410.010 Jurisdiction

The rules and regulations governing plats of subdivisions of land, ~~and~~ lot splits**, and lot combinations** contained herein shall apply within the corporate limits of the City of Republic in accordance with the provisions of Section 89.400, RSMo.

410.020 Definitions

For the purpose of interpreting these regulations, certain words and terms are defined as follows:

ADOPTED PLANS

Any plans, maps, or supporting documentation adopted by the City Council as ordinance(s).

ALLEY

A passage or way affording generally a secondary means of vehicular access to the back or side of abutting properties and is not intended for general traffic circulation.

AS-BUILT PLANS

A plan representing the construction of the actual infrastructure built within the subdivision as it relates to the approved construction plans as well as serving as official public notice of all finish floor elevations.

BLOCK

A tract of land entirely surrounded by public highways, streets, waterways or railway rights-of-way, etc., or any combination thereof.

BUILDING OFFICIAL

The Building Official of the City of Republic, Missouri, or whomever shall be designated as building official.

BUILDS DEPARTMENT ADMINISTRATOR

The Administrator of the BUILDS Department of the City of Republic, Missouri.

CITY

The City of Republic, Missouri.

CITY COUNCIL

The City Council of the City of Republic, Missouri.

CITY ENGINEER

The City Engineer of **the City of** Republic, Missouri, or whomever shall be designated as engineer.

COMPREHENSIVE PLAN

The Comprehensive or Master Plan of the City of Republic, Missouri, whether in whole or in part, as adopted by the Republic Planning **and Zoning** Commission and the City Council and duly recorded by the office of the County Recorder of Greene County.

CITY INSPECTOR

The Construction Inspector of the City of Republic, Missouri, or whomever shall be designated as construction inspector.

COUNTY

Greene County, Missouri.

COUNTY CLERK
The office of the Greene County Clerk.

CUL-DE-SAC
A short street having one (1) end open to traffic and being terminated at the other end by a vehicular turnaround.

DEVELOPER
See "Subdivider".

DEVELOPER'S AGREEMENT
Agreement between the City of Republic and Developer entered into by City Council.

DIGITAL COPY

A Portable Document Format (PDF) file providing an electronic image of text of text and graphic that looks like a printed document and can be viewed, printed, and electronically transmitted.

EASEMENT
A grant by the property owner of the use, for a specific purpose or purposes, of a strip of land by the general public, utility companies or private individuals.

IMPROVEMENTS
Grading, street surfacing, curbs and gutters, sidewalks, crosswalks, culverts, bridges, water, sanitary and storm sewers, lines, and other utilities, and other required features.

LOT
A parcel of land occupied or intended for occupancy by a building or an integrated group of buildings and uses customarily incidental, including such open spaces as are required by the Zoning Code.

OPEN SPACE, PUBLIC
Land which may be dedicated or reserved for acquisition for general use by the public, including parks, recreation areas, school sites, community or public building sites, and other such areas that shall be deemed necessary.

PLANNING COMMISSION
The City Planning **and Zoning** Commission of Republic, Missouri.

PLANNING COMMISSION REPRESENTATIVE
The ~~City~~ **Principal** Planner, or his/her designee, in matters pertaining to the subdivision of land.

PLAT, FINAL
A complete and exact subdivision plat prepared for official recording as required by Statute and ordinances of the City of Republic to define property boundaries ~~and proposed streets and improvements~~**necessary for the transfer of title by lot and dedication of streets and easements.**

PLAT, PRELIMINARY
A preliminary plat for a subdivision shall **consist of preliminary survey plan and a preliminary engineering plan and shall meet the requirements herein.**~~be a formal plan, drawn to scale, indicating prominent existing features of a tract and its surroundings and the general layout of the proposed subdivision and shall meet the requirements herein.~~

PRE-APPLICATION SKETCH
A general drawing or sketch and discussion showing the general layout and characteristics of the proposed subdivision.

PRELIMINARY ENGINEERING PLAN
A preliminary plan for a subdivision shall be a formal plan, drawn to scale, indicating prominent existing and proposed features of the tract and its surroundings, and the general layout of the proposed infrastructure for the subdivision, and shall meet the requirements herein.

PRELIMINARY SURVEY PLAN
A preliminary plan for a subdivision shall be a formal plan, drawn to scale, indicating prominent existing and proposed features of the tract and its surroundings, and the general layout of the proposed infrastructure for the subdivision, and shall meet the requirements herein.

PRINCIPAL PLANNER
The Principal Planner of the City of Republic, Missouri, or whomever shall be designated by the BUILDS Administrator as Principal Planner.

RIGHT-OF-WAY
~~The land opened, reserved or dedicated for a street, walk, drainage or other public purpose.~~**All land considered as City controlled space by virtue of ordinance, dedication, easements, platting, or other written instruments providing the City control over others usage thereof.**

SUBDIVIDER
A person, firm or corporation undertaking the subdividing or resubdividing of a lot, tract or parcel of land into two (2) or more lots, or other subdivisions of land for the purpose of transfer of ownership or development, whether immediate or future, including all changes in street or lot lines.

SUBDIVISIONS (General)
The subdivision of land shall be deemed to be the division of any parcel or tract of land into two (2) or more parcels, sites or lots, ~~any one (1) of which contains less than five (5) acres~~ for the purpose, whether immediate or future, of transfer of ownership or development, provided however, that the following shall not constitute a subdivision: transfer of interests by will or pursuant to court order; leases for a term not to exceed ten (10) years; mortgages or easements; and the sale or exchange of parcels of land between owners of adjoining property if additional lots are not thereby created, and the lots resulting are not reduced below the size required by law.

SUBDIVISION (Minor)
Notwithstanding other definitions of this Chapter, a minor subdivision is defined as any division of land which creates not more than four (4) tracts.

SUBDIVISION (Major)
Notwithstanding other definitions of this Chapter, a major subdivision is defined as any division of land into five or more lots, shall include the construction and dedication of public infrastructure, shall follow the preliminary/final plat procedure and shall be regulated by the provisions of Articles **III, IV** and **V** of this Chapter.

410.030 No Contract Of Sale

Whoever, being the owner or agent of the owner of any land located within the City of Republic, transfers or sells or agrees to sell or negotiates to sell any land covered by the provisions of Articles **II** — **V** of this Chapter before a subdivision plat has been approved by the City Council and recorded or filed in the office of the Recorder of Deeds of Greene County shall forfeit and pay a penalty, as provided for in the fee schedule found in Section 805.050 of this code, for each lot or parcel so transferred or sold or agreed or negotiated to be sold. The City of Republic enjoin such transfer or sale or agreement by action for injunction brought in any court of equity jurisdiction or may recover the said penalty by a civil action in any court of competent jurisdiction.

410.040 Interpretation And Conflict With Other Laws

This Chapter shall not apply to any lot or lots forming a part of a subdivision created and recorded prior to the adoption of this code, except for further dividing of existing lots, or the addition of improvements not authorized or approved under previous platting. This Chapter is not intended to repeal, abrogate, annul or in any way impair or interfere with existing provisions of other ordinances, or regulations, private agreements, or with recorded restrictive covenants running with the land to which the City of Republic is a party. Where this Chapter imposes a greater restriction upon land than is imposed or required by previous ordinances of the City of Republic, the provisions of this Chapter shall prevail.

410.050 Administration

The provisions of this Chapter shall be administered in accordance with Chapter 89, RSMo., as amended, and shall be administered by the Planning and Zoning Commission, the City Administrator, **the BUILDS Administrator** ~~the City Planner or Building Official~~ or their ~~delegate~~ **designee, t**he Mayor, and the City Council.

410.060 Fees

The fees for the review of plans and plats and other sundry costs shall be paid to the City by the developer upon submitting a request or application for approval by the City.

410.070 Conformity With Zoning Code

All plats reviewed under provisions of this Chapter shall conform to all Zoning Code provisions for the district in which the proposed plat is to be located. All required zoning changes shall be made prior to approval of the Record Plat.

410.075 Stop Work

A. *Authority*. Whenever the ~~City Planner~~ **BUILDS Administrator** or his/her designee finds any work regulated by this Code or the associated regulations being performed in a manner contrary to the provisions of this Code or in a dangerous or unsafe manner, the **B**~~b~~uilding **O**~~o~~fficial is authorized to issue a stop work order.

B. *Issuance*. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

C. *Unlawful Continuance*. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

410.080 Denial Of Utility Service, Permits And Plat Approval

A. *Permits*. No building permits shall be issued for any structure on a lot in a subdivision for which a plat has not been finally approved and recorded in the manner prescribed herein.
B. *Denial Of Utility Service, Plat Approval And/Or Building Permits*. To promote and ensure the public health, safety and welfare, the City shall have the authority by written order to deny the connection of utility service, plat or plan approval and/or building permits on the grounds that non-compliance with City regulations, adopted ordinances and/or policies have occurred.

410.090 Compliance With Design Principles Required

In planning and developing a subdivision the developer shall comply with the general principles of design and minimum requirements for the layout of subdivisions set forth in Article **VI**, and with the rules and regulations concerning required improvements set forth in Article **IV**, in these regulations, and in every case shall pursue the procedure in the following Sections. Approval of any plat or plan by the City shall not relieve the subdivider or developer from complying with the regulations established herein.

410.100 Platting Exceptions

A. The requirements of this Chapter do not apply to the following types of land subdivision:
~~1. Recording of a subdivision plat shall not be required in case of the sale or exchange of parcels of land between owners of adjoining properties for the purpose of adjustments in boundaries, provided that: additional lots are not thereby created; that the original lots are not reduced below the minimum sizes required by this Chapter or the Zoning Code; and that a survey of the adjustments of boundaries is recorded with the County Recorder.~~

1. ~~2.~~ The conveyance of parcels of land or interests therein for use as a right of way for railroads or other public utility facilities or other pipe lines which do not involve any new streets or easements of access.
2. ~~3.~~ The conveyance of land for highway or other public purposes or grants or conveyance relating to the vacation of land impressed with a public use.
3. ~~4.~~ Conveyances made to correct description of prior conveyances.

Article 410-II Minor Subdivisions

410.110 Minor Subdivisions

A. All subdivisions of land, not otherwise classified as a major subdivision **and regardless of the size of the area of land to be subdivided**, shall be classified as a minor subdivision and shall be subject to the procedures described in this Article. Applications for minor subdivisions will be reviewed **by the BUILDS Department**, ~~considered, and forwarded to the Planning and Zoning Commission~~ based on the following qualifications:
    1. The proposed subdivision will not create more than four tracts of land, including the remainder to be retained by the owner.
    2. The proposed subdivision does not include the dedication of a new street or other public right-of-way or change in existing streets, general utility easements, water, sewer or other public improvements. It is the intent of this provision to limit approval of minor subdivisions to those cases where the improvements required by these regulations have been provided, with exception to the extension of service to individual lots. It is not the

intention of this provision to permit all requests, based solely requests that meet the minimum standards.

