted.

8.7.1.1. Emergency exemption: Emergency maintenance work performed for the protection of public health and welfare.

8.7.1.2. Maintenance exemption: Any maintenance to an existing system made in accordance with plans and specifications approved by the City Engineer.

8.7.1.3. Development related exemptions: The applicant shall provide to the City Engineer in writing a request for exemption which shall include a scaled site map, property tax number, and street address if applicable.

8.7.1.3.1. Single-family or duplex exemption: Single-family or duplex residential construction on a single lot that is not part of a new, residential subdivision or other common plan for new, residential development.

8.7.2. The following activities may be exempted from all Stormwater Regulations set forth elsewhere in this Ordinance, except those relating to the quality of stormwater runoff.

8.7.2.1. Historic Lebanon Central Business District exemption:

8.7.2.1.1. The City Engineer shall review and approve the expansion of existing parking lots and the construction of new parking lots of four spaces or more within the boundaries of the Historic Lebanon Central Business District, as identified in § 1132.02 and 1137.17 of the Codified Ordinances of Lebanon, consistent with the following standards:

8.7.2.1.1.1. Any new or expansion of any impervious area within the Historic Lebanon Central Business District shall be exempt from Stormwater Detention/Retention and Stormwater Quality requirements unless if, in the opinion of the City Engineer, the proposed use of an exempted property exhibits a significant environmental risk. If such a risk exists, stormwater detention and/or stormwater quality provisions shall be implemented as part of the improvements to the property.

8.7.2.1.1.1.1. One exemption is gravel parking lots. Any proposed expansion of an existing gravel parking lot will require both the existing lot as well as the proposed parking area to be paved or covered with an acceptable material as defined in the City of Lebanon Zoning Code.

8.7.2.1.1.2. A detailed plan, prepared by a professional engineer registered in the State of Ohio, shall be submitted for approval, which shall demonstrate that stormwater is conveyed in a manner that will not adversely impact adjacent and downstream properties.

8.7.2.1.1.3. Any new or expanded impervious areas shall not be exempt from compliance with other applicable City, state and federal codes and regulations.

8.7.3. The following activities may be exempted from regulations relating to the quality of stormwater runoff.

8.7.3.1. Properties less than one acre in area, unless they are part of a larger overall development.

8.7.3.2. Single-family or duplex residential construction on a single lot that is not part of a new, residential subdivision or other common plan for new, residential development.

8.7.4. If, in the opinion of the City Engineer, the proposed use of an exempted property exhibits a significant environmental risk, the stormwater quality provision exemption may be removed for said property. If the exemption is removed, all applicable stormwater regulations will be enforced.

8.8. GENERAL REQUIREMENTS

8.8.1. A stormwater management system that contains features that provide for flood protection, erosion control, and runoff pollution abatement, shall be designed and installed for any non-exempt development. The stormwater management system shall conform to the Stormwater Design Standards contained in this Section hereof, to the Stormwater Management Plan, and to other standards that may be specified by the City Engineer. The intent of these requirements is to encourage environmentally sound stormwater management practices that go beyond merely providing drainage facilities. The City's stormwater management perspective includes the management of both water quantity and water quality. Stormwater management design shall blend into the natural environment and be aesthetically integrated into site design.

8.8.2. All development activity within a special flood hazard area designated by the Federal Emergency Management Agency (FEMA) shall comply with Chapter 1308 of the Lebanon Code of Ordinances. All development shall be designed to maintain the flood carrying capacity of the floodway such that the base flood elevations are not increased, either upstream or downstream. Furthermore, no fill shall be placed or allowed to be placed in the 100-year floodplain, without an equivalent volume of soil removed to compensate for the consequent loss of flood storage. Compensating storage shall be determined by the volume of material removed above the ordinary high water table and below the 100-year flood elevation established for that area. Compensating storage shall be provided within the legal boundaries of the development.

8.8.3. The stormwater management system shall not create an adverse impact on stormwater quantity or quality in either upstream or downstream areas. The discharge from offsite areas which discharge onto or across a site proposed for development shall be accommodated in the site stormwater management plans for the development. No site stormwater management plan shall be approved until it is demonstrated that the runoff from the project will not overload or otherwise adversely impact any downstream areas.

8.8.4. Natural Wetlands shall not be used for stormwater management or stormwater runoff quality treatment. In some circumstances, Constructed Wetlands may be used for stormwater management or stormwater runoff quality treatment, subject to the approval of the City Engineer, or his/her authorized designee.

8.8.5. All proposed stormwater management systems shall be designed to minimize the pollution of groundwater resources by stormwater, promote safety, minimize health hazards, preserve natural features, and provide for recharge where appropriate. Neither submission of a plan under the provisions herein, nor compliance with the provisions of these regulations shall relieve any person from responsibility for damage to any person or property otherwise imposed by law.

8.8.6. Where deemed necessary by the City Engineer, the applicant shall construct storm drains to handle on-site runoff; provide on-site and off-site drainage easements; and provide for the conveyance of off-site runoff to an acceptable outlet in the same watershed.

8.9. REQUIRED SUBMITTALS

8.9.1. The following items shall be required unless otherwise indicated in writing by the City Engineer:

8.9.1.1. USGS topography map or similar type of topographic map with the area of the proposed development clearly indicated on the map. The map shall include all onsite and offsite drainage areas that will contribute stormwater to the proposed development. The purpose of this map is to allow for the entire drainage basin to be clearly identified.

8.9.1.2. Pre-development site drainage map with 4-foot maximum contours. The site drainage map shall show all onsite and offsite drainage areas that will contribute stormwater flow to the site.

8.9.1.3. Post-development drainage map with 2-foot maximum contours. This map is to delineate all drainage areas contributing to all catch basins and overland flow to detention ponds.

8.9.1.4. Stormwater piping calculations.

8.9.1.5. Stormwater detention volume and routing calculations.

8.9.1.6. Stormwater quality calculations.

8.9.1.7. As-Built Plans

8.9.1.7.1. As-built plans of all stormwater detention/retention and stormwater quality BMPs shall be submitted to the City of Lebanon prior to the release of any bonds.

8.10. STORMWATER DESIGN STANDARDS

8.10.1. General

8.10.1.1. Except where they might differ with requirements delineated herein, the ODOT Drainage Design Manual and any subsequent revisions thereto shall be used for the design of storm sewers, culverts, open channels, and permanent and temporary erosion and sedimentation control. Except where they might differ with requirements delineated herein, the latest edition of *The Water Environment Federation Manual of Practice, No. 23* and *American Society of Civil Engineers Manual and Report on Engineering Practice, No. 87* shall be used for the design of stormwater runoff quality control features of site development. The City Engineer shall recommend to City Council the adoption of any necessary modifications to the design standards of these documents.

8.10.2. Hydraulic design criteria.

8.10.2.1. Method

8.10.2.1.1. For areas up to and including 640 acres, the Rational Method shall be used. For areas in excess of 640 acres, the Soil Conservation Service (SCS) TR55 shall be used. The total area shall include offsite contributing areas in addition to the area to be developed.

8.10.2.1.1.1. Other methods may be acceptable upon approval by the City Engineer.

8.10.2.2. The design frequency for major drainage systems may be increased if deemed necessary by the City Engineer to protect upstream or downstream properties or to comply with other regulations.

8.10.2.3. Rainfall volumes shall be in accordance with data for Southwest Ohio provided in the *Rainfall Frequency Atlas of the Midwest, Bulletin 71*, 1992 and any subsequent updates thereto.

8.10.2.4. Rainfall distribution for stormwater management systems is to be in accordance with SCS Type II Rainfall Distribution.

8.10.2.5. The following 'c' values shall be used in runoff calculations

8.10.2.5.1. The average acceptable runoff coefficient shall be as follows:

Commercial development:	0.90
Industrial development:	0.90
Residential development:	
Single-family:	0.65
Multi-family	0.75

8.10.2.5.2. Composite runoff coefficient (to be used when calculating weighted 'c' values):

Crop land (row crops)	0.45
Grass land:	0.30
Woodland:	0.25
Parks (open space):	0.30
Parking lots:	0.95
Roofs:	0.95
Asphalt and concrete:	0.95

8.10.2.5.3. Calculations used to determine composite 'c' values are subject to approval of the City Engineer.

8.10.3. Detention/retention facilities.

8.10.3.1. Types:

8.10.3.1.1. The following types of stormwater detention/retention will be acceptable:

8.10.3.1.1.1. Detention Basin - (dry basin). These surface storage basin areas are created by constructing earthen embankments to retain storm water. These basins may be designed in such a manner as to be multi-use, such as park and playground and open spaces.

8.10.3.1.1.2. Retention Basins - (ponds). These basins are permanent ponds where additional storm water storage capacity is provided above normal water level.

8.10.3.1.1.3. Subsurface Storage - Subsurface storage is a structure constructed below ground for the purpose of detaining storm water.

8.10.3.1.1.4. Other types of storage may be considered on a case-by-case basis.

8.10.3.2. A detention/retention facility shall be installed on all development projects, unless the applicant demonstrates that the project will not increase the peak rate of runoff; volume, or frequency of the runoff hydrograph of the site as it existed prior to the applicant's proposed development. Detention/retention facilities shall be designed in the following manner:

8.10.3.2.1. Determine the total volume of runoff from a 1-year, 24-hour storm occurring over each of the site's drainage areas before and after development. The total runoff in cubic feet shall be determined by using the following equation:

Equation 4 - Total Volume of Runoff

$$\text{Runoff} = (A * 43560)(c)\left(\frac{R}{12}\right)$$

Where:
A is the area in acres
c is the runoff coefficient for the area
R is the total rainfall for a 1-year, 24-hour event as found in the *Rainfall Frequency Atlas of the Midwest, Bulletin 71*, 1992 and any subsequent updates thereto

8.10.3.2.2. Determine the percent of increase in runoff volume due to development. Using this percentage, select the critical storm from Table 20.

8.10.3.2.3. Determine the peak rate of runoff for the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year and 100-year, 24-hour storms occurring over each of the site's drainage areas before and after development.

8.10.3.2.4. The peak rate of runoff from the critical storm occurring over the developed site shall not exceed the peak rate of runoff from a 1-year, 24-hour storm occurring over the same area prior to development, as defined in the Stormwater Management Plan.

8.10.3.2.5. Storms of less frequent occurrence (longer return period) than the critical storm shall have the peak rate of runoff not greater than that for the same storm under pre-development conditions.

Table 20 - Critical Storm Determination

If The Percent Of Increase In Runoff Volume Is:		
Equal To Or Greater Than:	**And Less Than:**	**The Critical Storm Runoff Rate Will Be Limited To:**
>0	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	---	100 year

8.10.3.3. Stormwater Detention Basin Sizing

8.10.3.3.1. The following method shall be used in sizing detention basins:

8.10.3.3.1.1. Calculation of existing runoff generated by an one-year, 24 hour storm is determined using Equation 5the following equation:

Equation 5 - Pre-Development Runoff

$$q = Aci$$

Where:
q is the pre-development generated flow (allowable release rate)
A is the watershed area
c is the pre-development runoff coefficient for the watershed area
i is the rainfall intensity

8.10.3.3.1.2. i is calculated by using the following equation:

Equation 6 - Pre-Development Rainfall Intensity

$$i = \frac{a}{(t+b)^d}$$

Where:
i is the pre-development rainfall intensity in inches/hour
t is the pre-development time of concentration in minutes
a is constant a found in Table 21
b is constant b found in Table 21
d is constant c found in Table 21

Table 21 – Rainfall Intensity Formula Constants

Frequency (years)	Constant a	Constant b	Constant d
1	55.977	15.400	0.912
2	85.568	16.500	0.950
5	118.822	18.700	0.969
10	112.172	16.800	0.923
25	198.920	19.300	1.004
50	206.025	19.600	0.990
100	355.551	23.199	1.076

8.10.3.3.1.3. Calculate the runoff generated by the critical storm after development using the following equation:

Equation 7 - Post-Development Runoff

$$Q = ACI$$

Where:
Q is the post-development discharge rate in CFS
A is the watershed area in Acres
C is the runoff coefficient for the watershed area
I is the post-development maximum rainfall intensity in inches per hour

8.10.3.3.1.4. The post-development rainfall intensity is determined using Equation 8.

Equation 8 - Post-Development Rainfall Intensity

$$I = \frac{a}{(T+b)^d}$$

Where:
I is the post-development maximum rainfall intensity in inches/hour
T is the post-development maximum time of concentration
a is the design storm constant a found in Table 21
b is the design storm constant b found in Table 21
d is the design storm constant c found in Table 21

8.10.3.3.1.5. The post-development time of concentration is found using the following equation:

Equation 9 - Post-Development Time of Concentration

$$T = \sqrt{\frac{(A * C * a * b)}{\left(\frac{2 * q}{3}\right) - \left(\frac{q^2 * t}{6 * C * A * a}\right)}} - b$$

Where:
T is the post-development maximum time of concentration
A is the watershed area
C is the post-development runoff coefficient for the watershed area
t is the pre-development time of concentration in minutes
a is the 1-year storm constant a found in Table 21
b is the 1-year storm constant b found in Table 21
q is the pre-development generated flow

8.10.3.3.1.6. Minimum basin sizing is determined using the following equation:

Equation 10 - Required Storage Volume

$$Vol = (60 * Q * T) - \left(\frac{2 * q * (T + t) * 60}{3}\right) + \left(\frac{q^2 * t * 60}{6 * Q}\right)$$

Where:
Vol is the required detention volume in cubic feet
Q is the post-development discharge rate in CFS
T is the post-development maximum time of concentration
q is the pre-development generated flow
t is the pre-development time of concentration in minutes

8.10.3.4. The bottom of the facility shall be designed and constructed with sufficient slopes to drain properly. Slopes of less than 2.00% for grass areas shall not be permitted.