3. The subdivision is in compliance with the Zoning Code and other ordinances and regulations of the City of Republic and no substandard tract, parcel or lot will be created.
4. The subdivision will not result in substantial increases in service requirements (e.g., utilities, traffic control, parks, schools, streets, etc.), nor interfere with the maintenance of existing service levels (e.g., additional curb cuts, repaving, etc.) as~~d~~ determined by the BUILDS Administrator or their designee.
5. The parent tract was lawful under these regulations at the time the existing property description was recorded.
6. The configuration of the property was created by a court decree or order resulting from testamentary or interstate provisions.
7. The configuration of the property was created by the assembly or combination of existing tracts of record.
8. Minor subdivisions shall be limited so that no more than four (4) new tracts or parcels of land are created ~~by minor subdivision~~ from the original parent tract or parcel as that tract or parcel was at the time of annexation, or else as the parcel was platted within a major subdivision in the interest of preventing the circumvention of the major subdivision process. Upon a request for a second (2nd) minor subdivision of a tract or parcel previously subdivided into fewer than four (4) new tracts or parcels, **the BUILDS Department may request that City** Council ~~may~~ authorize staff by resolution to execute a subsequent minor subdivision that otherwise meets the minor subdivision requirements.

410.120 Minor Subdivisions Procedures

A. *Filing Procedures*. The applicant shall submit a **digital**~~minimum of five (5)~~ cop**y**~~ies~~ of the proposed minor subdivision ~~or more, as required by theCommunity Development Department~~, a completed application form and applicable application fees, as provided for in the fee schedule found in Section 805.050, to the Republic ~~Community Development Department~~**BUILDS Department**. ~~A completed minor subdivision checklist shall accompany all applications for subdivision.~~

B. *Review Criteria And Procedures*. An application for minor subdivision shall be reviewed for conformance with the City's zoning and subdivision regulations. The ~~Community Development~~**BUILDS** Department staff~~, public works staff and the City Engineer~~ shall use the following criteria to review the minor subdivision for its conformance and shall ensure the development in the proposed location:

1. Will be in conformity with the Comprehensive Plan, thoroughfare plan, zoning regulations or other plans officially adopted by the Planning and Zoning Commission and the City Council~~;~~.

C. *Effect Of Minor Subdivision Approval*. Minor subdivision approval shall confer upon the developer the right that the City will not change the general terms and conditions under which the approval was granted. Within sixty (60) days after approval of the plat by the ~~Community Development Department~~**BUILDS Department** staff, the subdivider shall file said plat with the County Recorder. The subdivider shall pay the cost of recording the plat~~, easements, right-of-way deeds~~ and any other related accompanying documents. If the plat is disapproved, the ~~Community Development~~**BUILDS** Department staff shall notify the applicant in writing of the actions and reasons therefore. If the applicant shall fail to record the plat within sixty (60) days, then the plat shall be held for naught.

D. *Information Required*. The following information is required on all minor subdivision plats submitted for approval. The required information may be combined for presentation on one (1) or more drawings or maps. In the interests of clarity, speed and efficiency in the review process, ~~Community Development~~**BUILDS Department** ~~–~~staff may require that the information be presented on separate or additional drawings or maps. In all cases the minor subdivision plat submission shall be designed in conformity with the Republic Zoning Code, Chapter **405**, and shall include the following information:

1. The proposed subdivision name, the general location, as it is commonly known, or by some other name by which the project may be identified, the name and address of the present owner and sub divider and the surveyor. The City shall supply a case number identifying the minor subdivision prior to submission.
2. Title, **bar** scale, north arrow, date of preparation and each date~~,~~ which a revision was made.
3. Location by section, township, range, City, County, State or if a re-subdivision of an existing or approved subdivision, then by lot or block numbers and name of original subdivision.
4. The names, location and dimensions of adjacent streets within any adjoining subdivision.
5. **The accuracy class of property shall be noted on the plat as Urban Class property or Rural Class property.**
    a. **For Urban Class property the uncertainty due to random errors of any dimension or direction, distance or coordinate shown on the plat shall not exceed fifty parts per million (50 ppm) or one-tenth of a foot (0.10') for distances less than two thousand feet (2,000') at the sixty-eight percent (68%) confidence level [one (1) sigma].**
    b. **For Rural Class property the uncertainty due to random errors of any dimension or direction, distance or coordinate shown on the plat shall not exceed one hundred parts per million (100 ppm) or one tenth of a foot (0.10') for distances less than one thousand feet (1,000') at the sixty-eight percents (68%) confidence level [one (1) sigma].**
6. ~~5.~~ The plat ~~boundaries~~ shall show the ~~external~~ bearings **of all boundary lines, and** distances ~~and internal angles~~ **shall be displayed** ~~with~~ dimensione**d**~~s~~ in hundredths of **a foot**~~feet. A minimum closure of one tenth of a foot (0.10) or 1:20,000 for distances greater than two thousand (2,000) feet (minimum standards for urban class property survey) to close the traverse within a maximum of one (1) foot in 10,000 feet.~~ All bearings shall be ~~obtained~~ **on Grid North and by means of GPS, or optical instruments using celestial or solar observations.**~~by determination of true north by solar or celestial observation.~~
7. ~~6.~~ The boundary lines, location and dimensions **by bearings and distance** of ~~existing and~~ newly created tracts, parcels or lots that are part of the minor subdivision shall be shown on plat. ~~The dimensions and location of all arcs, radii, internal angles, points of curvature and tangent boundaries and other pertinent survey information necessary to an accurate description and location.~~ Survey data shall meet **all applicable portions of** the **current** ~~standards promulgated by the State of Missouri,~~ "Missouri **Standards for Property Boundary Surveys" as promulgated by the Departments of Agriculture, Division of Weights, Measures and Consumer Protection**~~Minimum Standards for Property Boundary Surveys", Division of Geology and Land Survey, Missouri Department of Natural Resources~~. All survey datum shall be vertically **tied to the NAVD 88 datum and shall graphically show a** horizontal~~ly~~ tie~~d~~ to **two subdivision corners by bearing and distance**

from the nearest published GRS monument which name and/or designation number, date of adjustment and coordinates shall be noted. If the MoDOT Real Time Network is used in lieu of a GRS monument, then a statement to that effect shall be noted along with the epoch/date of subdivision control. Also, State Plane Coordinates of at least two external boundary corners of subdivision shall be shown~~the Missouri Geographical Reference Stations (GRS)~~.

8. ***Curve Data.*** **When a boundary line is on a circular curve, the curve data shall be shown in place or on an included Curve Table.**
    a. **Curve data shown shall consist of at least the following: curve number/name if table is used, delta or central angle, radius, arc length, chord length, and bearing.**
    b. **Non-tangent curves shall be noted in place or within a Curve Table and shall show: Central Angle rather than Delta, bearing from radius point to point of curvature, and all other curve components mentioned in the above provision.**
9. ~~7.~~ Names of adjacent subdivisions and owners of adjoining parcels of **land not** ~~un~~subdivided ~~land~~.
10. ~~8.~~ The exact location and distances of all structures and other physical improvements in relation to proposed lot lines.
11. ~~9.~~ The extent and location of floodplains, floodways, or other waterways of record; elevations of which, shall be based on applicable Flood Insurance Studies, Flood Insurance Rate Maps, Flood Boundary and Floodway Maps.
12. ~~10.~~ Location of sanitary sewer, storm sewers, water mains, gas lines, fire hydrants, electric and telephone poles and street ~~-~~lights.
13. ~~11. Topography, contours at vertical intervals shall be shown as follows:~~
    ~~a. Average slope less than six percent (6%) — two (2) foot interval contour map~~
    ~~b. Average slope over six percent (6%) — five (5) foot interval contour map~~
13. ~~12~~. Existing zoning classification of the minor subdivision and adjacent area.
14. ~~13.~~ Setback lines on all lots and other sites.
15. ~~14~~. Certification by Missouri **Professional Land Surveyor** ~~registered land surveyor~~ as to accuracy of survey as such:
    That I, _____, do hereby certify that this plat was prepared under my supervision from an actual survey of the land herein described prepared by _____ dated _____ and signed by _____ P.L.S. No. _____ and that the corner monuments and lot corner pins shown herein were placed under the personal supervision of _____ P.L.S. No. _____ in accordance with ~~the~~**all applicable portions of the current Missouri Standards for Property Boundary Surveys as promulgated by the Department of Agriculture, Division of Weights, Measures and Consumer Protection.** ~~Division of Geology and Land Survey, Missouri Department of Natural Resource's "Minimum Standards for Property Boundary Surveys".~~
    Date Prepared: _____
    Signature: _____
    Missouri P.L.S. No. _____
16. ~~15~~. Certificate of Approval by the ~~Community~~**BUILDS** ~~Development~~ **Department** staff (to be placed on plat) which shall be provided as follows:
    In accordance with the provisions as set forth in the Subdivision Regulations of Republic, Missouri, I _____, do hereby certify that on the _____

day of _____, 20___, the ~~Community Development~~**BUILDS** Department approved the request for a minor subdivision for _____.

Any further subdivision of the above described land or modifications of the land description(s) will require reapproval in accordance with the Subdivision Regulations of the City of Republic, Missouri.

_____

~~Community Development~~**BUILDS** Department **Representative**

_____

Date

17. ~~16~~. Statement of owner**(s)** certifying that ~~he/she~~**the owner** had title to the land being subdivided:

As owner I have caused the land described on this plat to be surveyed, divided, mapped, and all access rights reserved and dedicated as represented on the plat.

_____

Owner and/or Subdivider

_____

Date

E. *Final Submittal*. Final submittal of the Minor Subdivision Plat shall be prepared on a reproducible original (mylar) twenty-four (24) inches by thirty-six (36) inches or those dimensions required by the Greene County Recorder of Deeds. In addition to the original the City may require additional elements to incorporate the Minor Subdivision into the City map. The following items shall be submitted:

~~1. Sixteen (16) inches x twenty-four (24) inches scaled reproducible mylar for the City's plat book.~~

~~2. Four (4) blue line copies (24" x 36").~~

1. ~~3~~. All applicable off-site easements and right-of-way deeds.

2. ~~4.~~ Copy of private and restrictive covenants to be recorded.

3. ~~5~~. Digital copy of subdivision plat, cad file, etc. for City map upgrades.

Article 410-III Major Subdivisions -- Preliminary Plat

410.130 Major Subdivisions -- Preliminary Plat

All subdivision of land classified as a major subdivision shall be subject to the procedures described in this Article. Approval of a Final ~~or Record~~ Plat shall be subject to approval of a Preliminary Plat in accordance with regulations contained herein.

410.140 Application For Preliminary Plat

The developer shall submit a **digital**~~minimum of five (5)~~ copy~~ies~~ of the proposed Preliminary Plat **consisting of the associated Preliminary Engineering Plan and Preliminary Survey Plan** ~~or more~~, as required by the City, a completed application form and applicable application fees, as provided for in the fee schedule found in Section 805.050, to the Republic ~~Community Development~~**BUILDS** Department at least twenty (20) working days prior to the meeting at which approval is requested. A completed Preliminary Plat checklist shall accompany all applications for major subdivisions.

410.150 Review Criteria And Procedures For Preliminary Plat

A. Application and Preliminary Plat shall be reviewed for conformance with all applicable City adopted codes and regulations by the **BUILDS Department staff**~~City Planner~~. If the **BUILDS Department staff**~~City Planner or City Engineer~~ reviews the application and plat and finds that it is incomplete or that the requirements of this Chapter, the comprehensive plan or other adopted plans have not been met, ~~than~~ the **BUILDS Department**~~City Planner~~ shall so notify the applicant in writing of any deficiencies. Once all deficiencies have been addressed and the **BUILDS Department**~~CityPlanner and City Engineer~~ ha**s**~~ve~~ approved the plat, ~~than~~ a recommendation for approval or denial shall be transmitted to the Planning and Zoning Commission. After receiving comments and recommendations from the ~~City~~ **BUILDS Department staff**~~Planner~~, the Planning and Zoning Commission shall review the Preliminary Plat for its conformance to the following review criteria and shall ensure the development, in the proposed location:
    1. Will not endanger the public health or safety;
    2. Will not injure the value of adjoining property or abutting property;
    3. Will be in conformity with the Comprehensive Plan, Transportation Plan, Zoning Code, Water System Master Plan, Wastewater System Facility Plan or other plans officially adopted by the City Council; and
    4. Will be in harmony with the area in which it is located.

B. The Planning and Zoning Commission may request modifications to the Preliminary Plat. The **Planning and Zoning** Commission shall then confer approval, conditional approval or disapproval of the Preliminary Plat within forty-five (45) days of filing and transmit all copies of the Preliminary Plat together with written reasons for its action to the City Council. The approval or the refusal to approve the Preliminary Plat by the City Council shall take place within thirty (30) days from and after the date in which the Planning and Zoning Commission has made a recommendation to approve or refuse to approve the Preliminary Plat. Once the City Council have approved or refused to approve the Preliminary Plat, the **BUILDS Department**~~City Planner~~ shall notify the owner or applicant of the decision in writing.

410.160 Effect Of Preliminary Plat Approval

Preliminary Plat approval shall confer upon the developer, for a period of two (2) years from date of approval, the conditional right that the City Council will not change the general terms and conditions under which the approval was granted. After approval of the Preliminary Plat, the developer may proceed with the detailed construction plans for all required infrastructure of the area planned for inclusion on the final plat. The City Council, upon recommendation by the Planning and Zoning Commission, may extend this two (2) year period if the developer has applied in writing for such an extension and the Planning and Zoning Commission and City Council determine a longer period should be granted due to unusual circumstances. If an extension is not granted, the Preliminary Plat approval is null and void. If no Final Plat of a subdivision for which preliminary approval has been given is approved within said two (2) year period, or such longer period as the City Council may allow, a resubmission and review by the Planning and Zoning Commission and City Council shall be required. It shall not be the responsibility of the City to notify the applicant of an expired Preliminary Plat.

410.170 Phased Construction And Platting

If phased construction is planned, the construction and final platting of the first phase shall be completed within two (2) years of the date of approval of the Preliminary Plat. Subsequent phases of the ~~f~~Final ~~p~~Plat may be submitted covering portions of the approved ~~p~~Preliminary ~~p~~Plat; provided, however, that all phases of the ~~p~~Preliminary ~~p~~Plat must be completed within four (4) years of the date of approval of the ~~p~~Preliminary ~~p~~Plat. If all phases of the ~~p~~Preliminary ~~p~~Plat have not been completed within four (4) years of the date of approval of the ~~p~~Preliminary ~~p~~Plat, then the ~~p~~Preliminary ~~p~~Plat shall be resubmitted to the

City for extension and approval in accordance with the provisions of Section **410.150** hereof. If an extension and approval is not granted, the original ~~p~~Preliminary ~~p~~Plat t approval shall be null and void.

[Ord. No. 03-56 §1, 8-25-2003]

410.180 Existing And Proposed Features To Be Shown On Preliminary Plat

A. **For all applications made, the Preliminary Plat submission must consist of a Preliminary Engineering Plan and a Preliminary Survey Plan. These two independent elements making up the entirety of the Preliminary Plat must be provided on separate pages. The Preliminary Plat submission must contain all of the following information for approval and shall be designed in conformity with the Design Standards contained in Article IV.** ~~The following information is required on all Preliminary Plats submitted for approval. The required information may be combined for presentation on one (1) or more drawings or maps. In the interests of clarity, speed and efficiency in the review process, the City Planner may require that the information be presented on separate or additional drawings or maps. In all cases the Preliminary Plat submission should include the following and shall be designed in conformity with the Design Standards contained in Article VI.~~

1. ~~*Name and code*. The proposed name of the subdivision, which shall not duplicate or closely resemble the name of another, previously recorded subdivision in the City of Republic.~~**The Preliminary Engineering Plan shall serve as a preliminary construction document reflecting the general layout of all infrastructure for the proposed subdivision and must contain all of the following information:**
    a. ***Boundary lines*. The boundary lines of subject property along with lot and easement lines, accurate in scale, of the tract to be subdivided. To reduce clutter during review, the above items may be lighter in color than the prominent items required on this plan.**
    b. ***Survey acknowledgement*. The name and license number of the Professional Land Surveyor or holder of a Corporate Survey License who provided the boundary information for the Preliminary Engineering Plan, and the date of usage conformation shall be noted on Plan.**
    c. ***Streets and other features*. The location, widths and names of all existing streets or other public ways within or adjacent to the tract.**
    d. ***Existing utilities*. Including but not limited to electric, gas, sewer, telephone, water mains, storm sewer, culverts, and other aboveground and underground structures within the tract and immediately adjacent thereto with pipe sizes and grades indicated.**
    e. ***Proposed design of streets, drainage, etc*.**
        (1) **The layout, names and right of way widths of proposed streets, alleys and easements; the location and approximate sizes of catch basins, culverts and other drainage structures; the location of proposed sewer lines, water lines, fire hydrants and other related infrastructure planned to serve the development.**
    f. ***Topography*. Contours at vertical intervals shall be based on the NAVD 88 datum or City monuments and shall be shown as follows:**
        (1) **Average slope less than six percent (6%)—two (2) foot interval contour map;**
        (2) **Average slope over six percent (6%)—five (5) foot interval contour map.**

g. The Preliminary Engineering Plan shall bear the date, signature and seal of a Professional Engineer holding a valid license to practice in the State of Missouri and shall be present on each sheet submitted.

h. North point, *etc*. Title, bar scale, north arrow, date of preparation and date of each successive revision.

2. ~~*Owners of record*. The names and addresses of the owner(s) of record, developer(s), engineer, and/or surveyor responsible for the subdivision design.~~The Preliminary Survey Plan must contain all of the following information:

a. *Name and code*. The proposed name of the subdivision, which shall not duplicate or closely resemble the name of another, previously recorded subdivision in the City of Republic.

b. *Owners of record*. The names and addresses of the owner(s) of record, developer(s), and/or surveyor responsible for the subdivision design.

c. *Vicinity map*. A vicinity map at a scale of four hundred (400) feet or more to the inch shall be drawn on the Preliminary Survey Plan. The map shall indicate:

(1) Section, Township, Range.

(2) Adjacent City Limits, other corporation or ad hoc district lines, such as school or sewer districts, etc.

(3) The nearest existing highways or thoroughfares, streets and alleys in neighboring subdivisions or property.

d. *Abutting owners*. The name of adjacent subdivisions and the names of record owners of adjacent parcels of unplatted land.

e. *Boundary lines*. The boundary lines, accurate in scale, of the tract to be subdivided.

f. *Streets and other features*. The location, widths and names of all existing or platted streets or other public ways within or adjacent to the tract, and other important features such as existing permanent buildings; large trees and watercourses; railroad lines; corporation and township lines.

g. *Other Existing Elements.* Right-of-way for streets and all easements for drainage, sewer, water and other utilities adjacent or connecting to tract.

h. *Proposed Elements.* All proposed right-of-way for streets and all easements for drainage, sewer, water and other utilities planned to be within the tract. and immediately adjacent thereto.

i. *Proposed design of streets, drainage, etc*.

(1) The layout, names and right-of-way widths of proposed streets, alleys and labeled easements intended to serve the development.

(2) Where additional right of way is required along an existing road, new right-of-way line(s) shall be based off section or the adjacent aliquot part line rather than center-line road splits.

(3) Exemptions or modifications may be made by the BUILDS Administrator or their designee.

j. *Proposed layout and legal description*. The legal description of the entire site to be subdivided, including acreage in tract, boundary and easement lines, locations and dimensions and bearings of newly created tracts, parcels or lots that are part of the subdivision shall be shown on the Preliminary Survey Plan. The dimensions and location of all arcs, radii points of curvature, tangent boundaries, and other pertinent survey information necessary to an accurate description and location. Survey data shall meet all applicable portions of the

current Missouri Standards for Property Boundary Surveys as promulgated by the Department of Agriculture, Division of weights Measures, and Consumer Protection. All survey datum shall be vertically tied to the NAVD 88 datum and shall graphically show a horizontal tie to two subdivision corners bearing and distance from the nearest published GRS monument which name and/or designation number, date of adjustment and coordinates shall be noted. if the MoDOT Real Time Network is used in lieu of a GRS monument, then a statement to that effect shall be noted along with the Epoch of subdivision control.

(1) *Curve data* — When a boundary, easement, lot or street is on a circular curve, data shall be shown in place or on an included Curve Table. Curve data shown shall consist of at least the following: Curve number/name if table is used; Delta or central angle; Radius; Arc length; Chord length and bearing.

(2) When curved lot lines are concentric to the centerline of street it shall be noted as such on the Preliminary Survey Plan.

(3) Non-tangent curves shall be noted in place or in Curve Table and shall show Central Angle rather than Delta; Bearing from radius point to point of curvature and all other curve components mentioned above.

k. *Lot information*. The plat shall indicate the area, lot size, proposed setbacks and exact location and distance of all structures and other physical improvements in relation to proposed lot lines. Each lot should bear sequential numbering.

l. *Zoning*. Zoning boundary lines and proposed use of property.

m. *North point, etc*. Title, bar scale, north arrow, date of preparation and date of each successive revision.

n. *Floodplains, etc.* The extent and location of floodplains, floodways or other waterways of record; elevations of which, shall be based on applicable Flood Insurance Studies, Flood Insurance Rate Maps, Flood Boundary and Floodway Maps.

o. *Sinkholes*. The extent and location of sinkholes must be shown, the location of which shall be based on the latest data from the Greene County Assessor's Department, a report conducted by a Geotechnical Engineer, or a source approved by the BUILDS Department Administrator or their designee. Any sinkhole and its associated thirty-foot "No Build" buffer zone must be entirely contained within a common lot.

p. The Preliminary Survey Plan shall bear the signature and seal of a Professional Land Surveyor holding a valid license to practice in the State of Missouri and shall contain the following statement to be completed by that individual:

(1) That I, _____, do hereby certify that this plat was prepared under my supervision from an actual survey of the land herein described prepared by _____ dated _____ and signed by _____ P.L.S. No. _____ and that the corner monuments and lot corner pins shown herein were placed under the personal supervision of _____ P.L.S. No. _____ in accordance with all applicable portions of the current Missouri Standards for Property Boundary Surveys as promulgated by the Department of Agriculture, Division of Weights, Measures and Consumer Protection.