8.10.3.5. Basin Gutters

8.10.3.5.1. For all detention basins, gutters constructed of an open, porous paving system constructed of concrete units, whether hand laid or in prefabricated assemblies shall be installed from inlet pipes to the outlet structure. Two examples of acceptable materials are Armorflex produced by Armortec, or Geoblock produced by Presto Products Company, though other products can be used, subject to approval by the City Engineer. Where two or more gutters intersect, special attention must be given to the change in direction by using large radius curves or other means so the flow is controlled in a gradual manner

8.10.3.6. Seed, sod or other approved erosion control methods or devices shall be used to protect all basin slopes.

8.10.3.7. The side slopes of a retention facility shall be no steeper than 4:1 unless the existing topographic conditions of the development site make this impractical.

8.10.3.8. Anti-seep collars shall be used on all pipe outlets of all basins.

8.10.3.9. An overflow structure shall be provided at the 50-year frequency storm elevation with the capacity to handle any blockages in the outlet structures.

8.10.3.10. Aeration shall be provided for all retention ponds. The aeration shall be sufficient to prevent stagnation of the water. Multiple aerators may be necessary in large or unusually shaped ponds.

8.10.3.11. Stormwater detention and retention ponds which meet height and storage capacities as outlined in the Ohio Department of Natural Resources Department of Water Fact Sheet entitled: *Dam Safety: Construction Permits for Dams*, are considered by Ohio Department of Natural Resources (ODNR) to be dam structures and shall be designed to safely pass the maximum probable precipitation storm or flood event as defined by ODNR. Where fill berms are proposed, calculations supporting the stability of the fill berms are to be submitted by a Geotechnical Engineer. The applicant shall design all raised berm stormwater ponds, classified by ODNR as dam structures, according to probable maximum precipitation of flood storms.

8.10.3.12. The discharge route of the all detention basins shall be shown a minimum of 250 feet downstream of the outlet structure.

8.10.3.13. If the site has multiple drainage basins, the drainage basin divides that exist prior to development shall be used to determine predevelopment rates of discharge for each drainage area of the site.

8.10.3.14. An emergency spillway capable of discharging a 100-year storm event at a depth not to exceed one (1) foot and at non-erosive velocities (less than 5 feet per second) for the spillway lining materials and downstream surfaces over and through which the spillway discharge will flow, shall be constructed at the discharge end of every detention/retention facility upon unexcavated (undisturbed) material.

8.10.3.14.1. The downstream discharge path of emergency spillway flow shall be clearly indicated at least 250 feet downstream of the emergency spillway.

8.10.3.15. Fenced stormwater facilities are strongly discouraged within the City and shall only be permitted if approved by the City Engineer. The City will consider fencing stormwater facilities <u>only where steep slopes that potentially endanger human life are unavoidable</u>. If fencing is required, the design shall be six-foot high fence, or better (i.e., brick wall) along the easement boundary around the entire perimeter, including maintenance berms with access for maintenance vehicles. Other designs may be permitted subject to the review and approval of the City Engineer.

8.10.3.16. Areas adjacent to open channels and ponds shall be graded to restrict the entrance of stormwater except at planned locations. Where retention or detention areas are located on the project periphery, the developer may be required to provide additional landscaping or screening to adequately protect abutting properties as per the standards set forth by the City of Lebanon Planning and Development Department.

8.10.3.17. The minimum requirement for maintenance berms is found in the following table:

Table 22 - Minimum Requirement for Maintenance Berms

Maintenance Ponds	Access Way Required
With fenced perimeter	20 feet all around
Without fencing	15 feet all around

8.10.3.18. Detention/retention facilities shall be designed to meet the requirements of this Chapter and the Erosion and Sediment Control requirements of section 8.12. and the Stormwater Runoff Quality requirements of section 8.11.

8.10.3.19. Full headwalls are required at all storm sewer management inlets and outlets to and from open channels, structures pipes, culverts, ponds, lakes, or other bodies of water. Headwalls

shall be constructed of reinforced, Lebanon Standard Concrete, or natural stone or brick, as approved by the City Engineer.

8.11. STORMWATER QUALITY

8.11.1. Stormwater quality provisions are in addition to stormwater quantity provisions. Facilities can be designed to handle both stormwater quantity and quality concerns, but the volumes shall be additive.

8.11.2. No person shall:

8.11.2.1. Construct, maintain, operate, and continue to operate, or utilize in any way an illicit connection to the storm sewer system.

8.11.2.2. Cause, allow or facilitate any illicit or illegal discharge.

8.11.2.3. Act, cause, permit, or suffer any agent, employee, or independent contractor to construct, maintain, operate or utilize any illicit connection, or cause, allow or facilitate any prohibited discharge.

8.11.3. Outdoor activities that, in the judgment of the City Engineer, cannot be conducted indoors shall be conducted within specified areas of the site designed to control stormwater quality in the following manner:

8.11.3.1. Runoff from outdoor activity areas shall not be allowed to co-mingle with runoff from the remainder of the site.

8.11.3.2. Runoff from outdoor activity areas shall be directed to separate treatment systems able to adequately control stormwater pollutant concentrations, as approved by the City Engineer. These systems include, but are not limited to the following:

8.11.3.2.1. The City's separate sanitary sewer system, providing the discharge satisfies all applicable requirements of Chapter 914 of the Lebanon Code of Ordinances.

8.11.3.2.2. An oil/water separator to remove uncharacteristically high concentrations of oil and grease, with treated effluent discharged to the separate sanitary sewer system.

8.11.3.2.3. A system appropriate for the containment of hazardous material spills, designed as specified in the Fire Prevention Code.

8.11.3.2.4. An industrial treatment system covered by a discharge permit issued by Ohio EPA.

8.11.4. Every site, except those exempted in Section 8.7., shall be designed to direct runoff from areas other than outdoor activity areas to one or more of the following stormwater quality treatment best management practices (BMPs).

8.11.5. BMP Types

8.11.5.1. The following BMP Types are acceptable:

8.11.5.1.1. Hydrodrnamic Systems

8.11.5.1.2. Manufactured systems

8.11.5.1.3. Vegetated Biofilter

8.11.5.1.4. Extended Detention

8.11.5.1.5. Extended Retention Basin

8.11.5.1.6. Bioretention Cell

8.11.5.1.7. Infiltration Trench

8.11.5.1.8. Infiltration Basin

8.11.5.1.9. Constructed Wetlands

8.11.5.1.10. Other approved BMPs

8.11.5.1.10.1. Any alternative BMP shall be discussed with the City Engineer in the pre-planning phase to discuss applicability and feasibility of the desired method.

8.11.5.1.10.2. Other BMPs may be recommended to satisfy the requirements of this chapter of the Stormwater Management Plan if:

8.11.5.1.10.2.1. the site, or experience at the site fails to demonstrate that the above, original BMPs remove at least 85% of the average annual pollutant load contained in runoff from the site,

8.11.5.1.10.2.2. that these BMPs do not possess adequate provisions for long-term maintenance,

8.11.5.1.10.2.3. create a nuisance, or

8.11.5.1.10.2.4. fail to satisfy other sections of the Stormwater Regulations.

*NOTE: Wet extended and dry extended detention basins, in this context, refer to those intended for the control of the quality of stormwater runoff. Their purpose and function here is not to control the volume of runoff as in Paragraph 8.10.3., even though they do provide some measure of volume control. While detention basins designed for volume control afford a significant stormwater quality control function, they are always larger and their volume is determined by completely different criteria and methods.

8.11.5.1.10.3. The design stormwater quality event for these BMPs shall be the first three-quarters of an inch of rainfall of each and every storm event. BMPs shall also be designed to accommodate flows exceeding their design capacity, either bypassing excess flows, conveying excess flows through the facility without disrupting its stormwater quality control effectiveness, or storing excess flows as necessary to achieve the drainage, flood control, and erosion control objectives of this chapter.

8.11.6. Water Quality Volume

8.11.6.1. Water Quality Volume Calculation

8.11.6.1.1. The following equation shall be used to calculate the water quality volume:

Equation 11 – Water Quality Volume Calculation

$$WQv = \frac{T(P * A * Cq)}{12} * 43{,}560$$

Where:

WQv = Water Quality Volume in Cubic-Feet

T =Treatment Percent (Refer to Paragraph 8.11.6.2)

P = Precipitation (0.75 inches)

A = Contributing Drainage Area to an Outfall in Acres

$Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

i = impervious area divided by the total area

8.11.6.2. Treatment Percent

8.11.6.2.1. A contributing drainage area to an outfall that has both existing and new impervious areas requires a weighted average calculation to determine the percent of treatment required. Existing impervious area requires treatment of 20% of the area. New impervious area requires treatment of 100% of the area. This percent is multiplied by the calculated WQv

or the ExT length to determine the amount of treatment. Use the following equation to determine the percent of treatment:

Equation 12 – Treatment Percent

$$\text{Treatment} = \frac{[(\text{Aix} * 20) + (\text{Ain} * 100)]}{(\text{Aix} + \text{Ain})}$$

Where:
Treatment = Treatment Percentage (%)
Aix = Existing Impervious Area in Acres
Ain = New Impervious Area in Acres

8.11.6.3. Structural BMP Using the WQv

8.11.6.3.1. The water quality volume (WQv) is the treatment volume required for post construction BMP. Use the WQv for the following BMP:

8.11.6.3.1.1. Vegetated Biofilter

8.11.6.3.1.2. Extended Detention

8.11.6.3.1.3. Extended Retention Basin

8.11.6.3.1.4. Bioretention Cell

8.11.6.3.1.5. Infiltration Trench

8.11.6.3.1.6. Infiltration Basin

8.11.6.3.1.7. Constructed Wetlands

*NOTE: Wet extended and dry extended detention basins, in this context, refer to those intended for the control of the quality of stormwater runoff. Their purpose and function here is not to control the volume of runoff as in Paragraph 8.10.3., even though they do provide some measure of volume control. While detention basins designed for volume control afford a significant stormwater quality control function, they are always larger and their volume is determined by completely different criteria and methods.

8.11.7. Water Quality Flow

8.11.7.1. Water Quality Flow Calculation

8.11.7.1.1. The water quality flow (WQf) is the discharge that is produced by using an intensity of 0.65 in/hr in the rational equation. Use the entire contributing drainage for the WQf calculation. Once an area has been treated, remove this area from the next downstream WQf calculation.

8.11.7.2. Structural BMP Using the WQf

8.11.7.2.1. Use the WQF for the following BMP:

8.11.7.2.1.1. Manufactured System

8.11.8. BMP Toolbox

8.11.8.1. Hydrodynamic Systems

8.11.8.1.1. Hydrodynamic systems consist of underground structures that treat the WQf by removing particulate matter, floatables, and oil and grease in specially designed chambers or tanks. Hydrodynamic systems have high maintenance requirements.

8.11.8.1.2. Unless approved in writing by the City Engineer, hydrodynamic systems will not be permitted for new development. Unless otherwise approved, hydrodynamic systems shall only be used in retrofit situations.

8.11.8.1.3. Hydrodynamic systems shall be capable of treating the entire WQf as described in Paragraph 8.11.7.

8.11.8.2. Manufactured Systems

8.11.8.2.1. Manufactured systems consist of underground structures that treat the WQf by removing particulate matter through settlement.

8.11.8.2.2. Unless approved in writing by the City Engineer, manufactured systems will not be permitted for new development. Unless otherwise approved, manufactured systems shall only be used in retrofit situations.

8.11.8.2.3. ODOT Supplemental Specification 895 covers the material and performance criteria for these devices. They are placed in an off-line configuration with manholes to allow for routine maintenance procedures (see figure 1118-2 in the *ODOT Location and Design Manual – Volume 2*). Provide a No. 3 Manhole, With ___" Base ID and ___" Weir at this location. Furnish two lengths of 603, Type B Conduit placed perpendicular to the inflowing trunk sewer (see reserved area table for the total length required). Use the following table when placing a Manufactured System:

Table 23 - Manufactured Systems

Type	WQf (CFS)	ODOT No. 3 Manhole Inside Diameter (Inches)	603-Type B Conduit Diameter (Inches)
1	1	84	12
2	2	90	15
3	3	96	18
4	6	108	24

8.11.8.2.4. Reserve an area (as measured from the centerline of the No. 3 Manhole) according to the following table:

Table 24 - Reserved Area for Manufactured System

Type	Width (Feet)	Length (Feet)	603-Type B Total Conduit Length (Feet)	Weir Height (Inches)
1	15	30	20	6
2	20	32	30	8
3	25	33	40	9
4	25	37	40	12

8.11.8.2.5. Center the length of the area at the No. 3 Manhole. If this area is not attainable contact Central Office Hydraulics for further guidance. Ensure this area is void of all utilities and is accessible for routine cleanout and maintenance.

8.11.8.3. Vegetated Biofilter

8.11.8.3.1. This method has limited application and is not intended for use in residential areas. Vegetated biofilters shall only be used with approval of the City Engineer. If permitted, vegetated biofilters shall be designed in accordance with the current edition of the *ODOT Location and Design Manual – Volume 2*).

8.11.8.4. Extended Detention Basins

8.11.8.4.1. Extended detention is a method that captures storm water during rain events and slowly releases the captured volume over a period of time. The WQv is used to determine the storage volume of the detention basin. The WQv is discharged over a 48 hour time frame. Increase the WQv by 20% when sizing the BMP to allow for sedimentation to occur. Detention can be either above or below ground. Detention basins that are above ground are the preferred choice and shall be used when feasible . However, when project site parameters dictate, an underground system may be the optimum choice.

8.11.8.4.2. The following design criteria shall be observed:

8.11.8.4.2.1. Allow for 1 foot of freeboard above the storage volume.

8.11.8.4.2.2. A micropool shall be provided when feasible. Refer to Figure 1117-5 in the *ODOT Location and Design Manual – Volume 2*.

8.11.8.4.2.3. Use side slopes of 4:1 (max).

8.11.8.4.2.4. Ensure the design check discharge will safely pass through the structure

8.11.8.4.2.5. Vegetate the sides of the basin with ODOT Item 670 Slope Erosion Protection.

8.11.8.4.2.6. Do not locate on uncompacted fill or steep slopes (2:1 or more) or where infiltrating ground water could adversely impact slope stability.

8.11.8.4.2.7. Furnish an anti-seep collar around the outlet pipe.

8.11.8.4.2.8. Furnish gravel pack protection at the outlet structure (see ODOT Standard Drawing WQ1.1).

8.11.8.4.2.9. Place channel protection (RCP or Concrete Mat) at the entrance of the basin to minimize erosion and sediment resuspension.

8.11.8.4.2.10. Furnish a forebay that is approximately 10% of the total design volume.

8.11.8.4.2.11. The sediment storage volume shall not be less than 20 percent of extended detention volume.

8.11.8.4.2.12. The outlet shall also be designed to minimize clogging, vandalism, and maintenance.

8.11.8.4.2.13. The basin design shall incorporate the following features to maximize multiple uses, aesthetics, safety, maintainability, and compatibility with the urban landscape.

8.11.8.4.2.14. A stable vehicular (maintenance berm) access way shall be provided to forebays and outlets shall be provided.

8.11.8.4.2.15. Aeration shall be provided for extended detention basins.

8.11.8.4.3. Water Quality Basin Design

8.11.8.4.3.1. Furnish an outlet structure that fully drains the WQv within 48 hours or more. No more than 50% of the WQv shall be released from the detention basin in one-third of the drain time.

8.11.8.4.3.2. The outlet structure requires a flow control structure such as a perforated riser pipe to restrict the drainage discharge. Details of a perforated riser pipe outlet structure can be found on ODOT standard drawing WQ1.1.

8.11.8.4.3.3. Furnish a perforated riser pipe for detention basins. The outlet structure consists of a catch basin with a perforated riser pipe on the inlet side and a conduit on the outlet side. The perforated riser pipe is used for flow control to achieve the required discharge time. A gravel envelope surrounds the perforated riser pipe along the inlet side of the catch basin to prevent blockage of the orifice holes in the pipe.

8.11.8.4.3.4. When separate quality and quantity basins are provided, furnish a weir to allow the design check discharge to bypass the structure without damage to the detention basin or embankment of the basin. The design check discharge shall be determined per the following:

8.11.8.4.3.4.1. A design check discharge with the frequency of a 10-year event shall be used as calculated by the Rational Equation. Use the entire drainage area that contributes to the BMP to calculate the design check discharge.

8.11.8.4.3.5. The equation for a single orifice is as follows:

Equation 13 - Single Orifice Discharge Rate

$$Q = A * C * \sqrt{64.4 * H}$$

Where:

Q = Discharge Rate in Cubic Feet Per Second

A = Orifice Area in Square Feet

C = Orifice Coefficient as found in Table 25

H = Head on the Orifice as Measured from the Water Surface to the Centerline of the Orifice

Table 25 - Orifice Coefficient Determination

C	Description
0.66	Use for thin materials where the thickness is equal to or less than the orifice diameter.
0.80	Use when the material is thicker than the orifice diameter.

8.11.8.4.3.6. A hydrograph curve for the outlet will be required to calculate the discharge time of the WQv and the design check discharge. The discharge time shall correspond to the minimum drain time of 48 hours and no more than 50% of the WQv shall be released from the detention basin in less than one-third of the drain time.

8.11.8.4.3.7. An underdrain network shall be installed beneath the bottom of the dry extended detention basin to aid in proper water removal from the basin bottom and to allow an alternative method of water removal in the event the primary outlet structure becomes clogged. The underdrain network shall drain to the primary control structure.

8.11.8.4.4. Anti-Seep Collar Design

8.11.8.4.4.1. An anti-seep collar shall be installed on conduits through earth fills where water is being detained. The following criteria applies to anti-seep collars:

8.11.8.4.4.1.1. Furnish a minimum of 2 collars per outlet conduit. Increase the seepage length along the conduit by a minimum of 15%. This percentage is based on the length of the pipe in the saturation zone.

8.11.8.4.4.1.2. Anti-seep collars shall be placed equally within the saturation zone. Place one collar at the end of the saturation zone. In cases where the spacing limit will not allow this, place at least one collar within the saturation zone.

8.11.8.4.4.1.3. Maximum collar spacing shall be 14 times the minimum projection above the pipe, but not more than 25 feet. The minimum collar spacing shall be 5 times the minimum projection, but not less than 10 feet.

8.11.8.4.4.1.4. Extend the collar dimensions a minimum of 2 feet in all directions around the outside of the conduit, measured perpendicular to the conduit. Center the anti-seep collars around the conduit..

8.11.8.4.4.1.5. The top of collar shall not be less than 6 inches below, measured normal to, the finished groundline.

8.11.8.4.4.1.6. Minimum thickness shall be 6 inches.

8.11.8.4.4.1.7. The design procedure for anti-seep collars is as follows:

8.11.8.4.4.1.7.1. Determine the length of the conduit within the saturated zone. The assumed normal saturation zone can be determined by projecting a line through the embankment, with a 4:1 (H:V) slope, from the point where the normal water elevation (10-year) meets the upstream slope to a point where it intersects the invert of the conduit. This line, referred to as the "phreatic line", represents the upper surface of the zone of saturation within the embankment (See Figure 1117-11). The 10-year storm pool elevation is the phreatic line starting elevation.

Equation 14 – Length of Conduit in Saturated Zone

$$L_S = Y * (Z + 4)\left[1 + \frac{S}{0.25 - S}\right]$$

Where:
L_s = Length of the conduit in the saturated zone (feet)
Y = Depth of the water at the spillway crest, 10-year frequency stormwater elevation (feet)
Z = Slope of the upstream face of the embankment (Z feet horizontal to 1 foot vertical)
S = Slope of the conduit (feet per foot)

8.11.8.4.4.1.7.2. Determine the required seepage length increase.

Equation 15 – Required Seepage Length Increase

$$\Delta L_S = 0.15 * L_S$$

Where:
ΔL_S = Required seepage length increase (feet)
L_s = Length of the conduit in the saturated zone (feet)

8.11.8.4.4.1.7.3. Choose a collar height and width that is at least 4 feet larger than the outside diameter of the conduit (minimum projection of 2 feet from all sides of the conduit). Give collar sizes in one foot increments.

Equation 16 – Anti-Seep Collar Projection

$$P = W - D$$

Where:
P = Projection of collar (feet)
W = Height or width of collar (feet)
D = Inside diameter of conduit

8.11.8.4.4.1.7.4. Determine the total number of collars required. The collar size can be increased to reduce the number of collars. Alternatively, the collar size can be reduced by providing more collars. In any case, the seepage length shall be increased by a minimum of 15%.

Equation 17 – Number of Anti-Seep Collars Required

$$\text{Number of collars required} = \Delta L_S / P$$

Where:
ΔL_S = Required seepage length increase (feet)
P = Projection of collar (feet)

8.11.8.5. Underground Detention

8.11.8.5.1. Underground detention areas are made up of a series of conduits. They range from an oversized storm sewer to a series of conduits that are specifically used for storm water detention. The following criteria apply when designing underground detention:

8.11.8.5.1.1. Ensure the Hydraulic Grade Line design of the storm sewer will pass through the structure and meet the requirements of 1104.4.2. of the *ODOT Location and Design Manual – Volume 2.*

8.11.8.5.1.2. Consider access to the conduits for periodic maintenance.

8.11.8.5.1.3. If practical, provide pretreatment of the storm water with vegetation.

8.11.8.6. Design Check Discharge

8.11.8.6.1. A design check discharge with the frequency of a 10-year event shall be used. Use the entire drainage area that contributes to the BMP to calculate the design check discharge

8.11.9. Extended Retention Basins

8.11.9.1. A retention basin is a "wet" pond that has a minimum water surface elevation between storms that is defined as the permanent pool. Above the permanent pool is a detention pool that provides storage for 75% of the WQv and discharges within 24 hours or more. The full storage water depth is typically between 3-6 feet and the volume is less than 15 Ac-ft. The permanent pool is sized to provide storage for 75% of the WQv. A retention basin is ideal for large tributaries, but it may require a large amount of space.

8.11.9.2. The following Design Criteria shall be observed:

8.11.9.2.1. The basin design shall incorporate the following features to maximize multiple uses: aesthetics, safety, maintainability, and compatibility with the urban landscape:

8.11.9.2.1.1. Underlying soils shall be compacted to prevent infiltration of the permanent pool or an impervious liner shall be used.

8.11.9.2.1.2. Allow for a minimum of 1 foot of freeboard above the WQv.

8.11.9.2.1.3. Basin side slopes shall have a run to rise ratio of 10:1 or flatter, whenever practical, to promote growth of wetland vegetation over 25 to 50 percent of the pond surface area. Side slopes shall not exceed 4:1 run to rise ratio.

8.11.9.2.1.4. Ensure the design check discharge will safely pass through the structure.

8.11.9.2.1.5. Basin depth in the permanent pool shall not be less than 3 feet, and shall not exceed 12 feet in open water areas to prevent thermal stratification.

8.11.9.2.1.6. A forebay designed to allow larger sediment particles to settle shall be placed at basin inlets. The forebay shall be 10% of the total retention volume.

8.11.9.2.1.7. A length to width ratio at least 3:1 shall be used to prevent short-circuiting.

8.11.9.2.1.8. Provide anti seep collar(s) on principal outlet pipe. Refer to Section 8.11.8.4.4. for requirements.

8.11.9.2.1.9. Install rip rap or other suitable erosion control materials as required at all pipe outlets entering or exiting the pond.

8.11.9.2.1.10. Aeration shall be provided for all wet extended detention basins

8.11.9.2.1.11. Provisions shall be provided to drain the permanent pool volume for removal of accumulated sediments. Remove accumulated sediment when 20% of the design storage volume has been filled.

8.11.9.2.1.12. A stable vehicular access way shall be provided to forebays and outlets.

8.11.9.2.1.13. No retention basin shall be placed closer than 10,000 feet from any municipal airport runway.

8.11.9.3. Water Quality Basin and Weir

8.11.9.3.1. A retention basin outlet structure is designed similar to the outlet structure for a detention basin. The difference is that 75% of the WQv shall be discharged out of the basin in 24 hours or more. The outlet structures are of a similar type, except the openings will be set at a high enough elevation to maintain 0.75% of the WQv in the permanent pool (see ODOT standard construction drawing WQ-1.1).

8.11.10. Bioretention Cell

8.11.10.1. Bioretention Cells consist of a depressed low-lying area that treat storm water through evapotranspiration and filtering through a planting soil. As the storm water passes through the soil it is filtered. An underlying perforated storm sewer or underdrain captures the treated storm water and carries it to an outlet. Extensive vegetation assists in the filtration of the storm water prior to filtering through the soil. Vegetation shall consist of shrubs or grasses that are native to the area.

8.11.10.2. The existing soil must be removed and replaced when constructing a bioretention cell. The bioretention planting soil (ODOT plan note WQ101) shall consist of a mixture of sand, topsoil, and compost.

8.11.10.3. A bioretention cell is sized to store the WQv prior to filtration. Total filtration shall occur in 40 hours or more. The size of the bioretention cell shall be determined using the spreadsheet available from the Office of the City Engineer.

8.11.10.4. The following criteria apply when designing a bioretention BMP:

8.11.10.4.1. Do not place where snow may be stored.

8.11.10.4.2. Furnish 10 feet or less width between 4 inch underdrain laterals.

8.11.10.4.3. Furnish bypass or overflow for the design check discharge. Use a catch basin(s) in conjunction with an overflow weir as needed.

8.11.10.4.4. Furnish pretreatment of the storm water via vegetation.

8.11.10.4.5. Ensure the water table or bedrock is below the invert of the bioretention area.

8.11.10.4.6. Use side slopes of 4:1 (max).

8.11.10.4.7. Furnish a length to width ratio of 2:1 (min).

8.11.10.4.8. Use a minimum depth of 4 feet of planting soil. Provide at least 4 inches of depth deeper than the largest root ball.