Date Prepared: _____

Signature: _____

Missouri Professional Land Surveyor No. _____

3. *Vicinity map*. A vicinity map at a scale of four hundred (400) feet or more to the inch shall be drawn on the preliminary plat. The map shall indicate:
    a. Section, Township, Range.
    b. Adjacent City Limits, other corporation or ad hoc district lines, such as school or sewer districts, etc.
    c. The nearest existing highways or thoroughfares, streets and alleys in neighboring subdivisions or property.
4. *Abutting owners*. The name of adjacent subdivisions and the names of record owners of adjacent parcels of unplatted land.
5. *Boundary lines*. The boundary lines, accurate in scale, of the tract to be subdivided.
6. *Streets — other features*. The location, widths and names of all existing or platted streets or other public ways within or adjacent to the tract, and other important features such as existing permanent buildings; large trees and watercourses; railroad lines; corporation and township lines, utility lines, etc.
7. *Existing utilities*. Existing sewer, gas, telephone, water mains, culverts and other underground structures within the tract and immediately adjacent thereto with pipe sizes and grades indicated.
8. *Topography*. Topography, contours at vertical intervals shall be based on USGS datum or City monuments and shall be shown as follows:
    a. Average slope less than six percent (6%) — two (2) foot interval contour map
    b. Average slope over six percent (6%) — five (5) foot interval contour map
9. *Proposed design — street, drainage, etc*. The layout, names and widths of proposed streets, alleys and easements; the location and approximate sizes of catch basins, culverts and other drainage structures; the location of proposed sewer lines, water lines, fire hydrants and other related infrastructure planned to serve the development.
10. *Proposed layout and legal description*. The legal description of the entire site to be subdivided, including acreage in tract, boundary lines, locations and of newly created tracts, parcels or lots that are part of the subdivision shall be shown on plat. The dimensions and location of all arcs, radii, internal angles, points of curvature, and tangent boundaries, and other pertinent survey information necessary to an accurate description and location. Survey data shall meet the standards promulgated by the State of Missouri, "Missouri Minimum Standards for Property Boundary Surveys", Division of Geology and Land Survey, Missouri Department of Natural Resources. All survey datum shall be vertically and horizontally tied to the City of Republic Geographical Reference Stations (GRS).
11. *Lot information*. The plat shall indicate the area, lot size, proposed setbacks and exact location and distance of all structures and other physical improvements in relation to proposed lot lines.
12. *Zoning*. Zoning boundary lines and proposed use of property.
13. *North point, etc*. Title, scale, north arrow, date of preparation and date of each successive revision.
14. *Floodplains, etc.* The extent and location of floodplains, floodways or other waterways of record; elevations of which, shall be based on applicable Flood Insurance Studies, Flood Insurance Rate Maps, Flood Boundary and Floodway Maps.
15. *Location of model home*. The location of proposed model home or spec. house and required parking.

16. *Commercial and industrial subdivisions*. Preliminary Plats for industrial or commercial subdivisions shall delineate who will be responsible for addressing open space, landscaping and buffer-yard requirements.

410.190 Model Home Procedure

1. *Purpose*. To provide a procedure whereby the construction of a model home or homes may begin prior to the recording of the Final Plat.
2. *Procedure*. After receiving approval of the Preliminary Plat of a proposed subdivision from the Planning and Zoning Commission and City Council and after an approved set of construction plans have been submitted, the developer may submit an application for a model home for review by the City Planner and Building Inspector. The application for a model home shall include all information as routinely required. In addition, the application shall be accompanied by a plan, which shall show the location, street elevation, size and the number and location of parking areas of the model home in relation to the lots, streets and utilities proposed in the subdivision.
3. *Sale Or Occupancy*. No part of the proposed subdivision may be conveyed, nor an occupancy permit issued, for any structure therein until the display home has been located on an approved lot in a recorded subdivision. The Building Inspector, with approval of the City Planner, may issue a temporary occupancy permit for the use of the home as a model, office or showroom during the duration of development of the subdivision, home construction, etc.
4. *Driveways And Off Street Parking*. Off-street areas used for standing and maneuvering of vehicles shall have concrete or asphalt driving surfaces adequate for all-weather use, transitioning at the appropriate grade and so drained as to avoid flow of water across sidewalks.

Article 410-IV Major Subdivision -- Improvements

410.200 General Procedures For The Preparation And Submission Of Subdivision Improvements Plans

After approval of the Preliminary Plat and prior to approval of the Final Plat, Construction Plans shall be prepared for all or a specified phase of the subdivision.

410.210 Procedure For Submission Of Subdivision Improvement Plans

A. *Preparation Of Plans*. It shall be the responsibility of the developer to have construction plans for streets, utilities and other required improvements prepared and submitted to the City for review. The Construction Plans for all aspects of the site development shall be prepared by a qualified ~~p~~Professional ~~e~~Engineer, registered in the State of Missouri. All improvements shall be designed and constructed in accordance with requirements of Article **VI**. General Principles of Design and Minimum Requirements for the Layout of Subdivisions**. In addition, all improvements shall be designed and constructed in accordance with the "Standard Specifications and Details for Water and Sewer Construction, City of Republic, Missouri", and the "Standard for Storwater Management and Design Criteria Manual"** ~~and in accordance with the "Construction Specifications for Public Improvements, City of Republic"~~, as amended from time to time, on file with at the offices of the City of Republic ~~Public Works~~**BUILDS** Department and incorporated herein by reference. ~~Five (5)~~**Three (3) physical** copies **and a digital version in pdf** ~~–~~shall be submitted for review to the **BUILDS Department**~~Public Works Director~~. The Construction Plan shall be any scale ~~from (1 inch = 10 feet) through (1 inch = 50 feet), so long~~ as the scale is an increment of ten (10) feet and is sufficiently clear in reflecting details of the proposed construction. **The signature and seal of the Professional Engineer in responsible charge shall**

appear on every plan sheet along with title, bar scale, north arrow, date of preparation and each date a revision was made shall be shown on each page as applicable. Construction Plans shall be prepared on exhibits 24 inches x 36 inches and shall be bound by staple on one side. All plan sheets shall be prepared to a degree to allow for adequate review and construction. Each page shall contain an approval block for approval from the City of Republic ~~Public Works Department~~. The ~~City~~**BUILDS Department** may require additional details to be developed to establish clarity for review and construction.

B. *Approval Of Construction Plans*. The ~~City Planner~~ **BUILDS Department** ~~-~~shall coordinate review and subsequent approval, with all related City departments, ~~the Public Works Director and City Engineer,~~ of the Construction Plans. If the ~~City Planner~~**BUILDS Department** determines that the plans do not meet the minimum standards and require modification, correction and are not approvable, **then**~~than the City Planner~~**BUILDS Department staff** shall forward a letter to the developer and his/her engineer stating the deficiencies. After all related deficiencies have been addressed and approval is given by all related departments ~~and the City Engineer~~, the ~~City Planner~~**BUILDS Department** shall issue an appropriate letter certifying approval**, send digital version of plans with approval signature from City,** and **provide** notice to proceed with an application for water and sewer main extension and other related permits from outside agencies.

C. *Review By Outside Agencies*. Engineering drawings of all required improvements shall be reviewed and approved by the ~~City~~**BUILDS Department**, except for improvements to be made under the jurisdiction of other Municipal, County or State agencies, in which case the drawings shall be submitted to the appropriate agency for review and approval. Where review and approval of engineering drawings is made by such agency, **the BUILDS Department**~~the CityPlanner~~ shall be given written confirmation that the necessary reviews have been completed and approvals have been granted.

D. *Review By Consultants*. Expenses incurred by the City for required reviews, inspections, and/or related testing shall be reimbursed to the City, by the developer, for all costs incurred by it in performing such review, inspection and/or testing, including all professional fees incurred as a result thereof. To insure payment or reimbursement of such costs, fees and expenses, all developers, and such other persons or entities associated with developers, as the **BUILDS Department** ~~Community Development Department~~ deems appropriate, shall execute a promissory note, payable to the order of the City on demand, in such amount as is anticipated to cover such costs, fees and expenses. The maker or makers of such promissory note may satisfy the same by the timely payment of all costs, fees and expenses incurred by the City as identified hereinabove. Such promissory note shall provide for the payment of interest at no less than twelve percent (12%) per annum from and after the date of demand and shall further provide for the payment of attorney fees by the maker or makers in the event of default.

E. *Pre-Construction Meeting And Final Plan Submittal*. The City ~~Planner~~ shall coordinate a pre-construction meeting with the developer, Project Engineer, Construction Inspector, ~~Public Works Director~~ **City Engineer,** general contractor, all appropriate subcontractors, and department heads. All related construction practices, policies and requirements will be discussed and established at the pre-construction meeting. It is the responsibility of the applicant, engineer and contractor to check and review all City requirements relating to the construction of public improvements. A minimum of ~~four (4)~~ **two (2)** sets of approved plans**, bearing the signature of the City Engineer,** prepared on twenty-four (24) inches by thirty-six (36) inches **D Size**, bound plan sheets and **two (2)**~~one (1) five (5)~~ set~~s~~ prepared on ~~twelve (12) inches by eighteen (18)~~**eleven (11) inches by seventeen (17)** inches **B Size**, bound plan sheets shall be submitted at or before the pre-construction meeting.

F. *Construction Permit*. No person, firm or corporation shall develop, install, alter, grade, remove vegetation, fill or modify any tract of land, roadway or any City-owned utility within the City of Republic or cause the same to be undertaken without first securing the approval of the construction plans as required by this Chapter or other City ordinances. The City shall charge a construction permit fee, as provided for in the fee schedule found in Section 805.050, for plan review and field inspection of all related public infrastructure including water, sewer, streets, stormwater and related infrastructure to be dedicated to the City as part of the development. Furthermore, no construction permit shall be issued until the following has been received:

1. Receipt of paid construction permit fees on file relating to inspection of infrastructure.
2. The minimum number of approved construction plans **sent** to the ~~City Planner~~**BUILDS Department**, sealed by the Project Engineer and signed under the hand of the ~~Public Works Director~~ **City Engineer** or his/her designee.
3. Approvals and permits from other affected County, State or Federal agencies.
4. All off-site utility easements drainage easements and right-of-way deeds shall be recorded by the County Recorder of Deeds and provided to the City at or before the pre-construction meeting.
5. **Confirmation of execution of any Developer's Agreement(s) for deferral of required infrastructure construction.**

G. *Phasing*. Where a subdivision is to be developed in phases, the provisions of this Article shall apply to each phase. However, improvements and financial guarantees may be required to extend beyond the boundaries of a subdivision phase if such extension is necessary to ensure the relative self-sufficiency of the phase pending completion of the entire subdivision. Improvements and financial guarantees may also be required for public infrastructure beyond the boundaries of a particular phase of the subdivision in order to secure the construction of planned infrastructure improvements that are necessitated in order to conform to the City's adopted Comprehensive Plan or constituent parts thereof. Such extensions, schedules, and similar arrangements shall be set forth in an agreement between the developer and the Council prior to approval of the Final Plat.