8.11.10.4.9. Furnish an organic or mulching layer at the top of the planting soil.

8.11.10.4.10. Furnish a maximum depth of 1 foot to the riser pipe or catch basin outlet from the mulching layer for storage of the WQv.

8.11.11. Infiltration

8.11.11.1. Infiltration techniques treat storm water through the interaction of a filtering substrate that consists of soil, sand, or gravel. This technique discharges the treated storm water into the ground water rather than into surface waters. Typically infiltration practices are ionly suitable for Hydrologic Soil Group(HSG) Type A soils or in some cases, HSG Type B soils.

8.11.11.2. Infiltration methods require an extensive investigation of the existing soils and geology to ensure success. The investigation shall begin with a preliminary soil evaluation of the project

site early in the design process. In situ testing is not anticipated during the preliminary evaluation process. Use available soil and geology data found in the Soil and Water Conservation maps, United States Geological Survey (USGS), adjacent projects, or estimations from a geotechnical engineer shall be used. Material property tables for infiltration, permeability, and porosity have been provided for the preliminary evaluation (*ODOT Location and Design Manual – Volume 2* Table 1118-1 & 1118- 2).

8.11.11.3. If the preliminary evaluation yields favorable results a more detailed evaluation shall be performed. The detailed evaluation will require a geotechnical investigation of the underlying soils and geology. Soil borings shall be performed to a maximum depth of 20 feet (or refusal) with samples taken every 5 feet for laboratory testing. The number and location of soil borings shall correspond with the approximate size (as determined in the preliminary evaluation) of the infiltration BMP and shall be recommended by the geotechnical engineer.

8.11.11.4. If the detailed evaluation yields favorable results, the ground water depth must be verified. The geotechnical engineer shall provide the seasonal high ground water depth. In some cases, observation wells may be installed and static water levels may be observed over a dry and wet season for verification.

8.11.11.5. The infiltration and permeability rate of the soil shall be tested in the detailed soil evaluation at the discretion of the geotechnical engineer. In some cases, insitu testing at the proposed location of the infiltration BMP may be required.

8.11.11.6. The following criteria applies to infiltration methods and must be met to be considered a feasible alternative:

8.11.11.6.1. Design using the WQv as per 8.11.6.

8.11.11.6.2. Do not place infiltration BMP where snow may be stored.

8.11.11.6.3. The appropriate soil type must be present:

8.11.11.6.3.1. Infiltration must be greater than 0.50 in/hr and no greater than 2.4 in/hr.

8.11.11.6.3.2. Soils must have less than 30% clay or 40% of clay and silt combined.

8.11.11.6.4. The invert of the structure must be at least 4 feet above the seasonal high water table and any impervious layer.

8.11.11.6.5. Infiltration techniques are not suitable on fill soil, compacted soil, or steep slopes (greater than 4:1). Consideration should be given to the long term impacts upon hillside stability if applicable.

8.11.11.6.6. Pretreatment shall be provided to remove large debris, trash and suspended sediment to extend the service life. An example of pretreatment includes providing vegetated ditches prior to flow entering the infiltration facility.

8.11.11.7. Infiltration Trench

8.11.11.7.1. An infiltration trench is an excavated trench that has been lined with a geotextile fabric and backfilled with aggregate. The storm water is filtered through the aggregate and is stored within the pore volume of the backfill material. It is allowed to percolate through the sides and bottom of the trench. The drawdown time of the WQv is 24 hours or more. Consider the following when designing an Infiltration trench:

8.11.11.7.1.1. The minimum acceptable permeability of the surrounding soil is =6.5*10^-5 ft/sec (21.37 min/in) (see).

8.11.11.7.1.2. Design using the WQv as per 8.11.6.

8.11.11.7.1.3. Long and deep infiltration trenches are most efficient (3 feet bottom width and 3-6 feet deep).

8.11.11.7.1.4. Furnish a 6 inch layer of Item 601 Infiltration Basin Aggregate on the top of the trench.

8.11.11.7.1.5. The geometric shape of the trench is a trapezoid with sides at a 1:1 (H:V) slope due to constructability. The top width is calculated as: Top Width = Bottom Width + (2 * Depth)

8.11.11.7.1.6. Pretreatment using vegetation shall be provided to ensure longevity of the infiltration trench.

8.11.11.7.1.7. An observation well shall be provided to facilitate ground water level inspection.

8.11.11.7.1.8. Locate the infiltration trench at least 1,000 feet from any municipal water supply well and at least 100 feet from any private well, septic tank, or field tile drains.

8.11.11.7.1.9. Ensure the bottom of the trench is below the frost line (2.5 feet)

8.11.11.7.2. The length of the trench depends upon the depth and the bottom width. The required length is calculated by assuming a depth and bottom width. The length is calculated based upon the inflow (WQv) and the outflow (ground water recharge). The following equation calculates the required length in feet:

Equation 18 - Required Infiltration Trench Length

$$L_t = \frac{WQv}{3600 * K * T * (b + 2 * d) + .04 * \left[D^2 + (b * D)\right]}$$

where:
L_t = Required Length of Infiltration Trench in Feet
WQv = Water Quality Volume in Cubic Feet
K = Permeability of the Surrounding Soil in Ft/Sec (Refer to Table 26)
T = Drain Time Through the Sides of the Trench (24 Hours)
D = Trench Depth in Feet
b = Bottom Width of the Trench in Feet

Table 26 - Permeability of Soil Types

Soil Type	Rate K (Ft/Sec)	Percolation Rate (Min/In)
Gravel	$3.3x10^{-3}$ to $3.3x10^{-1}$	0.42 to .0042
Sand	$3.3x10^{-5}$ to $3.3x10^{-2}$	42.09 to 0.04
Silt	$3.3x10^{-9}$ to $3.3x10^{-5}$	420,875 to 42.09
Saturated Clay	$< 3.3x10^{-9}$	> 420,875
Till	$3.3x10^{-10}$ to $3.3x10^{-6}$	4,208,754 to 420.88

8.11.11.8. Infiltration Basin

8.11.11.8.1. An infiltration basin is an open surface pond that uses infiltration into the ground as the release mechanism. It is designed to store the WQv.

8.11.11.8.2. Depending on the soil permeability, it may be used to treat from 5 to 50 acres. Lower permeable soils may require an underdrain system as an additional outlet. The drawdown time of the WQv shall be between 24-48 hours. The following criteria applies when designing an infiltration basin:

8.11.11.8.2.1. Use an energy dissipater at the inlet.

8.11.11.8.2.2. Allow for 1 foot (min) freeboard above the WQv.

8.11.11.8.2.3. Vegetate the sides of the basin with ODOT Item 670 Slope Erosion Protection.

8.11.11.8.2.4. Furnish a 6 inch layer of ODOT Item 601 Infiltration Basin Aggregate on the bottom of the basin.

8.11.11.8.2.5. Use side slopes of 4:1 (max).

8.11.11.8.2.6. Use a length to width ratio of 3:1

8.11.11.8.2.7. Furnish bypass or overflow for the design check discharge (Paragraph 8.11.8.6.).

8.11.11.8.2.8. Consider vehicle access to the basin for periodic maintenance.

8.11.11.8.2.9. Locate basin at least 1,000 feet from any municipal water supply well and at least 100 feet from any private well, septic tank, or drain field.

8.11.11.8.2.10. Furnish 10 feet or less width between 4 inch underdrain laterals (if used in the design).

8.11.11.8.2.11. Do not locate the basin where infiltrating ground water may adversely impact slope stability.

8.11.11.8.2.12. Ensure the invert of any underdrain in the basin is below the frost line (2.5 feet).

8.11.11.8.3. The invert area of the infiltration basin can be calculated by the following equation:

Equation 19 – Required Invert Area of Infiltration Basin

$$A = \frac{(WQv * S.F. * 12)}{(k * t)}$$

Where:
A = Area of the Invert of the Basin in Square Feet
WQv = Water Quality Volume in Cubic Feet
S.F. = Safety factor of 1.5
k = Infiltration Rate in Inches per Hour as found in Table 27
t = Drawdown Time of 48 Hours

8.11.11.8.4. The required depth of the infiltration basin can be calculated by the following equation:

Equation 20 - Required Infiltration Basin Depth

$$D = \frac{WQv}{A}$$

Where:
D = Infiltration Basin Depth in Feet
WQv = Water Quality Volume in Cubic Feet
A = Area of the Invert of the Basin in Square Feet

Table 27 - Infiltration Rates

NRCS Soil Type (From Soil Maps)	HSG Classification	Rate (k) in In/Hr
Sand	A	8.0
Loamy Sand	A	2.0
Sandy Loam	B	1.0
Loam	B	0.5
Silt Loam	C	0.25
Sandy Clay Loam	C	0.15
Clay Loam & Silty Clay Loam	D	<0.09
Clays	D	<0.05

Infiltration Rate (k)
From Urban Runoff Quality Management WEF Manual of Practice No. 23, 1998, published jointly by the WEF and ASCE, chapter five

8.11.11.9. Constructed Wetlands

8.11.11.9.1. Constructed wetlands treat storm water through bio-retention. They are depressed, heavily planted areas that are designed to maintain a dry weather flow depth ranging between 0.5 to 2 feet. The surface area required for a wetland is usually quite large due to the limited allowable depth. The area is usually on the magnitude of 1% of the entire drainage area. They are designed in a similar manner as a retention basin. The wetland is sized to provide storage for the WQv for a time frame of at least 24 hours (above the permanent pool) while providing a bypass or overflow for larger design check discharge. The water depth shall be maintained by an outlet structure capable of providing the required water depth with the provision of a one foot freeboard. The following criteria applies when designing a wetland:

8.11.11.9.1.1. Do not place on a steep or unstable slope or at a location, which could induce short-term or long-term instability.

8.11.11.9.1.2. Constructed wetlands must be greater than 10,000 feet from a municipal airport runway.

8.11.11.9.1.3. Base flow must be present to maintain the constant water depth (such as ground water).

8.11.11.9.1.4. Furnish a forebay that is 7% of the total required volume at a depth between 3-6 feet to settle out sediments.

8.11.11.9.1.5. Furnish side slopes of 4:1 (max).

8.11.11.9.1.6. Consider access for maintenance to the forebay and the outlet structure.

8.11.11.9.1.7. Vegetate the sides and bottom with grass

8.11.11.9.1.8. Furnish an impervious liner. Use a compacted clay bottom or a geotextile fabric to prevent infiltration of the storm water.

8.11.11.9.1.9. Furnish a length to width ratio of 3:1 (min) to prevent short-circuiting.

8.12. EROSION AND SEDIMENTATION CONTROL

8.12.1. Erosion and sedimentation controls shall be applied to all parcels used or being developed, either wholly or partially, for new or relocated projects involving highways, underground cables, or

pipelines; subdivisions or larger common plans of development; industrial, commercial, institutional, or residential projects; building activities on farms; redevelopment activities; general clearing; and all other uses that are not specifically exempted in this Document.

8.12.2. Erosion and sedimentation controls do not need to be applied to activities regulated by, and in compliance with, the Ohio Agricultural Sediment Pollution Abatement Rules.

8.12.3. Compliance with State and Federal Regulations

8.12.3.1. Approvals issued in accordance with this regulation do not relieve the applicant of responsibility for obtaining all other necessary permits and/or approvals from the Ohio EPA, the US Army Corps of Engineers, and other federal, state, and/or county agencies. If requirements vary, the most restrictive requirement shall prevail. These permits may include, but are not limited to, those listed below. All submittals required to show proof of compliance with these state and federal regulations shall be submitted with Storm Water Pollution Prevention Plans or Abbreviated Storm Water Pollution Prevention Plans.

8.12.3.1.1. Ohio EPA NPDES Permits authorizing storm water discharges associated with construction activity or the most current version thereof

8.12.3.1.1.1. Proof of compliance with these requirements shall be the applicant's Notice of Intent (NOI) number from Ohio EPA, a copy of the Ohio EPA Director's Authorization Letter for the NPDES Permit, or a letter from the site owner certifying and explaining why the NPDES Permit is not applicable.

8.12.3.1.2. Section 401 of the Clean Water Act

8.12.3.1.2.1. Proof of compliance shall be a copy of the Ohio EPA Water Quality Certification application tracking number, public notice, project approval, or a letter from the site owner certifying that a qualified professional has surveyed the site and determined that Section 401 of the Clean Water Act is not applicable. Wetlands, and other waters of the United States, shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.3. Ohio EPA Isolated Wetland Permit

8.12.3.1.3.1. Proof of compliance shall be a copy of Ohio EPA's Isolated Wetland Permit application tracking number, public notice, project approval, or a letter from the site owner certifying that a qualified professional has surveyed the site and determined that Ohio EPA's Isolated Wetlands Permit is not applicable. Isolated wetlands shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.4. Section 404 of the Clean Water Act

8.12.3.1.4.1. Proof of compliance shall be a copy of the U.S. Army Corps of Engineers Individual Permit application, public notice, or project approval, if an Individual Permit is required for the development project. If an Individual Permit is not required, the site owner shall submit proof of compliance with the U.S. Army Corps of Engineer's Nationwide Permit Program. This shall include one of the following:

8.12.3.1.4.1.1. A letter from the site owner certifying that a qualified professional has surveyed the site and determined that Section 404 of the Clean Water Act is not applicable.

8.12.3.1.4.1.2. A site plan showing that any proposed fill of waters of the United States conforms to the general and special conditions specified in the applicable Nationwide Permit. Wetlands, and other waters of the United States, shall be delineated by protocols accepted by the U.S. Army Corps of Engineers at the time an application is made under this regulation.

8.12.3.1.5. Ohio Dam Safety Law

8.12.3.1.5.1. Proof of compliance shall be a copy of the ODNR Division of Water permit application tracking number, a copy of the project approval letter from the ODNR Division of Water, or a letter from the site owner certifying and explaining why the Ohio Dam Safety Law is not applicable.

8.12.4. Development of Storm Water Pollution Prevention Plans

8.12.4.1. This regulation requires that a Storm Water Pollution Prevention Plan be developed and implemented for all parcels disturbing one (1) acre or more and on which any regulated activity is proposed.

8.12.4.2. The following activities shall submit an Abbreviated Storm Water Pollution Prevention Plan:

8.12.4.2.1. New single-family residential construction regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.2.2. Additions or accessory buildings for single-family residential construction regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.2.3. All non-residential construction on parcels of less than one (1) acre.

8.12.4.2.4. General clearing activities not related to construction and regardless of parcel size. If such activities disturb one (1) acre or more, or are part of a larger common plan of development or sale disturbing one (1) acre or more, an Ohio EPA Construction Site General Permit and a Storm Water Pollution Prevention Plan may be required.

8.12.4.3. Activities disturbing 1/10th (one tenth) or less of an acre are not required to submit a Storm Water Pollution Prevention Plan or an Abbreviated Storm Water Pollution Prevention Plan, unless required by the City Engineer. These activities must comply with all other provisions of this regulation.

8.12.5. Application Procedures

8.12.5.1. Soil Disturbing Activities Submitting A Storm Water Pollution Prevention Plan: The applicant shall submit two (2) sets of the SWP3 and the applicable fees to the City of Lebanon and two (2) sets of the SWP3 as follows:

8.12.5.1.1. For subdivisions: After the approval of the preliminary plans and with submittal of the improvement plans.

8.12.5.1.2. For other construction projects: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.1.3. For general clearing projects: Prior to issuance of a zoning permit by the Planning and Development Department.

8.12.5.2. Soil Disturbing Activities Submitting An Abbreviated Storm Water Pollution Prevention Plan: The applicant shall submit two (2) sets of the ASWP3 and the applicable fees to the City of Lebanon and two (2) sets of the ASWP3 as follows:

8.12.5.2.1. For single-family home construction: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.2.2. For other construction projects: Before issuance of a zoning permit by the Planning and Development Department.

8.12.5.2.3. For general clearing projects: Prior to issuance of a zoning permit by the Planning and Development Department.

8.12.5.3. The City of Lebanon shall review the plans submitted for conformance with these regulations and approve, or return for revisions with comments and recommendations for revisions. A plan rejected because of deficiencies shall receive a narrative report stating specific problems and the procedures for filing a revised plan.

8.12.5.4. Soil disturbing activities shall not begin and zoning permits shall not be issued without an approved SWP3 or ASWP3.

8.12.5.5. SWP3 for individual sublots in a subdivision will not be approved unless the larger common plan of development or sale containing the sublot is in compliance with this regulation.

8.12.5.6. Approvals issued in accordance with this regulation shall remain valid for one (1) year from the date of approval.

8.13. STORM WATER POLLUTION PREVENTION PLAN (SWP3)

8.13.1. In order to control sediment pollution of water resources and wetlands, the applicant shall submit a SWP3 in accordance with the requirements of this regulation.

8.13.2. The SWP3 shall be certified by a professional engineer, a registered surveyor, certified professional erosion and sediment control specialist, or a registered landscape architect.

8.13.3. The SWP3 shall incorporate measures as recommended by the most current edition of *Rainwater and Land Development* as published by the Ohio Department of Natural Resources and shall include the following information:

8.13.3.1. Site description: The SWP3 shall provide:

8.13.3.1.1. A description of the nature and type of the construction activity (e.g. residential, shopping mall, highway, etc.).

8.13.3.1.2. Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas).

8.13.3.1.3. An estimate of the impervious area and percent of imperviousness created by the soil-disturbing activity.

8.13.3.1.4. Existing data describing the soil and, if available, the quality of any known pollutant discharge from the site such as that which may result from previous contamination caused by prior land uses.

8.13.3.1.5. A description of prior land uses at the site.

8.13.3.1.6. An implementation schedule which describes the sequence of major soil-disturbing operations (i.e., grubbing, excavating, grading, utilities and infrastructure installation) and the implementation of erosion and sediment controls to be employed during each operation of the sequence.

8.13.3.1.7. The location and name of the immediate receiving stream or surface water(s) and the first subsequent receiving water(s).

8.13.3.1.8. The aerial (plan view) extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project.

8.13.3.1.9. For subdivided developments where the SWP3 does not call for a centralized sediment control capable of controlling multiple individual lots, a detail drawing of a typical individual lot showing standard individual lot erosion and sediment control practices.

8.13.3.1.10. Location and description of any storm water discharges associated with dedicated asphalt and dedicated concrete plants associated with the development area and the best management practices to address pollutants in these storm water discharges.

8.13.3.1.11. Site map showing:

8.13.3.1.11.1. Limits of soil-disturbing activity of the site, including off site spoil and borrow areas.

8.13.3.1.11.2. Soils types shall be depicted for all areas of the site, including locations of unstable or highly erodible soils.

8.13.3.1.11.3. Existing and proposed one-foot (1') contours. This must include a delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed in acres.

8.13.3.1.11.4. Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the applicant intends to fill or relocate for which the applicant is seeking approval from the Army Corps of Engineers and/or Ohio EPA.

8.13.3.1.11.5. Existing and planned locations of buildings, roads, parking facilities, and utilities.

8.13.3.1.11.6. The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during the course of site development.

8.13.3.1.11.7. Sediment ponds, including their sediment settling volume and contributing drainage area.

8.13.3.1.11.8. Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including Dumpster areas, areas designated for cement truck washout, and vehicle fueling.

8.13.3.1.11.9. The location of designated stoned construction entrances where the vehicles will ingress and egress the construction site.

8.13.3.1.11.10. The location of any in-stream activities including stream crossings.

8.13.4. Soils Engineering Report

8.13.4.1. The City Engineer may require the SWP3 to include a Soils Engineering Report based upon his/her determination that the conditions of the soils are unknown or unclear to the extent that additional information is required to protect against erosion or other hazards. This report shall be based on adequate and necessary test borings, and shall contain all the information listed below. Recommendations included in the report and approved by the City Engineer shall be incorporated in the grading plans and/or other specifications for site development.

8.13.4.1.1. Data regarding the nature, distribution, strength, and erodibility of existing soils.

8.13.4.1.2. If applicable, data regarding the nature, distribution, strength, and erodibility of the soil to be placed on the site.

8.13.4.1.3. Conclusions and recommendations for grading procedures.

8.13.4.1.4. Conclusions and recommended designs for interim soil stabilization devices and measures, and for permanent soil stabilization after construction is completed.

8.13.4.1.5. Design criteria for corrective measures when necessary.

8.13.4.1.6. Opinions and recommendations covering the stability of the site.

8.14. ABBREVIATED STORMWATER POLLUTION PREVENTION PLAN (ASWP3)

8.14.1. The ASWP3 shall be certified by a professional engineer, a registered surveyor, certified professional erosion and sediment control specialist, or a registered landscape architect.

8.14.2. The ASWP3 shall include a minimum of the BMPs found in Section 8.15. The City of Lebanon may require other BMPs as site conditions warrant.

8.14.3. Internal Inspection and Maintenance. All controls on the development area shall be inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period. Maintenance shall occur as detailed below:

8.14.3.1. When practices require repair or maintenance

8.14.3.1.1. If the internal inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment-settling pond, it must be repaired or maintained within three (3) days of the inspection. Sediment settling ponds must be repaired or maintained within ten (10) days of the inspection.

8.14.3.2. When practices fail to provide their intended function

8.14.3.2.1. If the internal inspection reveals that a control practice fails to perform its intended function and that another, more appropriate control practice is required, the ASWP3 must be amended and the new control practice must be installed within ten (10) days of the inspection.

8.14.3.3. When practices depicted on the ASWP3 are not installed

8.14.3.3.1. If the internal inspection reveals that a control practice has not been implemented in accordance with the schedule, the control practice must be implemented within ten (10) days from the date of the inspection. If the inspection reveals that the planned control practice is not needed, the record must contain a statement of explanation as to why the control practice is not needed.

8.14.3.4. Final Stabilization

8.14.3.4.1. Final stabilization shall be determined by the City Engineer.

8.15. EROSION AND SEDIMENTATION CONTROL BMPS

8.15.1. The following BMPs shall be implemented on any construction site as applicable. The City of Lebanon may require other BMPs as site conditions warrant.

8.15.1.1. Construction Entrances

8.15.1.1.1. Construction entrances shall be built and shall serve as the only permitted points of ingress and egress to the development area. These entrances shall be built of a stabilized pad of aggregate stone or recycled concrete or cement sized greater than 2" in diameter, placed over a geotextile fabric, and constructed in conformance with specifications in the most recent edition of the *Rainwater and Land Development Manual.*

8.15.1.2. Street Sweeping

8.15.1.2.1. Streets directly adjacent to construction entrances and receiving traffic from the development area, shall be cleaned daily to remove sediment tracked off-site. If applicable, the catch basins on these streets nearest to the construction entrances shall be cleaned weekly.

8.15.1.3. Temporary Stabilization

8.15.1.3.1. The development area shall be temporarily stabilized as detailed in the following table:

Table 28 – Temporary Stabilization

Area requiring stabilization	Time frame to apply erosion controls
Any disturbed area within 50 feet of a stream and not at final grade.	Within 2 days of the most recent disturbance if that area will remain idle for more than 21 days
For all construction activities, any disturbed area, including soil stockpiles, that will be dormant for more than 21 days but less than one year, and not within 50 feet of a stream.	Within 7 days of the most recent disturbance within the area
Disturbed areas that will be idle over winter	Prior to November 1.
Note: Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed. These techniques may include mulching or erosion matting.	

8.15.1.4. Topsoiling

8.15.1.4.1. The application of at least a minimum depth of topsoil may be required for those critical areas, such as within open channels and fill slopes, where glacial till material is left on the surface after final grading. Unweathered glaciated till is that material located approximately 30 inches to 40 inches below the soil surface, and can be found at the ground surface in highly eroded areas. The subgrade shall be raked and all rubbish, sticks, roots, and stones larger than 2-inch shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with topsoil.

8.15.1.4.2. Topsoil shall be evenly spread to a minimum depth of four (4) inches. All areas to be utilized for soil stockpiles shall be clearly identified on the approved erosion control plan. The topsoil stockpile shall be located so as not to interfere with site work, and shall be provided with adequate temporary erosion control measures according to those guidelines specified herein, and shown on the approved erosion control plan. Surface roughening must be completed to allow proper bonding of topsoil to the soil material below.

8.15.1.5. Mulching and Erosion Control Blankets

8.15.1.5.1. Application of mulching material immediately after temporary and permanent seeding will be required. Seed mixtures may be applied as part of a hydroseeder slurry containing wood fiber on slopes less than 4 (horizontal) to 1 (vertical), and less than 300 feet in length, or with straw mulch. Straw mulch and seeding is required to be placed the first 2 feet behind curbs.

8.15.1.5.2. Straw mulching shall be at a rate of 1.5 to 2 tons per acre, and shall be anchored utilizing nylon 1-inch square mesh netting installed according to manufacturer's recommendations, or a liquid binder. Binding of straw mulch may be accomplished as follows:

8.15.1.5.2.1. Any liquid asphalt or asphalt emulsion material that is thin enough to be adequately blown from spray equipment, applied at a rate of 0.10 gallon per square yard. Synthetic binders may be used as recommended by the manufacturer.

8.15.1.5.3. Installation of erosion control blankets according to manufacturer's specifications will be required within the flowline of all drainage swales, on all retention/detention pond banks and on all fill slopes of 4 (horizontal) to 1 (vertical) or steeper.

8.15.1.6. Sodding

8.15.1.6.1. Establishment of permanent vegetation by sodding will not generally be required by the City, except on basin side slopes. In those areas where the immediate establishment of permanent turf is deemed necessary, sodding will be an acceptable means of providing vegetative cover for erosion control. When placed within the flowlines of defined drainage ways, staking of sod to prevent undermining will be required. Sod in good condition must be placed on a roughened surface and kept watered for a minimum of two weeks. The preparation of areas to be sodded and the placement of sod shall conform to ODOT item 660.

8.15.1.7. Dumping and Unstable Water Banks

8.15.1.7.1. No soil, rock, debris, or any other material shall be dumped or placed into a water resource or into such proximity that it may readily slough, slip, or erode into a water resource unless such dumping or placing is authorized by the City Engineer, and, when applicable, the U.S. Army Corps of Engineers, for such purposes as, but not limited to, constructing bridges, culverts, and erosion control structures.