H. *Modification During Construction*. All installation and construction shall conform to the approved engineering drawings. However, if the developer chooses to make minor modifications in design and/or specifications during construction, he/she shall make such changes at his/her own risk, without any assurance that the City will approve the completed installation or construction. It shall be the responsibility of the developer to notify the City of any changes from the approved drawings. The developer may be required to correct the installed improvement so as to conform to the approved engineering drawings.

I. *As-Built Drawings*. The developer shall submit to the ~~City Planner at least five (5) sets of~~**BUILDS Department** "as-built" engineering drawings of the required improvements that have been completed. **Said drawings will consist of all original plan sheets and show the distinct changes that took place during construction. As-Built Drawings will also be required as digital drawing (dwg) files, portable document files (pdf) and/or may be required in another digital format at the BUILDS Department staff's discretion.** The Project Engineer shall certify each set of drawings in accordance with the requirements of Section **410.360**.

410.215 Construction Plans

A. The construction plan for all aspects of the site development shall be prepared by a qualified **P**~~p~~rofessional **E**~~e~~ngineer, registered in the State of Missouri. **The construction plans shall be significantly based on the configuration shown on the approved Preliminary Plat.** ~~Five (5)~~**Three**

(3) copies **and a digital copy** shall be submitted for review to the ~~Public Works Director~~**BUILDS Department**. The construction plan shall be any scale ~~from one (1) inch equals ten (10) feet through one (1) inch equals fifty (50) feet,~~ so long as the scale is an increment of ten (10) feet and is sufficiently clear in reflecting details of the proposed construction. Construction plans shall be prepared on exhibits twenty-four (24) inches by thirty-six (36) inches and shall be **bound** ~~by staple on one (1) side~~. All plan sheets shall be prepared to a degree to allow for adequate review and construction. Each page shall contain an approval block for approval from the City of Republic ~~Public Works Department~~. The City may require additional details to be developed to establish clarity for review and construction. The plans shall generally consist of the following:

1. Title (cover) page containing, but not limited to, the following: owner's and developer's name, engineer of record, name of project, table of contents **with page numbers**, general rules of construction, phone numbers of utility suppliers and a record of submittals and approval blocks.
2. Street plans, sidewalk plans and profile sheets containing, but not limited to, the following:
    a. Pavement installation, widening or resurfacing improvements dimensioned and developed in accordance with the standard typical section applicable to the project;
    b. Top of pavement mathematical profile grade elevations at twenty-five (25) feet intervals on vertical curves and fifty (50) feet intervals on tangent sections for all roadway construction. Top back of curb elevations at twenty-five (25) foot intervals for all horizontal curves, at thirty-degree (30°) intervals for street intersections and cul-de-sacs. Existing vertical curve elevations shall be shown at points of extension at intervals of twenty-five (25) feet. Existing vertical curve elevations shall be shown at points of extension at intervals of twenty-five (25) feet. PC and PT elevations shall be indicated at all curves and intersections;
    c. Resurfacing profile grade elevations on existing centerline and edges of pavement at twenty-five (25) feet intervals and breaks in grade (i.e. irregularities in pavement) and establish new centerline and edge of pavement profiles; and
    d. Existing and proposed grades at the centerline and left and right back of curb.
3. Pavement striping, marking and signage plan containing, but not limited to, the following:
    a. Location, type of markings and signage prescribed;
    b. The type of materials used; and
    c. The method for installation. The plan shall be based and designed on the Manual on Uniform Traffic Control Devices.
4. Grading, erosion and sediment control plan containing, but not limited to, the following:
    a. Finished contours shall be shown to the limits of the project **for the entire site**, establishing the desired (planned) flow of all on-site stormwater in connection with planned streets, sidewalks, stormwater ditches, pipes and structures; and
    b. Location and composition of silt fences, construction entrances, catch basins and related temporary structures and devices to prevent erosion, siltation and nuisances to adjacent properties, storm sewers and streets**, and a delineation showing limits of disurbance**.
5. Sanitary sewer plans and profile sheets containing, but not limited to, the following:
    a. Profiles establishing the class and size of pipe, invert elevations, grade, distance between manholes and minimum distance from other proposed or existing utilities. Profile sheets shall accurately depict the elevation, size and material type of intersecting proposed or existing utilities;

b. Plans establishing the exact location, class and size of service lines; and
c. Plan and profiles establishing lift stations and related components of the system. Site development details and requirements shall be provided and referenced in accordance with the Construction Specifications for Public Improvements.

6. Water plans containing, but not limited to, the following:
   a. Plan view of the proposed system, including class of pipe and size in relation to the back of curb, including fire hydrants, gate valves, blow-off assemblies, service lines and meter pits, etc.; and
   b. Profile drawings~~, submitted at the discretion of the City, shall~~ accurately depicting the elevation, size and material type of intersecting proposed or existing utilities.
7. Additional submittals containing, but not limited to, the following forms, documents and exhibits intending to parallel the provisions of the Missouri Department of Natural Resources including specific information for determining the most efficient and cost-effective manner in which to extend public utilities:
   a. A copy of the application for the Missouri Department of Natural Resources Request for Extension of Sanitary Sewer and Public Drinking Water. The completed and executed document shall be retained by the City;
   b. Sanitary sewer engineering report containing a letter of transmittal from the design engineer summarizing the facilities, a discussion on the design criteria and assumptions used, hydraulic and BOD loading calculations, an opinion as to the conformity of the proposed sewer extension with the City of Republic Master Plan and discussion on facility sizing in regard~~s~~ to future development. If a lift station is proposed, the engineering report shall include a feasibility study for alternative facilities (gravity sewer) and the potential for retirement of the proposed lift station;
   c. Water engineering report containing a letter of transmittal from the design engineer summarizing the facilities, a discussion on the design criteria and assumptions used, a hydraulic analysis demonstrating domestic and fire flow conditions, an opinion as to the conformity of the proposed extension with the City of Republic Water Master Plan and discussion on facility sizing in regard~~s~~ to future development;
   d. Easements for all proposed **drainage**, sewer and water extensions located outside **previously existing** easements **or right-of-way**, to be dedicated via a final plat, must be accompanied by draft instruments for the formal dedication of temporary construction and permanent easements. Depending upon the number of land-owners and the complexity of the proposed sewer extension, the City may require a property owner's exhibit accompanied by an opinion of title as issued by a recognized title company; and
   e. Cost estimate indicating an engineer's statement of probable cost for the construction of the proposed main extension. If a sewer lift station or water pressure control facilities are proposed, estimated operating costs for ten (10) years shall be included.
8. Storm drainage, storm sewer plan and profile sheet containing, but not limited to, the following:
   a. Drainage plans indicating all existing and proposed storm sewer lines, inlet boxes, manholes, basins, swales, watercourses, culverts and other underground or at-grade structures in the vicinity of construction and immediately adjacent thereto.

Pipe classes, sizes, grades, inverts, box openings and related structure details shall also be established and indicated on the plan sheets; and

b. Grading details pertaining to site development shall be shown in plan or on cross-section sheets. Details shall be shown with respect to existing and proposed contours, normally at two (2) foot intervals.

9. Detention plan containing, but not limited to, the following: detention plans, elevations, dimensions, weir elevations and cross-sections, low-flow channels, pipe sizes, discharge and dissipation structures.
10. *Record drawings*. One (1) record copy of all drawings, specifications and addenda addressing public improvements shall be maintained by the developer's contractor and by the City's Construction Inspector in good order and annotated to show all changes made during construction. Upon completion of the work, these record documents will be delivered to the engineer of record who shall provide ~~copies of these documents, to include reproducible copies and electronic copies~~**As-Built Plans as a digital copy (in pdf), and a drawing file (dwg)** or **other approved format of** digital CAD files of the revised drawings, to the City at no cost.

410.220 Inspection And Acceptance Of Subdivision Improvements

A. *Certification By Project Engineer*. In accordance with the ~~"Construction Specifications for Public Improvements"~~ **"Standard Specifications and Details for Water and Sewer Construction, City of Republic, Missouri", and the "Standards for Stormwater Management and Design Criteria Manual",** all improvements required by this Chapter shall be inspected by the developer's engineer, or his/her agent, and certified in writing to the City as having been completed, except for improvements made under jurisdiction of other public agencies, in which case engineers or inspectors of each agency will make the necessary inspections. Where inspections are made by other agencies, the Engineer shall be given written reports of each final inspection.

B. *Inspection By The City.* In addition to inspection and certification by the Project Engineer, the City shall provide inspection of all phases of construction to field verify that the location of all infrastructure installed are in coordination with submitted as-built plans.

C. *Compliance With Standards*. The developer shall bear the final responsibility for the plans, construction drawings and the installation, construction and inspection of all required improvements according to provisions of this Chapter and to standards and specifications of ~~various~~**applicable** public agencies.

D. *Acceptance*. Approval of installation and construction of improvements by the Project Engineer shall not constitute acceptance by the City of the improvements for dedication purposes. Acceptance shall be established by approval of all related City departments and the approval by all outside public agencies, including, but not limited to, County, State or Federal Governments.

E. *Site Cleanup*. The developer shall be responsible for removal of all equipment, material and general construction debris from the subdivision and from any lot, street or public way or therein or adjacent thereto. Dumping such debris into sewers, adjacent property or other land in the City is also prohibited. Burning of debris is prohibited unless a permit is obtained from the MoDNR.

Article 410-V Major Subdivision -- Final Plat

410.230 Application For Final Plat

The developer shall submit a completed application and applicable fees as provided for in the fee schedule found in Section 805.050, a completed Final Plat checklist, final inspection fees, sign installation fee, **a**

digital copy, and a minimum of three~~five~~ (3~~5~~) copies of the proposed Final Plat or more, as required by ~~the City Planner~~BUILDS Department staff, to the BUILDS Department ~~Republic Community Development Department~~ at least twenty (20) working days prior to the meeting of the City Council at which the plat is to be considered for approval. ~~A Final Plat and application shall not be accepted for review after the two-year anniversary date of the City Council's Preliminary Plat approval.~~

410.240 Review Procedures

The ~~City Planner~~BUILDS Department shall determine if the submittal is complete, and if so, transmit the same to the City Clerk in adequate time for inclusion on the agenda for the City Council's next meeting. If the ~~City Planner, Community Development Director or City Engineer~~BUILDS Department staff reviews the application and plat and finds that it is incomplete or that the Minimum Required Improvements are not completed, then ~~City Planner~~BUILDS Department staff shall so notify the applicant in writing and shall note any deficiencies. Once all deficiencies have been addressed and the final plat is signed by the owner, sealed by the surveyor of record and all others required herein, the plat will be forwarded to the City Council for approval by general ordinance, prepared by the City Attorney.