8.15.1.7.2. Unstable soils prone to slipping or landsliding shall not be graded, excavated, filled, or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

8.15.1.8. Cut and Fill Slopes

8.15.1.8.1. Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration shall be given to the length and steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization. The angle of vegetated cut and fill slopes shall not exceed 3 (horizontal) to 1 (vertical) unless a detailed slope stability plan is provided. Slope protection shall be provided by use of temporary and permanent diversion dikes, vegetative cover, and slope drains. Concentrated stormwater flow shall not be allowed to flow down cut or fill slopes without proper slope stabilization.

8.15.1.9. Stabilization of Channels and Outlets

8.15.1.9.1. All constructed channels and outlets associated with a development must be constructed so that they remain stable during all phases of the construction activities. All channel lining must be designed for construction and final conditions. Grass channel shall be limited to a maximum two percent slope under bare earth conditions. Natural channels should be left undisturbed whenever possible. If the minimum slope cannot be maintained then temporary ditch checks shall be constructed consisting of straw or hay bales or coarse aggregate to minimize erosion. Temporary ditch lining shall meet the requirements of ODOT Item 667, 668, or 670.

8.15.1.10. Outlet channel Protection

8.15.1.10.1. Concentrated stormwater runoff leaving a development site shall be discharged to an open channel, storm sewer pipe inlet or culvert that is capable of receiving this discharge. Runoff velocities shall be controlled during all storm events, up to the 100-year return interval storm, so that the peak runoff velocity during and after the completion of the land alteration approximates existing conditions.

8.15.1.11. Inlet Protection

8.15.1.11.1. Erosion and sediment control practices, such as boxed inlet protection, shall be installed to minimize sediment-laden water entering active storm drain systems. Straw or hay bales are not acceptable forms of inlet protection.

8.15.1.12. Temporary Sediment Traps/Basins

8.15.1.12.1. Concentrated stormwater runoff from disturbed areas flowing at rates that exceed the design capacity of sediment barriers**,** stormwater runoff from drainage areas that exceed the design capacity of sediment barriers and/or stormwater runoff from 10-acres of disturbed land shall pass through a sediment-settling facility. The sediment-settling pond shall provide both a sediment storage zone and a dewatering zone. The volume of the dewatering zone shall be at least 67 cubic yards of storage per acre of total contributing drainage area and have a minimum of 48-hour drain time for sediment basins serving a drainage area over 5 acres.

8.15.1.12.2. The volume of the sediment storage zone shall be calculated by one of the following methods:

8.15.1.12.2.1. The volume of the sediment storage zone shall be 1000 cubic feet per disturbed acre within the watershed of the basin.

8.15.1.12.2.2. The volume of the sediment storage zone shall be the volume necessary to store the sediment as calculated with a generally accepted erosion prediction model.

8.15.1.12.3. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity must be included unless runoff from these areas is diverted away from the sediment settling pond and is not comingled with sediment-laden runoff. The depth of the dewatering zone must be less than or equal to five (5) feet. The configuration between the inlets and the outlet of the basin must provide at least two units of length for each one unit of width (> 2:1 length: wide ratio), however a length to width ratio of 4:1 is recommended. Sediment must be removed from the sediment-settling pond when the design capacity has been reduced by 40 percent. This limit is typically reached when sediment occupies one-half of the basin depth. When designing sediment settling ponds, the applicant must consider public safety, especially as it relates to children, as a design factor for the sediment basin and alternative sediment controls must be used where site limitations would preclude a safe design. The use of a combination of sediment and erosion control measures in order to achieve maximum pollutant removal is encouraged.

8.15.1.12.4. The facility's storage capacity shall be sixty-seven cubic yards per acre of drainage area. Temporary sediment basins shall be constructed by methods described in ODOT Item 203 Excavation and Embankment or Item 601 Rock Channel Protection, Type C without filter. Sand or filter fabric may be required. The purpose for installation of temporary sediment traps/basins is to detain sediment-laden runoff from small disturbed areas for a length of time sufficient to allow the majority of sediment to settle out.

8.15.1.12.5. Temporary sediment traps, along with the other pertinent controls, shall be installed as shown on the approved erosion control plan prior to the initiation of any land disturbing activities. Sediment traps and basins shall be inspected routinely and after each rain event and shall be cleaned of sediment deposits and repaired as necessary to maintain their operating efficiency.

8.15.1.12.6. The ability of the contractor to install on-site soil stabilization and sedimentation practices such as temporary and permanent seeding, sediment barriers, and flow diversion in a timely manner may be used to determine the need for installation of sediment basins. Effective use of these other available erosion and sediment control practices within a defined construction sequence may be considered by the designer when evaluating potential site applications for sediment basins.

8.15.1.13. Silt fence

8.15.1.13.1. The purpose of fabric fencing is to intercept and retain sediment from disturbed areas of limited size and preventing this sediment from leaving the construction site. Sheet flow

runoff from denuded areas shall be intercepted by silt fence or diversions to protect adjacent properties, water resources, and wetlands from sediment transported via sheet flow Fabric fences may also be used to decrease the velocity of sheet flows and moderate velocity channel flows.

8.15.1.13.2. Where intended to provide sediment control, silt fence shall be placed on a level contour and shall be capable of temporarily ponding runoff.

8.15.1.13.3. The relationship between the maximum drainage area to silt fence for a particular slope range is shown in Table 29.

8.15.1.13.4. Table 29Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes. Such devices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres. Placing silt fence in parallel does not extend the permissible drainage area to the silt fence. See the following table for maximum drainage areas to silt fence.

Table 29 - Maximum Drainage Area to Silt Fence

Maximum Drainage Area (acres) to 100 linear feet of silt fence	Range of Slope for a drainage area (%)
0.5	<2%
0.25	≥ 2% but < 20%
0.125	≥ 20% but < 50%

8.15.1.13.5. Synthetic filter fabric barriers shall be provided with wooden or reinforcement bar stakes at a maximum spacing of six (6) feet for reinforced barriers and four (4) feet for non-reinforced barriers. The City may require the use of fence backed (reinforced) silt fencing.

8.15.1.13.6. Sediment barriers shall be inspected after each rainfall, and at least daily during periods of prolonged rainfall. Barriers that become decomposed or inoperable prior to the end of their effective use shall be promptly replaced.

8.15.1.13.7. Sediment deposits shall be removed upon reaching approximately one-half of the height of the barrier at its lowest point or if it causes a silt fence to bulge. Sediment should be deposited at a controlled fill area. During clean-out operations, the fence must not be undermined.

8.15.1.14. Diversions

8.15.1.14.1. Diversion terraces are temporary or permanent channels constructed with a ridge along their downstream side, placed across the slope, in order to reduce the slope length and intercept and divert stormwater runoff to a stabilized outlet.

8.15.1.14.2. Diversion terraces shall be installed where sheet flow must be diverted from disturbed areas so that permanent vegetation may be established, or where slope lengths must be reduced in order to prevent sheet, rill, and gully erosion.

8.15.1.14.3. Stabilization of all disturbed areas upstream of the diversion dike must be completed concurrently with installation of the diversion dike and flow channel.

8.15.1.14.4. The flow velocity of open channels may be determined utilizing Manning's equation. Permissible velocities are given in Table 30. Alternately, the designer can provide calculations to prove that the channel has been designed to be non-eroding.

Table 30 - Permissible Velocities for Diversions

Soil Texture	Bare Channel (FPS)	Fair Vegetative Cover (FPS)
Sand, Silt, Sandy Loam, Silty Loam	1.5	2.5
Silty Clay Loam, Sandy Clay Loam	2.0	3.5
Clay	2.5	4.5

8.15.1.14.5. Diversion channels shall be provided with adequate outlets that convey concentrated flow without erosion. This outlet may be provided as a properly stabilized developed stormwater conveyance channel, storm sewer pipe, or culvert.

8.15.1.14.6. The diversion channel, dike, stabilized upstream areas, and outlet channel shall be inspected after every rainfall. Sediment deposits shall be removed, damaged and eroded areas repaired, and reseeding accomplished within either twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.15. Riprap/Rock Channel Protection

8.15.1.15.1. The installation of rock riprap provides a permanent, erosion-resistant ground cover through use of large, loose, angular stone. Note that approved commercial products may be used in place of rock riprap where applicable.

8.15.1.15.2. Rock riprap shall be required by the City as a means of protecting the soil surface from the erosive forces of concentrated stormwater runoff, as a sediment filtering device, and as a means of stabilizing eroding stream banks and slopes with seepage problems and/or non-cohesive soils. Some examples of where rock riprap may be utilized would include at storm sewer outlets, at culvert ends, on channel banks and/or bottoms, within roadside ditches, as temporary sediment barriers, as rock chute structures, and for slope stabilization.

8.15.1.15.3. Placement of the rock riprap must follow immediately after installation of the filter fabric layer, and a dense, well-graded mass of stone with minimal voids must be produced. Riprap shall be placed to its full thickness in one operation, avoiding the segregation of the various stone sizes.

8.15.1.15.4. With the approval of the City Engineer, crushed, discarded concrete may be an acceptable alternative to rock riprap provided it is well graded, a density adjustment is made, and it meets all other requirements of this policy. The minimum thickness of the riprap layer shall be no less than 6 inches. Temporary rock check dams will be accepted as sediment barriers within minor drainage channels that drain to abutting off-site properties and/or drainage facilities, in minor swales and ditch lines that have been rough graded, around activated storm sewer inlets, and at the outlet ends of storm sewer pipes.

8.15.1.15.5. Rock riprap installations shall be inspected after every rainfall to determine if high flows have caused undermining, or if stones have been dislodged. Needed repairs shall be accomplished within twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.16. Temporary Stream Crossings

8.15.1.16.1. Due to the potential for significant erosion and sediment suspension, construction activities in and around streams shall be kept to a minimum. Streams including bed and banks shall be restabilized immediately after in-channel work is completed, interrupted, or stopped. To the extent practicable, construction vehicles shall be kept out of streams. Where in-channel work is necessary, precautions shall be taken to restabilize the work area during

construction to minimize erosion. If a live (wet) steam must be crossed by construction vehicles during construction, a temporary stream crossing shall be provided.

8.15.1.16.2. The purpose of temporary stream crossings is to provide a means for construction traffic to cross-flowing streams without damage to the channel or banks, and to keep sediment generated by construction traffic out of the stream.

8.15.1.16.3. Multiple culvert installations shall be approved on a case basis, provided the minimum pipe diameter proposed is eighteen (18) inches, and sufficient space is provided between culverts to allow for soil compaction.

8.15.1.16.4. Culverts shall have a slope greater than or equal to the stream bed being crossed, and extend the full width of the crossing, including side slopes.

8.15.1.16.5. Temporary stream crossings shall be inspected after every rainfall, and at least weekly for assessment of damages due to stormwater flows or construction equipment. Necessary repairs shall be accomplished within twenty-four (24) hours, or as soon as the soil dries sufficiently to allow work to proceed.

8.15.1.17. Non-Structural Preservation Measures

8.15.1.17.1. The ASWP3 or SWP3 must make use of practices that preserve the existing natural condition to the maximum extent practicable. Such practices may include preserving riparian areas, preserving existing vegetation and vegetative buffer strips, phasing of construction operations in order to minimize the amount of disturbed land at any one time, and designation of tree preservation areas or other protective clearing or grubbing practices.

8.15.1.18. Non-Sediment Pollution Controls

8.15.1.18.1. No solid or liquid waste, including building materials, shall be discharged in storm water runoff. The applicant must implement site Best Management Practices (BMPs) to prevent toxic materials, hazardous materials or other debris from entering water resources or wetlands. These practices shall include but are not limited to the following:

8.15.1.18.1.1. Waste Materials: A covered Dumpster shall be made available for the proper disposal of garbage, plaster, drywall, grout, gypsum, and other water materials.

8.15.1.18.1.2. Concrete Truck Wash Out: The washing of concrete material into a street, catch basin, or other public facility or natural resource id prohibited. A designated area for concrete washout shall be made available.

8.15.1.18.1.3. Fuel/Liquid Tank Storage: All fuel/liquid tanks and drums shall be stored in a marked storage area. A dike shall be constructed around this storage area with a minimum capacity equal to 110% of the volume of all containers in the storage area.

8.15.1.18.1.4. Toxic or Hazardous Waste Disposal: Any toxic or hazardous waste shall be disposed of properly.

8.15.1.18.1.5. Contaminated Soils Disposal and Runoff: Contaminated soils from redevelopment sites shall be disposed of properly. Runoff from contaminated soils shall not be discharged from the site. Proper permits shall be obtained for development projects on solid waste landfill sites or redevelopment sites.

8.15.1.19. Permanent Stabilization

8.15.1.19.1. Disturbed areas must be stabilized as specified in the following table:

Table 31 - Permanent Stabilization

Area requiring permanent stabilization	Time frame to apply erosion controls
Any area that will lie dormant for one year or more.	Within 7 days of the most recent disturbance.
Any area within 50 feet of a stream and at final grade.	Within 2 days of reaching final grade.
Any area at final grade.	Within 7 days of reaching final grade within that area.

8.15.1.20. Permanent stabilization of conveyance channels

8.15.1.20.1. Applicants shall undertake special measures to stabilize channels and outfalls and prevent erosive flows. Measures may include seeding, dormant seeding, mulching, erosion control matting, sodding, riprap, natural channel design with bioengineering techniques, or rock check dams, all as defined in the most recent edition of *Rainwater and Land Development* or the Field Office Technical Guide available at www.nrcs.usda.gov/technical/efotg/.

8.16. EROSION AND SEDIMENTATION CONTROL PERFORMANCE STANDARDS

8.16.1. The SWP3 or ASWP3 must contain a description of the controls appropriate for each construction operation and the applicant must implement such controls. The SWP3 or ASWP3 must clearly describe for each major construction activity the appropriate control measures; the general sequence during the construction process under which the measures will be implemented; and the contractor responsible for implementation (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization). The SWP3 or ASWP3 shall identify all subcontractors engaged in activities that could impact storm water runoff. The SWP3 or ASWP3 shall contain signatures from all of the identified subcontractors indicating that they have been informed and understand their roles and responsibilities in complying with the SWP3 or ASWP3.

8.16.2. General Regulations

8.16.2.1. All development activity greater than 0.10 acre shall be provided with erosion and sedimentation control devices during all phases of construction. Development activity less than or equal to 0.10 acres may be required to have erosion and sedimentation control provided during all construction phases if determined to be necessary by the City Engineer.

8.16.2.1.1. All developments requiring erosion and sedimentation control shall post an Erosion and Sedimentation Control Bond with the City of Lebanon as described in Section 2.10 of this Manual.

8.16.2.2. No construction or other development activity such as grading, cutting, or filling for site development shall be started or continued unless erosion and sedimentation control devices have been installed and maintained to the satisfaction of the City Engineer.

8.16.2.3. All roadways shall be kept clean of mud, dirt, gravel, and debris. Any debris in the roadway shall be promptly cleaned.

8.16.2.4. All erosion control measures shall be maintained throughout construction and after construction activities have been completed until final sustainable cover has been established.

8.16.2.5. Stormwater discharges that are released to natural channels shall be at non-erosive velocities unless the channel is stabilized or otherwise able to withstand higher velocities, as determined by the City Engineer.

8.16.2.6. As delineated in Sections 8.13. and 8.14., a SWP3 or ASWP3 plan shall be submitted to the City Engineer, which incorporates current BMPs for construction site runoff control.

8.16.2.7. Truck washout facility for mud on tires, etc shall be required for all construction sites unless otherwise approved by the City Engineer.

8.16.3. Runoff Control Practices

8.16.3.1. The SWP3 or ASWP3 shall incorporate measures that control the flow of runoff from disturbed areas so as to prevent erosion. Such practices may include rock check dams, pipe slope drains, diversions to direct flow away from exposed soils and protective grading practices. These practices shall divert runoff away from disturbed areas and steep slopes where practicable.

8.16.4. Sediment Control Practices

8.16.4.1. The SWP3 or ASWP3 shall include a description of, and detailed drawings for, all structural practices that shall store runoff, allowing sediments to settle and/or divert flows away from exposed soils or otherwise limit runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, silt fences, storm drain inlet protection, and earth diversion dikes or channels which direct runoff to a sediment settling pond. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless used in conjunction with a sediment settling pond.

8.16.5. Surface Waters of the State protection

8.16.5.1. Construction vehicles shall avoid water resources and wetlands. If the applicant is permitted to disturb areas within 50 feet of a water resource or wetland, the following conditions shall be addressed in the SWP3:

8.16.5.1.1. All BMPs and stream crossings shall be designed as specified in the most recent edition of the Rainwater and Land Development Manual.

8.16.5.1.2. Structural practices shall be designated and implemented on site to protect water resources or wetlands from the impacts of sediment runoff.

8.16.5.1.3. No structural sediment controls (e.g., the installation of silt fence or a sediment settling pond in-stream) shall be used in a water resource or wetland.

8.16.5.1.4. Where stream crossings for roads or utilities are necessary and permitted, the project shall be designed such that the number of stream crossings and the width of the disturbance are minimized.

8.16.5.1.5. Temporary stream crossings shall be constructed if water resources or wetlands will be crossed by construction vehicles during construction.

8.16.5.1.6. Construction of bridges, culverts, or sediment control structures shall not place soil, debris, or other particulate material into or close to the water resources or wetlands in such a manner that it may slough, slip, or erode.

8.16.6. Modifying controls

8.16.6.1. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the applicant shall replace or modify the control for site conditions.

8.16.7. Compliance With Other Requirements

8.16.7.1. The SWP3 shall be consistent with applicable State and/or local waste disposal, sanitary sewer, or septic system regulations, including provisions prohibiting waste disposal by open burning, and shall provide for the proper disposal of contaminated soils located within the development area.

8.16.8. Trench And Ground Water Control

8.16.8.1. There shall be no sediment-laden or turbid discharges to water resources or wetlands resulting from dewatering activities. If trench or ground water contains sediment, it must pass through a sediment-settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water dewatering which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

8.16.9. Internal Inspections

8.16.9.1. All controls on the site shall be inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period. The inspection frequency may be reduced to at least once every month if the entire site is temporarily stabilized or runoff is unlikely due to weather conditions (e.g., site is covered with snow, ice, or the ground is frozen). A waiver of inspection requirements is available until one month before thawing conditions are expected to result in a discharge if prior written approval has been attained from the City Engineer and all of the following conditions are met:

8.16.9.1.1. The project is located in an area where frozen conditions are anticipated to continue for extended periods of time (i.e. more than one (1) month).

8.16.9.1.2. Land disturbance activities have been suspended, and temporary stabilization is achieved.

8.16.9.1.3. The beginning date and ending dates of the waiver period are documented in the SWP3.

8.16.9.2. The applicant shall assign qualified inspection personnel to conduct these inspections to ensure that the control practices are functional and to evaluate whether the SWP3 is adequate, or whether additional control measures are required. Qualified inspection personnel are individuals with knowledge and experience in the installation and maintenance of sediment and erosion controls. These inspections shall meet the following requirements:

8.16.9.2.1. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for, pollutants entering the drainage system.

8.16.9.2.2. Erosion and sediment control measures identified in the SWP3 shall be observed to ensure that they are operating correctly. The applicant shall utilize an inspection form provided by the City of Lebanon or an alternate form acceptable to the City Engineer. The inspection form shall include:

8.16.9.2.2.1. The inspection date.

8.16.9.2.2.2. Names, titles and qualifications of personnel making the inspection.

8.16.9.2.2.3. Weather information for the period since the last inspection, including a best estimate of the beginning of each storm event, duration of each storm event and approximate amount of rainfall for each storm event in inches, and whether any discharges occurred.

8.16.9.2.2.4. Weather information and a description of any discharges occurring at the time of the inspection.

8.16.9.2.2.5. Locations of:

8.16.9.2.2.5.1. Discharges of sediment or other pollutants from site.

8.16.9.2.2.5.2. BMPs that need to be maintained.

8.16.9.2.2.5.3. BMPs that failed to operate as designed or proved inadequate for a particular location.

8.16.9.2.2.5.4. Where additional BMPs are needed that did not exist at the time of inspection.

8.16.9.2.3. Corrective action required including any necessary changes to the SWP3 and implementation dates.

8.16.9.2.4. Discharge locations shall be inspected to determine whether erosion and sediment control measures are effective in preventing significant impacts to the receiving water resource or wetlands.

8.16.9.2.5. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking.

8.16.9.2.6. The applicant shall maintain for three (3) years following final stabilization the results of these inspections, the names and qualifications of personnel making the inspections, the dates of inspections, major observations relating to the implementation of the SWP3, a certification as to whether the facility is in compliance with the SWP3, and information on any incidents of non-compliance determined by these inspections.

8.16.10. Maintenance

8.16.10.1. The SWP3 shall be designed to minimize maintenance requirements. All control practices shall be maintained and repaired as needed to ensure continued performance of their intended function until final stabilization. All sediment control practices must be maintained in a functional condition until all up slope areas they control reach final stabilization. The applicant shall provide a description of maintenance procedures needed to ensure the continued performance of control practices and shall ensure a responsible party and adequate funding to conduct this maintenance, all as determined by the City Engineer.

8.16.10.1.1. When inspections reveal the need for repair, replacement, or installation of erosion and sediment control BMPs, the following procedures shall be followed:

8.16.10.1.1.1. When practices require repair or maintenance

8.16.10.1.1.1.1. If an internal inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment-settling pond, it must be repaired or maintained within three (3) days of the inspection. Sediment settling ponds must be repaired or maintained within ten (10) days of the inspection.

8.16.10.1.1.2. When practices fail to provide their intended function

8.16.10.1.1.2.1. If an internal inspection reveals that a control practice fails to perform its intended function as detailed in the SWP3 and that another, more appropriate control practice is required, the SWP3 must be amended and the new control practice must be installed within ten (10) days of the inspection.

8.16.10.1.1.3. When practices depicted on the SWP3 are not installed

8.16.10.1.1.3.1. If an internal inspection reveals that a control practice has not been implemented in accordance with the schedule, the control practice must be implemented within ten (10) days from the date of the inspection. If the internal inspection reveals that the planned control practice is not needed, the record must contain a statement of explanation as to why the control practice is not needed.

8.17. STORMWATER QUALITY BMP MAINTENANCE REQUIREMENTS

8.17.1. Stormwater quantity provisions and stormwater quality BMPs that are constructed on privately-owned land shall be maintained by a Homeowners Association or if no Homeowner's Association is established, the owner of the subject property. In the case of a TIF property, the provisions

shall be maintained by the building owner. The following requirements shall be met for all stormwater quantity provisions and stormwater quality BMPs that have been constructed on privately-owned property.

8.17.2. Minimum maintenance requirements

8.17.2.1. At a minimum, the following maintenance requirements found in the following two tables shall be performed on all BMPs:

Table 32 - Preventive BMP Maintenance Schedule for Typical Routine Tasks

BMP Structure Type	Routine Task	Frequency
Wet Ponds/Dry Ponds/Infiltration Basins/Infiltration Trenches	Remove Trash/Debris for BMP and contributing area	Quarterly
	Mow to 6”-8” grass height	Quarterly
	Remove wood vegetation from dam and banks	Spring/Fall
	Stabilize/Revegetate side areas	As needed
	Repair embankment and side slopes	As needed
	Fill animal burrows	ASAP
Wet Pond	Lubricate mechanical components	Annually
Bioretention Cells	Remove Trash/Debris from contributing area	Quarterly
	Ensure contributing areas are not sources of vehicle fluids	Quarterly
	Stabilize/Revegetate cell area	Quarterly
	Replace mulch layer	Annually or as needed
	Stabilize/Revegetate contributing areas	As needed

Table 33 - BMP Preventive Maintenance Schedule for Typical Non-Routine Tasks

BMP Structure Type	Task	Frequency
Wet Ponds	Remove accumulated sediment/pollutants	5-15 years
	Replace mechanical components	20 yrs
	Reconstruct spillways and embankments	20-50 years
	Control algae	When Identified
	Remove noxious weeds	When Identified
	Repair fencing	When Identified
Dry Ponds/Infiltration Trenches	Remove accumulated sediment/pollutants	2-10 years
	Dethatch grass to remove sediment buildups	2 years
	Aerate compacted area to promote infiltration	2-3 years
	Replace components, reconstruct embankments	20-50 years
Infiltration Basins/Infiltration Trenches	Remove/replace top 6" of gravel	2 years
	Remove accumulated sediment from main cells	20 years
Bioretention Cells	Removed accumulated sediments	1-2 years
	Remove and replace top few inches of mulch/media	1-2 years
	Replace filter media, replace underdrains	20 years

8.17.3. Maintenance Covenants

8.17.3.1. Prior to approval of a Final Plat for an Subdivision/PUD and/or the issuance of an Occupancy Permit for any building within a permitted development served by stormwater quantity detention and retention basins and stormwater quality BMPs, the applicant or owner of the stormwater quantity provisions and stormwater quality BMPs shall establish a formal Maintenance Covenant approved by the City of Lebanon and recorded in the Warren County Recorder's Office in which the owner acknowledges the duty of the owner and all subsequent owners of the property to maintain the stormwater quantity provisions and stormwater quality BMPs in accordance with the terms of the covenant.

8.17.3.1.1. For existing facilities, copies of recorded maintenance covenants shall be provided by the responsible entity to the City within 90 days from a written request of the City of Lebanon.

8.17.3.2. Maintenance Covenants shall also specify the Homeowners Association or other party responsible for maintenance of the stormwater quantity provisions and stormwater quality BMPs. A Homeowners Association or similar legal entity has the power to compel contributions from residents of a development to cover their proportionate shares of the costs associated with stormwater quantity provision and stormwater quality BMP maintenance.

8.17.3.3. A maintenance plan, schedule, and responsible party contact information shall be provided to the City when the copy of the recorded covenant is provided to the City.

8.17.4. Requirements for the Maintenance Covenants

8.17.4.1. Stormwater quantity provisions and stormwater quality BMPs shall be periodically inspected as described in the Maintenance Covenant to identify maintenance and repair needs and to ensure compliance with the requirements of these regulations. Any identified maintenance and/or repair needs shall be addressed in a timely manner.