410.250 Minimum Required Improvements

A. The owner or developer is required to have all subdivision improvements, including sidewalks, completed prior to the filing of the final plat. In lieu of the final completion of said improvements before the plat is recorded, the owner or developer ~~or other person~~shall enter into a Developer's Agreement~~who agrees~~ with the City to make the public improvements ~~on behalf of the owner or developer may~~to post a ~~surety bond with one (1) or more corporate sureties engaged in the business of signing surety bonds in the State of Missouri, an escrow agreement, letter of credit or other appropriate security agreement for certain improvements~~financial security with the approval of the ~~City Attorney and the City Administrator~~City Council of the City of Republic~~,~~. ~~which surety, escrow agreement or other appropriate security agreement~~The financial security will insure to the City that the improvements will be completed by the owner or developer.
    1. Improvements related to ensuring public safety within the development must be completed and accepted prior to the filing of the final plat. All other improvements must be completed within ~~one (1) year after the recording of the final plat~~the terms of the Developer's Agreement. The ~~Director of Public Works~~ BUILDS Administrator, or their designee, may require that certain improvements such as storm sewers, off-site improvements and basic improvements necessary for the provision of public health and safety be made and refuse to accept security for such improvements when they determine the improvements are necessary for the protection of adjacent property or of the general public. ~~The City may, upon proof of hardship, extend the completion date set forth in said bond or agreements for a maximum period of one (1) additional year; provided a request for said extension is made prior to the end of the one (1) year following recordation and provided the amount of said security is revised pursuant to a revised estimate by the Department of Public Works.~~ The City Attorney and City Administrator, acting in conjunction, may at any time during the period of such bond accept a substitution of principal or sureties on the bond or a substitution of a letter of credit, escrow or other approved security agreement. The amount of the corporate surety bond, escrow agreement or other appropriate security agreement shall not be less than the estimated cost of the improvements, said estimate of cost to be made by the BUILDS Department ~~of Public Works~~. The City may defer at the time of final approval, subject to appropriate conditions, the provision of any and all such improvements as, in its judgment, are not appropriate because of incompatible grades, future planning,

inadequate or lack of connecting facilities or other reasons. As a condition of deferral, the owner or developer shall pay their share of the costs of the future improvements to the City prior to the signing of the final plat or the owner or developer may post an appropriate security approved in the same manner as stated above which shall insure completion of said deferred improvements upon demand by the City. If the improvements are not completed within the specified time, the City Council may use the funds from said security, or any necessary portion thereof, to complete the same.

2. The release or reduction of said corporate surety bond, escrow agreement or other appropriate security agreement shall be in accordance with the following:
    a. When a petition for improvements by the tax bill method is filed for the improvements of this Section and when said petition has passed the required remonstrance petition assuring the City that all improvements will be installed, said bond or agreements posted by the owner or developer to insure the City the improvements of this Section may be released and returned to the owner or developer.
    b. The **BUILDS Administrator** ~~Director of Public Works~~ with the approval of the City Administrator, may release or reduce said bond or agreements posted by the owner or developer to insure to the City the improvements of this Section when **they have** ~~he has~~ determined that all required improvements have been satisfactorily completed and the owner or developer's engineer or surveyor has certified to said Administrator, through submission of a detailed "as-built" survey plat of the subdivision indicating location, dimensions, materials and other information required by said Administrator, that the layout of the line and grade of all public improvements are in accordance with construction plans for the subdivision and that the improvements have been completed, are ready for dedication to the local government and are free and clear of any and all liens and encumbrances.
    c. The **BUILDS Administrator** ~~Director of Public Works~~ with the approval of the City Administrator may reduce, upon request, said bond or agreements when he has made the findings and received the information required in the above Subsection **(b)**, but such reduction shall not exceed the ratio that the cost of completed improvements bears to the total estimated cost of total public improvements for the plat.
3. The City, its boards, commission and agents shall withhold all City improvements or services of whatsoever nature, including the furnishing of sewer, water, electricity and gas, from all additions which have not been approved as provided by these regulations; and further, no permits shall be issued by the **BUILDS** ~~Community Development~~ Department of the City of Republic on any property which has not been approved as provided by these regulations.
4. Provided however, the improvements and permits withheld above shall not be withheld by reason of the conditions therein stated when the City finds the improvements are necessary to comply with other ordinances of the City of Republic which carry a penalty for failure to comply~~.~~

410.260 Effect Of Final Plat Approval

Final Plat approval shall confer upon the developer the conditional right that the City Council will not change the general terms and conditions under which the approval was granted. Approval of the Final

Plat, by general ordinance, and the subsequent recording of the Final Plat shall constitute the subdivision of the property into lots and the creation and dedication of right-of-way and utility easements.

410.270 Monuments

A. All monuments shall be set in the ground at least to the depth of the minimum length given, unless they are encased in concrete. The precise position of corner monuments shall be marked by a point on a cap and the cap inscribed with the registration number o~~–~~f the land surveyor responsible for placement or the corporate registration number or name of the company. Monumentation shall comply with the following at a minimum.
    1. *Permanent monuments*. Two (2) permanent monuments per subdivision block, adjacent to or located in the right-of-way.
        a. Minimum diameter of five-eights (5/8) inch by twenty-four (24) inches length, steel or coated steel rebar or similar bar.
        b. Monuments shall have a permanently attached cap of the same or of a dissimilar metal if the metals are insulated with a plastic insert to reduce corrosion.
    2. *Semi-permanent monuments*. Located at each lot corner of each platted lot in the subdivision.
        a. Minimum diameter of one-half (1/2) inch by eighteen (18) inches in length, steel or coated steel rebar or similar bar.
        b. Monuments shall have a plastic or aluminum cap.
    3. ~~*Elevation markers*~~***Benchmarks***. For subdivisions platted in the vicinity of floodplains, ponds, lakes, creeks and other major drainage features, a permanent **benchmark** ~~elevation marker~~ shall be established at location(s) required by the City to reference and verify minimum finished floor elevations **as published on the As-Built Plans**.

410.280 Existing Or Proposed Features To Be Shown On The Final Plat

A. Prior to approval of the Final Plat, the ~~City Planner and the City Engineer~~**BUILDS Department** shall review the Final Plat for conformance to the Preliminary Plat and to determine that the plat shows or establishes the following information, which shall be in substantial conformity to the Preliminary Plat.
    1. *Name and code*. The name of the subdivision, phase or addition as provided on the Preliminary Plat.
    2. *Date of preliminary plat approval*. The date and name in which the Preliminary Plat was approved as shall be indicated on the Final Plat. In addition, any ordinance, resolution or other bill passed by the City Council or Planning and Zoning Commission that relates to the subdivision or particular phase, shall be included on the plat.
    3. *Owners of record*. The names and addresses of the owner(s) of record, developer(s), engineer, **and/**or surveyor responsible for the subdivision design.
    4. *Vicinity map*. A vicinity map at a scale of four hundred (400) feet or more to the inch shall be drawn on the **Final** ~~preliminary~~ **P**lat. The map shall indicate:
        a. Section, Township, Range.
        b. Adjacent City limits, other corporation or ad hoc district lines, such as school or sewer districts, etc.
        c. The nearest existing highways or thoroughfares, streets and alleys in neighboring subdivisions or unplatted property.

5. *Abutting owners*. The name of adjacent subdivisions and the names of record owners of adjacent parcels of unplatted land.
6. *Boundary lines*. The boundary lines, accurate in scale, of the tract to be subdivided.
7. *Streets — other features*. The location, widths and names of all existing or platted streets, right-of-way or other public ways within or adjacent to the tract, and other important features such as watercourses; railroad lines; corporation and township lines, utility lines, etc.
8. *Proposed design — street, drainage, etc*.
    a. The layout, names and widths of right-of-way, streets, alleys and easements serving stormwater, sewer, water or other utilities within the property being subdivided.
    b. **Where additional right of way is required along an existing road, new right of way line(s) shall be based off of section or other adjacent aliquot part line rather than centerline of road splits.**
    c. **Exemptions or modifications may be made by the BUILDS Administrator or their designee.**
9. *Proposed layout and legal description*. The legal description of the entire site to be subdivided, including ~~approximate~~ acreage in tract**,** ~~,~~ **The** boundary **and easement** line~~s~~, location**s**, ~~and~~ dimensions**, and bearings** of newly created tracts, parcels or lots that are part of the subdivision shall be shown on plat. The dimensions and location of all arcs, radii, ~~internal angles,~~ points of curvature and tangent boundaries and other pertinent survey information necessary ~~to~~ **for** an accurate description and location. Survey data shall meet **all applicable portions of the current Missouri Standards for Property Boundary Surveys as promulgated by the Department of Agriculture, Division of Weights, Measures and Consumer Protection.** ~~the standards promulgated by the State of Missouri, "Missouri Minimum Standards for Property Boundary Surveys", Division of Geology and Land Survey, Missouri Department of Natural Resources.~~ All survey datum shall be vertically **tied to the NAVD 88 datum** and **shall graphically show a horizontal tie to two subdivision corners by bearing and distance from the nearest published GRS monument which name and/or designation number, date of adjustment and coordinates shall be noted. If the MoDOT Real Time Network is used in lieu of a GRS monument, then a statement to that effect shall be noted along with the Epoch of subdivision control. Also State Plane Coordinates of at least two external boundary corners of subdivision shall be shown.** ~~horizontally tied to the City of Republic Geographical Reference Stations (GRS).~~
10. ~~*Curvature and radius*~~***Curve Data***. When a **boundary, easement, lot, or** street is on a circular curve, the ~~main chord of the~~ centerline **data shall be shown in place or on an included Curve Table. Curve data shown shall consist of at least the following; Curve number/name if table is used; Delta or central angle; Radius; Arc length; Chord length and bearing.**
    a. **When curved lot lines are concentric to the centerline of street it shall be noted as such on plat.**
    b. **Non-tangent curves shall be noted in place or in Curve Table and shall show Central Angle rather than Delta; Bearing from radius point to point of curvature and all other curve components mentioned above.** ~~shall be drawn as a dotted line in its proper place; and either in it or in an adjoining table, the bearing and length shall be noted; the radius of the circle of which the curve is a part; the central angle subtended; the bearing of the radius at the point~~

~~of curve; and the chord length and deflection angles used in staking out the survey. The lot lines on the street sides may be shown in the same manner or by bearings and distances. When a curve of two hundred (200) feet radius or less is used, it is sufficient to show the length and bearing of the main chords, the radius at one (1) end of the curve, and the central subtended.~~

11. *Lot information*. The plat shall indicate the area, proposed setbacks**, proposed and existing easements**, and exact location and distance of all structures and other physical improvements in relation to proposed lot lines.
12. *Zoning*. Zoning boundary lines and proposed use of property.
13. *North point, etc*. Title, **bar** scale, north arrow, **basis of bearing**, date of preparation, and date of each successive revision.
14. *Floodplains, etc*. The extent and location of floodplains, floodways or other waterways of record; elevations of which, shall be based on applicable Flood Insurance Studies, Flood Insurance Rate Maps, Flood Boundary and Floodway Maps.
15. *Location of model home*. The location of the model home or spec. house, if applicable, as it occupies a platted lot in the subdivision.
16. *Commercial and industrial subdivisions*. Final Plats~~ for industrial or commercial subdivisions~~ shall delineate who will be responsible for addressing open space, landscaping and buffer yard requirements.
17. *Notes and related information*. Notes pertaining to particular items such as:
    a. Access limitations;
    b. Total area;
    c. Total number of lots;
    d. Smallest/largest lot;
    e. Replat information;
    f. Source of title;
    g. Recording information for covenants and restrictions.
18. ~~*Minimum finished floor elevations:* provide in a table or by other means, minimum finished floor elevations for each lot created by the subdivision, typically 1 ft above top of curb height directly adjacent.~~
19. ***Sinkholes*. The extent and location of sinkholes must be shown, the location of which shall be based on the latest data from the Greene County Assessor's Department, a report conducted by a Geotechnical Engineer, or a source approved by the BUILDS Department Administrator or their designee. Any sinkhole and its associated thirty-foot "No Build" buffer zone must be entirely contained within a common lot.**
20. ***Dedications of Off Site Right of Way and Easements to the City* All right of way for streets and easements for proposed drainage, sewer and water extensions located outside existing easements or right-of-way, shall be dedicated to the City via formal legal instruments. This shall include dedication for streets, temporary construction, and permanent easements and shall be shown and or noted on Final Plat. Depending upon the number of landowners and the complexity of the proposed street or utility extensions the City may require a property owner's exhibit accompanied by an opinion of title as issued by a recognized title company.**

410.290 Professional~~Registered~~ Land Surveyor's Certificate

A certification shall be included on the plat by a ~~registered~~Professional ~~l~~Land ~~s~~Surveyor to the effect that the plat represents a survey made by him/her, and that the locations of all required survey monuments~~,~~

~~installed or to be installed,~~ are correctly shown thereon. The months and year during which the survey was made shall be shown. The certification block shall substantially conform to the following.