8.17.4.2. The inspection and maintenance requirement may be increased as deemed necessary by the Office of the City Engineer to ensure proper functioning of the stormwater quantity provisions and stormwater quality BMPs.

8.17.5. Records of Installation and Maintenance Activities

8.17.5.1. Parties responsible for the inspection, operation, and maintenance of a stormwater quantity provisions and stormwater quality BMPs shall make records of the installation of all the maintenance and repairs and shall retain the records for at least five years. Those records shall be made available to the Office of the City Engineer upon request and/or as specifically outlined in the Maintenance Covenant.

8.17.6. Failure to Maintain Practices

8.17.6.1. It is unlawful for a property owner to fail to meet the requirements of the Maintenance Covenant. Any person or association that fails to meet the requirements of the Maintenance Covenant shall be subject to a civil penalty payable to the City of Lebanon as defined in Section 931 of the City of Lebanon Codified Ordinances Each day that the violation continues shall constitute a separate violation.

8.17.6.2. No penalties shall be assessed until the person alleged to be in violation has been notified in writing of the violation by registered or certified mail, return receipt requested, or by other means which are reasonably calculated to give actual notice.

8.17.6.3. The notice shall describe the nature of the violation with reasonable particularity, specify a reasonable time period within which the violation must be corrected, and warn that failure to correct the violation within the time period will result in assessment of a civil penalty or other enforcement action.

8.17.6.4. In the event that a stormwater quantity provisions and stormwater quality BMPs becomes a danger to public safety or public health, the City of Lebanon, after reasonable notice as described above, may seek a mandatory or prohibitory injunction and order of abatement commanding the property owner to correct a violation of the design criteria standards or maintenance needs contained in the Maintenance Covenants by performing all necessary work to place the stormwater quantity provisions and stormwater quality BMPs in proper working condition.

8.17.6.5. If the property owner fails to take corrective action as ordered by the Court, the City of Lebanon may seek an order holding the property owner in contempt of court and for authority to execute the order of abatement by taking the corrective action. If the City of Lebanon executes the order of abatement it shall have a lien upon the property for the cost of executing the order of abatement.

8.18. DEDICATION OF EASEMENTS AND RIGHTS-OF-WAY

8.18.1. The applicant shall, at no expense to the City, convey drainage easements or rights-of-way required in the Stormwater Regulations for the public stormwater facilities within the development.

8.18.2. The owner or applicant shall secure the offsite drainage easements required by the Stormwater Regulations when a proposed drainage system will carry water across private land outside the development.

8.18.3. When a development is bisected by a watercourse or open channel, the applicant shall provide a drainage easement, or right-of-way, conforming substantially to the alignment of such watercourse or open channel, and of the minimum width indicated in Paragraph 8.18.6. below.

8.18.4. Easements and rights-of-way shall include suitable access for maintenance equipment from public rights-of-way as specified herein.

8.18.5. All drainage easements, both on and off-site, shall be recorded on a final plat or other separate recorded document approved by the City.

8.18.6. Outfall ditches and channels shall have sufficient rights-of-way and/or easements for the facility itself and an unobstructed and approved maintenance access way on one or both sides. The access way portion of said rights-of-way and/or easements shall connect to a public right-of-way or easement in ways sufficient to allow for suitable access by maintenance equipment. The total width of said easements shall be the width of the facility in addition to the amount determined from the criteria given in Table 34.

Table 34 - Minimum Easement Requirements

Ditch Or Channel Top Of Bank Width	Minimum Maintenance Easement Required
Less than 16 feet	20 feet one side
16 feet to 32 feet	20 feet both sides
32 feet to 55 feet	20 feet one side and 30 feet opposite side
Over 55 feet	30 feet both sides

8.18.7. Detention/retention facilities, stilling basins, ponds or other drainage related structures or facilities shall have sufficient rights-of-way and/or easements for the facility itself and its maintenance, and an unobstructed and approved maintenance access way that connects to a public right-of-way or easement in ways sufficient to allow for suitable access by maintenance equipment, including sufficient space at cul-de-sacs for turning maintenance vehicles around.

8.18.8. Where the right-of-way and/or easement is provided for access only, the minimum width shall be 20 feet, or wider if deemed necessary by the City Engineer.

8.18.9. Responsibility for the private maintenance of all such facilities shall be delineated in a legally binding document which shall be approved by the City Engineer prior to granting record plat approval.

8.18.10. Maintenance access ways shall be sloped at 1/4-inch per foot across their entire width, or crowned at the centerline and sloped at 1/4-inch per foot in both directions.

8.18.11. A 20-foot minimum easement centered on a storm sewer shall be conveyed to the City when the storm sewer is not located within dedicated rights-of-way. Such easements shall cross or be connected to public rights-of-way in ways that will allow suitable access by maintenance equipment.

8.18.12. Overland flood routing paths shall be used to convey stormwater runoff from the 100-year, 24-hour storm event to an adequate receiving water body, stormwater system or stormwater detention basin such that the runoff is contained within an easement for the flood routing path and does not cause flooding of residential or commercial buildings or related structures. When designing the flood routing paths, the conveyance capacity of the area's storm sewers shall be taken into consideration.

8.19. ACCEPTANCE OF STORMWATER IMPROVEMENTS

8.19.1. Subsequent to satisfying the requirements of the Stormwater Regulations, other applicable ordinances, and the issuance of appropriate permits and/or approvals, the applicant shall,

immediately prior to and during construction, arrange for and schedule the following inspections by the City:

8.19.1.1. During clearing operations and early excavation activities to assure that effective control practices relative to erosion and sedimentation are being followed.

8.19.1.2. All public underground conveyance and control structures prior to backfilling, and all taps of private underground conveyance systems into public conveyance systems.

8.19.1.3. Final inspection when all public systems required under the approved Site stormwater management plan have been installed. Prior to final acceptance, a video inspection in accordance with the requirements set forth in Section 2.13. of all storm sewer pipe and structures shall be conducted at the Contractor's expense by a professional inspection firm. Copies of all video and written reports shall be provided to the City of Lebanon for review and approval prior to the acceptance of the improvements or the release of bonds.

8.19.2. The Professional Engineer for the project shall submit a signed and sealed set of as-built plans, on electronic disk and in reproducible form on Mylar brand polyester film drawing sheets, certifying that the system has been constructed as designed, and that it satisfies all conditions of the site stormwater management plan. Where changes have been made which deviate from the approved construction plans for the stormwater management system, the Professional Engineer shall submit supporting documentation along with the as-built plans that proves, to the satisfaction of the City Engineer, that the stormwater system is in compliance with the Stormwater Regulations. All as-built plans shall be in accordance with the current City of Lebanon As-Built Drawing Requirements.

8.19.3. Maintenance and compliance inspections of stormwater management systems will also be conducted on a routine, periodic, or random basis as deemed appropriate by the City or other agency(s) having jurisdiction, or as complaints arise concerning the system. By seeking and obtaining plan approval under the Stormwater Regulations, the owner/applicant and his/her/their contractor shall be deemed to have consented to such inspections by the City and/or other appropriate regulatory agencies or departments, upon presentation of proper identification by their representative(s) conducting the inspections.

8.19.4. Public improvements, in the form of public stormwater conveyance and control systems, may be accepted for public use after the following minimum conditions have been met:

8.19.4.1. The applicant shall provide to the City Engineer proof of security as required by the City Engineer;

8.19.4.2. The applicant shall provide to the City Engineer as-built plans according to Paragraph 8.19.2. of the Stormwater Regulations; and

8.19.4.3. The as-built plans have been reviewed and approved by the City Engineer.

8.19.5. Private improvements in the form of private stormwater conveyance and control systems may be approved for use after the following minimum conditions have been met:

8.19.5.1. The applicant shall provide to the City Engineer as-built plans according to Paragraph 8.19.2. of the Stormwater Regulations; and

8.19.5.2. The as-built plans have been reviewed and approved by the City Engineer. Until said as-built plans have been approved, no conditional occupancy or final occupancy permit shall be issued.

8.19.5.3. No act of review, approval, permitting, inspection(s), or the like, including associated activities shall be construed as acceptance of private improvements by the City.

8.20. MAINTENANCE RESPONSIBILITY

8.20.1. The installed stormwater management system shall be maintained by the legal entity responsible for maintenance. All site stormwater management plan applications shall contain documentation sufficient to demonstrate that the operation and maintenance entity is the legal entity empowered and obligated to perpetually maintain the stormwater management facilities. The City considers the following entities acceptable to operate and maintain stormwater management facilities:

8.20.1.1. Local governmental units, including the county, municipalities, or Municipal Service Taxing Units;

8.20.1.2. Non-profit corporations, including homeowners associations, property owners associations or condominium owners associations, under certain conditions which ensure that the corporation has the financial, legal, and administrative capability to provide for the long-term operation and maintenance of the facilities.

8.20.2. The property owner or developer is normally not acceptable as a responsible entity, especially when the property is to be sold to various third parties. However, the property owner or developer may be acceptable under one of the following circumstances:

8.20.2.1. Said applicant wholly owns the property and the ownership is intended to be retained. This would apply to a farm, corporate office, or single industrial facility, for example.

8.20.2.2. The ownership of the property is retained by the applicant and is either leased to third parties (such as in some shopping centers), or rented to third parties (such as in some mobile home parks), for example.

8.20.3. It is the policy of the City of Lebanon that all stormwater quality BMPs and all stormwater detention facilities shall be maintained by the property owner or other approved and legally empowered entity as defined in Paragraph 8.20.1. The City maintains an inventory of all such BMPs and detention facilities and performs regular inspections thereof. If, in the course of said inspections, it is determined that any such stormwater quality assurance facility is not performing as originally designed, the City Engineer shall issue an order requiring the responsible person or entity to make whatever repairs are necessary to restore it to function as originally intended.

8.20.4. The following statements shall be added to all construction plans and plats:

8.20.4.1. "The City of Lebanon assumes no legal obligation to maintain or repair any stormwater detention/retention facilities, open drainage ditches, or open channels, areas designated as "drainage easements", stormwater quality provisions, or BMPs. The easement area of each lot and all improvements within it shall be maintained continuously by the lot owner. Within the easements, no structure, planting, fencing, culvert, or other material shall be placed or permitted to remain which may obstruct, retard, or divert the flow through the watercourse."

8.20.4.2. In the case of a development with a Homeowner's Association:

8.20.4.2.1. "Detention/retention & stormwater quality structures and facilities shall be maintained in perpetuity by the Homeowner's Association."

8.20.4.3. In the case of a development or property without a Homeowner's Association:

8.20.4.3.1. "Detention/retention & stormwater quality structures and facilities shall be maintained in perpetuity by the lot owners of the development."

8.20.5. Public improvements shall have adequate easements, in accordance with Paragraph 8.17., to permit the City to inspect and, if necessary, to take corrective action shall the responsible legal entity fail to maintain the system properly.

8.20.6. Maintenance of stormwater facilities shall allow the stormwater management system to function and perform as originally designed and permitted by the City, other appropriate governmental agencies, and as set forth in the site stormwater management plan.

8.20.7. Maintenance shall comply with City building and construction codes, and all other applicable codes and regulations.

8.20.8. Enforcement of these maintenance responsibilities shall be subject to the provisions of Paragraph 8.22., ENFORCEMENT and to Paragraph 8.23., PENALTIES.

8.21. WATERCOURSE PROTECTION

8.21.1. Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property reasonably free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse. The owner or lessee shall not remove healthy bank vegetation beyond that actually necessary for maintenance, nor remove said vegetation in such a manner as to increase the vulnerability of the watercourse to erosion

8.22. ENFORCEMENT

8.22.1. If at any time the City Engineer determines that the project is not in accordance with the approved site stormwater management plan, or if any project subject to the Stormwater Regulations is carried out without an approved plan, the City Engineer is authorized to take corrective action.

8.22.1.1. In the event of performing a project subject to the Stormwater Regulations without an approved plan, give the owner, person(s) in possession, or other applicable legal entity, written notice of the corrective action required. Should the owner/legal entity fail to complete such corrective action within 15 days of the date of the notice, the City Engineer may enter upon the property, take the necessary corrective action, bill the violator for the cost thereof and, if the bill is not paid within 90 days, file a lien against the property for the cost of such corrective action.

8.22.1.2. With or without an approved plan, take appropriate corrective action in the event of an emergency situation determined by the City Engineer to exist that endangers persons, property, or both.

8.22.1.3. In the event of noncompliance with an approved plan, issue written notice to the applicant/owner/legal entity specifying the nature and location of the alleged noncompliance, with a description of the remedial actions necessary to bring the project into compliance within five working days.

8.22.2. Failure to comply with any of these enforcement provisions, including failure to complete the prescribed remedial work within the specified time, shall result in the issuance of a stop-work order directing the applicant, owner, or person(s) in possession to cease and desist all or any portion of development work in the area that violates the provisions of the Stormwater Regulations. The applicant shall then bring the project into compliance with the Stormwater Regulations before said stop work order is released and development work can proceed on the project

8.22.3. Failure to carry out the provisions of the maintenance commitment plan portion of the site stormwater management plan during and after completion of construction activities, shall result in the same enforcement sanctions prescribed in Paragraphs 8.22.1. through 8.22.1.2.

8.23. PENALTY

8.23.1. Whoever violates any provisions of this section is subject to penalties as described in the City of Lebanon codified Ordinances.