That I, _____do hereby declare that this plat was prepared under my supervision from an actual survey of the land herein described prepared by _____ dated _____ and signed by _____ P.L.S. No. _____ and that the corner monuments and lot corner pins shown herein were placed under the personal supervision of _____ P.L.S. No. _____ in accordance **all applicable portions of the current Missouri Standards for Property Boundary Surveys as promulgated by the Department of Agriculture, Division of Weights, Measures and Consumer Protection.** ~~with the Division of Geology and Land Survey, Missouri Department of Natural Resource's "Current Missouri Minimum Standards for Property Boundary Surveys as Promulgated by the Missouri Department of Natural Resources".~~

Date Prepared _____

Signature: _____

Missouri Professional Land Surveyor No. _____

Date: _____

410.300 Owner's Certificate

A signed statement, substantially conforming to the following shall be included on the plat, which certifies that he/she had title to the land being subdivided and all access rights as represented on the plat are hereby dedicated. This certification block shall include a notary blank.

OWNER(S) DEDICATION

As owner(s) I/We, Owner(s) Name have caused the land described on this plat to be surveyed, divided, mapped, and all access rights reserved and dedicated as represented on the plat. I/We hereby dedicate, grant, and convey right-of-way and easements shown hereon to the City of Republic. Furthermore, I/We, certify that there are no suits, actions, liens, or trusts on the property conveyed herein, and warrant generally and specially the property conveyed for public use and will execute such further assurances as may be required.

_____
Name of Owner(s) and/or Subdivider

Date: _____

410.310 Certificate Of Taxes Paid

The plat shall contain a certification block for the City and County Official to the effect that there are no unpaid taxes and unpaid special assessments due and payable at the time of plat approval. The certification block shall substantially conform to the following:

CERTIFICATE OF TAXES PAID There are no unpaid taxes due and payable at the time of plat approval and no unpaid special assessments, whether or not due and payable at the time of plat approval on any of the lands included in this plat, and all outstanding taxes and special assessments have been paid on all property dedicated to public use.

_____
Parcel Number

_____
County Collection Official

_____
Date

410.320 City Council Certificate

A statement of approval by the City Council indicating the date and ordinance number in which Final Plat was accepted and approved. The certification block shall substantially conform to the following.

APPROVAL BY THE CITY COUNCIL

I, , City Clerk of the City of Republic, Greene County, Missouri, Do hereby certify that the Plat of _____ was presented to, accepted and approved by the City Council of said City of Republic, and approved by General Ordinance No. _____on the _____day of _____, 20_____.

_____
City Clerk

_____
Date

410.330 Compliance With Land Use Regulations Certification, Certificate Of Compliance With Zoning And Subdivision Regulations

The Plat shall include a signature block establishing conformance to the Land Use Regulations adopted by the City of Republic.

CERTIFICATE OF COMPLIANCE WITH ZONING AND SUBDIVISION REGULATIONS I, _____, City Planner of the City of Republic, Missouri, do hereby certify on the _____ day of _____, 20____, the Final Plat of _____ _____ conforms to the City of Republic Land Use Regulations, in accordance with Title IV of the Republic Code of Ordinances.

410.340 Recorder's Office

A title block shall be included on the plat for the Office of the Recorder of Deeds, Greene County, Missouri substantially conforming to the following.

IN THE RECORDER'S OFFICE I, _____, Recorder of Deeds, Greene County, Missouri, do hereby certify that the within instrument of writing was on the day of_____, 20 , duly filed for record and is recorded in the records in this office in book _____ page _____in testimony whereof, I have hereunto set my hand and affixed my official seal at my office in Springfield, Missouri, this _____day of _____, 20_____.

_____
Recorder of Deeds

_____
Date

410.350 Final Submittal

A. Final submittal of the Final Plat shall be prepared on two (2) reproducible original (mylars) 24" X 36" or those dimensions required by the County Recorder of Deeds. The following shall be submitted in addition to the original.
   1. ~~Sixteen (16) inches X twenty-four (24) inches scaled reproducible mylar for the City's plat book.~~
   2. ~~Six (6) blue line copies (24" X 36"). The developer may submit more than the required minimum of blue line copies.~~
   3. All off-site easements and right-of-way deeds.
   4. As-built drawings **as described in 410.210** of the phase being approved.
   5. Permits, on file, from MoDNR for authorization to connect and place the water and sewer lines in service.
   6. Copy of private and restrictive covenants to be recorded.
   7. Electronic copies of the subdivision plat, infrastructure or as-built plans, etc.
   8. The ~~community development~~ **BUILDS Department** staff may require additional elements to incorporate the final plat to the City map or to supply related government agencies with plats and reproducible prints, as needed.

410.355 Maintenance After Approval

The developer shall maintain and keep in repair all public infrastructure and detention areas for a period of one (1) year from the date the constructed improvements are approved by the City. To guarantee this maintenance, an acceptable maintenance bond, letter of credit or other acceptable security shall be provided in the amount of ten percent (10%) of the contract price of the improvements against defects in workmanship and materials for the above-mentioned one (1) year period. The bond, letter of credit or security shall be filed with the City and be from a surety company licensed to do business in the State of Missouri and in a form to be approved by the City Attorney.

Article 410-VI General Principles Of Design And Minimum Requirements For The Layout Of Subdivision

410.360 Functional Classification Of Streets

As defined in this Chapter, the following terms are used as follows:

EXPRESSWAY

A limited-access highway with some grade crossings and signals at major intersections intended for high-volume, moderate to high speed traffic across the metropolitan area with minimal access to adjacent land.

FREEWAY

A fully controlled access highway with grade-separated interchanges at major thoroughfares. Intended for high-volume, high-speed traffic movement between cities and across the metropolitan area and not intended to provide direct access to adjacent land.

PRIMARY ARTERIAL

A street primarily intended to provide for high-volume, moderate-speed traffic from one part of the City to another or between major activity centers. Providing access to abutting property is a secondary function and access points should be controlled.

SECONDARY ARTERIAL

A street which supplements and feeds the principal arterial system and is intended for moderate-volume, moderate-speed traffic. Access to abutting property is a secondary function and access points should be partially controlled.

COLLECTOR
A street which collects and distributes traffic to and from Local Streets and Arterial Streets. Collector Streets are intended for moderate volume, low speed and short length through trips. The main function of a Collector Street is to move traffic from Local Streets to the Arterial System. A secondary function of a Collector Street is to provide access to Local Streets.

LOCAL STREET
A street intended to provide access to abutting property while its secondary function is to provide traffic flow and movement. Local Streets, which comprise the largest percentage of total City street mileage, are designed for low-volume, low-speed traffic. ~~During the platting process a Local Street may be designated as a Local-Commercial, Local-High-density residential or Local-Low-density residential street, depending upon the predominant land use it will serve.~~

410.370 Design Standards -- Streets And Sidewalks

A. Streets shall be designed in accordance with the latest addition of the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets.*

B. Sidewalks shall be 5' minimum width and conform to the latest standards identified by the American's with Disabilities Act (ADA).

410.380 Street Grades And Curves

A. The grades of streets shall not exceed the following except that, where unusual or exceptional conditions exist, the Planning Commission may modify these requirements:
   1. *Arterials.* Five percent (5%) maximum.
   2. *Collector streets*. Seven percent (7%) maximum.
   3. *Local streets, service drives and alleys*. Ten percent (10%).
   4. *Pedestrian ways or crosswalks*. Twelve percent (12%), unless steps of an acceptable design are to be constructed.
   5. *Minimum grade*. In no event shall the minimum grade of any street be less than seventy-five hundredths percent (.75%) with lengths not to exceed two hundred (200) feet.
   6. *Changes in street grades*. All changes in street grades in excess of one percent (1%) shall be connected by vertical curves of a minimum length equal to fifteen (15) times the algebraic difference in the rate of grade for highways, thoroughfares and parkways; and one-half (½) of this minimum for all other streets.
   7. *Curvature of centerline*. **shall be designed in accordance with AASHTO's *A Policy on Geometric Design of highways and Streets*** ~~The radii of curvature on the centerline shall not be less than the following:~~

      a. ~~*Highways, etc.* Highways, thoroughfares and parkways: four hundred (400) feet.~~
      b. ~~*Local streets, etc.* Local streets, minor streets and service drives: one hundred (100) feet.~~

410.390 Easements To Be Granted To The City

A. Utility easements shall be provided adjacent to all lots and rights-of-way, the following minimum utility easements are required.
    1. Utility easements adjacent to right-of-way: ten (10) feet.
    2. Easements for off-site utilities: fifteen (15) feet.
    3. Easements for all other utilities: fifteen (15) feet.
    4. Temporary construction easements: sixty (60) feet.

410.395 Location Of Certain Public Utilities

A. The location of public utility easements shall be compliant with the following requirements:
    1. Proposed public utilities are prohibited in any location the City Engineer determines interferes with the operation or maintenance of any of the City's utility infrastructure or will otherwise interfere with the rights and reasonable convenience of property owners.
    2. Proposed public utilities located in residential subdivisions to be dedicated, owned, and/or maintained by the City of Republic are prohibited in the rear or side yard; exceptions may be granted by the City Engineer if no other alternative is available.

410.400 Access Management

A. *Freeways, Expressways, Primary Arterials*.
    1. When subdividing land, all parcels shall have direct frontage on a dedicated street to obtain access. Access to property via ingress/ egress easements shall not be allowed.
    2. When subdividing land adjacent to Freeways, Expressways and Primary Arterials, direct access from parcels to the arterial shall be prohibited. Access shall be provided to Freeways, Expressways and Primary Arterials via Local Streets, Collector Streets and Secondary Arterial Streets.
    3. If the land adjacent to the Freeway, Expressway or Primary Arterial is zoned for commercial land uses, a Secondary Circulation System shall be constructed according to the Major Thoroughfare Plan to control access and maintain traffic flow. The Secondary Circulation System shall be located at least four hundred forty (440) feet from the highway and run parallel to the highway thus creating reverse frontage lots.
    4. In the case of infill development along Freeways, Expressways and Primary Arterials, where direct access cannot be prevented because of prior platting or existing development patterns, joint access driveways shall be constructed.
    5. In the Site Plan review process, commercial property along Freeways, Expressways and Primary Arterials shall be required to construct Internal Circulation Systems between parcels to provide access management to the Arterial Street.
B. *Collector Streets And Secondary Arterial Streets*.
    1. When subdividing land adjacent to Secondary Arterial Streets and Collector Streets, direct access from parcels to the arterial or collector shall be prohibited.
    2. If the land adjacent to the Collector Street or Secondary Arterial Street is zoned for commercial land uses, a Secondary Circulation System shall be constructed according to the Major Thoroughfare Plan to control access and maintain traffic flow. The Secondary Circulation System shall be located at least two hundred twenty (220) feet from a Secondary Arterial and one hundred twenty (120) feet from a Collector and shall run parallel to the highway thus creating reverse frontage lots.

3. In the case of infill development where direct access cannot be prevented because of prior platting or existing development patterns, the construction of turnaround drives shall be provided.

C. Access Restrictions by Classification of Roadway

1. All Distances are centerline-to-centerline. If roadway is owned/operated by another Authority Having Jurisdiction (AHJ) then follow their access spacing guidelines.

a. Collector

(1) Full access roadway intersections spacing shall be a minimum distance of 660'

(2) Commercial driveway spacing shall be a minimum distance of 160'

b. Secondary Arterial

(1) Full access roadway intersections spacing shall be a minimum distance of 660'

(2) Commercial driveway spacing shall be a minimum distance of 210'

c. Primary Arterial

(1) Full access roadway intersections spacing shall be a minimum distance of 1/4 mile.

(2) Commercial driveway spacing shall be a minimum distance of 330'

410.410 Street Layout

The street layout of the subdivision shall be in conformity with the adopted Transportation Plan. The design and arrangement of streets in the subdivision shall provide for the continuation of streets in adjacent subdivisions, where such extension is not prohibited by topographic conditions. Local Streets shall be laid out so as to discourage their use by through traffic. Streets shall be arranged in proper relation to topography so as to result in usable lots and safe and reasonable grades, both for the streets and driveways intersecting therewith.

410.420 Intersections

Proposed Collector Streets and Secondary Arterial Streets shall intersect one another at ninety-degrees (90°). The street centerline shall never be less than eighty-five degrees (85°) when a Collector Street or Secondary Arterial Street is involved. The street centerline should never be less than eighty degrees (80°) when a Local Street is involved. Four-way intersections shall be created for minor interior streets. Street jogs with centerline offsets of less than one hundred twenty-five (125) feet shall be prohibited on all types of streets.

410.430 Private Roads And Gated Developments

A. The Planning and Zoning Commission and the City Council may approve a plan or plat for a gated/private development if the proposal is found to meet acceptable planning and design guidelines and shall furthermore meet the following:

1. The proposed development shall not adversely affect **the adopted Major Thoroughfare Plan,** existing or planned neighborhoods, rights-of-way**,** and**/or** public infrastructure.
2. The proposal must provide adequate information relating to restrictive covenants, bylaws and contingencies to ensure the development will be sustainable and self sufficient.
3. Private or gated developments shall meet the general principles of design and minimum requirements for the layout of subdivision in the City of Republic; all improvements shall be constructed to City standards.

410.440 Blocks

A. The length of blocks in a subdivision shall be designed to be more than five hundred (500) feet and shall not exceed one thousand five hundred (1,500) feet as measured from centerlines of streets.
B. The width of blocks in a subdivision shall be designed to provide two (2) tiers of lots, except where the lots back onto a major street, natural feature, subdivision boundary or other feature or facility that requires reverse frontage.

410.450 Dead-End Streets And Cul-De-Sacs

A. Except as otherwise provided herein, temporary dead-end streets shall be approved where the layout of the subdivision requires streets to be built to property lines for future development of the street system. A temporary cul-de-sac will be required on roads more than one hundred fifty (150) feet in length. When the staging of development allows the developer to stage the construction of streets in the development.
B. Dead-end streets of reasonable length (normally not over five hundred (500) feet) may be approved where necessitated by topography or where, in the opinion of the ~~Planning and Zoning Commission~~**BUILDS Administrator or their designee**, they are appropriate for the type of development contemplated. At the end of all said streets, cul-de-sacs shall be built.
C. Cul-de-sac streets may be allowed if the street does not exceed five hundred (500) feet in length measured from the centerlines and the closed end shall have a turnaround encompassing a minimum right-of-way diameter of one hundred (100) feet.
D. Sidewalks constructed on dead-end streets shall be extended to the end of the street and around the entire radius of the cul-de-sac.

410.460 Street To Extend To Boundary Lines

A. Proposed streets shall be extended to the boundary lines of the tract to be subdivided, unless prevented by topography or other physical conditions or unless, in the opinion of the Planning and Zoning Commission, such extension is not necessary or desirable for the future development of adjacent tracts.
B. Where appropriate to the design, proposed streets shall be continuous and in alignment with existing, planned or platted streets with which they are to connect. It is not the intent of these regulations to require that streets be designed in a grid-fashion. Streets shall be designed to accommodate natural obstacles, such as known sinkholes, floodplains, pipelines, streams or other waterways.
C. Local streets shall connect with surrounding streets where necessary to permit the convenient movement of traffic between residential neighborhoods or to facilitate access to neighborhoods by emergency service vehicles or for other sufficient reasons, but connections shall not be permitted where the effect would be to encourage the use of such streets by substantial through traffic.

410.470 Sidewalks And Greenways

A. Unless otherwise approved, sidewalks shall be **5 feet in width and** required on both sides of all existing and new Secondary Arterial Streets and Collector Streets and one (1) side of all existing and new Local Streets, with the following exception:
    1. The ~~Planning and Zoning Commission~~**BUILDS Administrator or their designee** may deem it unnecessary to require sidewalks on interior streets in industrial subdivisions.

B. The ~~Planning and Zoning Commission~~**City's Adopted Plans** may require greenways along Secondary Arterials ~~according to the City's Transportation Plan~~.

410.480 Water Supply

A. Where a public water supply main is reasonably accessible, in the judgment of the Planning and Zoning Commission, the subdivision shall be provided with a looped water distribution system adequate to serve the area being platted, including a connection for each lot and appropriately spaced fire hydrants, in accordance with requirements set out below and in conformance with ~~"Construction Specifications for Public Improvements, City of Republic"~~**"Standard Specifications and Details for Water and Sewer Construction, City of Republic, Missouri"** on file at the offices of the City of Republic ~~Public Works~~ **BUILDS** Department and incorporated herein by reference. All water system plans shall be designed and installed in accordance with the City's Water System Master Plan. Main extensions, upgrades and related looping required by the plan shall be done so at the expense of the developer.

B. The minimum size of a water main ~~providing fire protection and serving fire hydrants~~ shall be six (6) inches in diameter. Larger mains shall be required, if necessary, to allow withdrawal of the required fire flow while maintaining the minimum residual pressure of twenty (20) pounds per square inch throughout the distribution system or to conform to the City's Water System Master Plan. ~~Mains not providing fire protection shall be no smaller than two (2) inches in diameter.~~ All mains shall be extended to adjacent property lines for future extension and looping.

C. *Fire Hydrants*.
   1. Fire hydrants should be located in accordance with National Fire Protection guidelines in reference to fire flow requirements in heavy use areas and residential but shall be placed not more than five hundred (500) feet apart in heavy residential areas and not more than three hundred (300) feet apart in heavy business areas.
   2. Fire hydrants located in heavy traffic areas, such as alleys or parking lots, shall be provided with protection against collision.
   3. **Fire Hydrants shall be painted "safety yellow".**

410.490 Bridges And Culverts -- Closed Storm Sewers

A. *Bridges And Culverts*. Bridges, box culverts or concrete pipe culverts shall be provided where continuous streets or alleys cross watercourses in accordance with the design requirements of ~~Section 410.650. Each structure shall be designed to carry H-20 loadings~~**the Adopted Plans of the City** using construction materials and installation procedures conforming with ~~"Construction Specifications for Public Improvements, City of Republic"~~**"Standard Specifications and Details for Water and Sewer Construction, City of Missouri" and the "Standards for Stormwater Management and Design Criteria Manual",** on file at the offices of the City of Republic ~~Public Works~~ **BUILDS** Department and incorporated herein by reference.

B. *Closed Storm Sewers*.
   1. Closed storm sewers shall be designed ~~for H-20 loadings and shall conform with "Construction Specifications for Public Improvements, City of Republic"~~**in accordance and shall conform to the Adopted Plans of the City** on file at the offices of the City of Republic ~~Public Works~~ **BUILDS** Department and incorporated herein by reference.
   2. Closed storm sewers shall be designed at and constructed to grades such that the velocity therein shall not be less than three (3) feet per second nor greater than twelve (12) feet per second **during rain events**.

3. Closed storm sewers shall extend to the furthest downstream point of development with consideration given to velocities and to providing discharge energy dissipaters to prevent erosion and scouring along downstream properties.

410.500 Public Sanitary Sewer

Where a public sanitary sewer main is reasonably accessible, in the opinion of the Planning Commission, the subdivision shall be provided with a complete sanitary sewer system connected with such sewer mains, at a grade not less than one-half of one percent (.5%)**, unless approved by the City Engineer,** including a lateral connection for each lot. The sewer system shall be designed to extend to adjacent property lines for future development. Such system and connection shall comply with the regulations of the Missouri Department of Natural Resources and to the regulations established by the City of Republic.

~~**410.510 Subdivision Sanitary Sewer**~~

~~Where a public sanitary sewer system is not reasonably accessible, in the opinion of the Planning and Zoning Commission, but where plans for the installation of sanitary sewers in the vicinity of the subdivision have been prepared and approved by the Missouri State Water Pollution Board, the developer shall install sewers in conformity with such plans. Where immediate connection is not possible and until such connection with the sewer system in the district can be made, the use of private sewage treatment facilities may be permitted, provided such disposal facilities are installed and maintained in accordance with the regulations and requirements of the State Water Pollution Board and approved by the City of Republic.~~

410.520 Private Sewage Collection

Where no sewers are accessible and no plans for a sewer system have been prepared and approved, the developer shall either install a sewage collection and disposal system in accordance with the requirements of ~~Title VII: Utilities and/or~~**the City of Republic and** the latest adopted Building Code.

410.530 Planting

All landscaped strips, parkways and screening areas dedicated to the public shall be graded, seeded and planted and maintained in accordance with City regulations. Where shrubs are required for the purpose of screening, location, specimen, density and other pertinent features shall be in accordance with the City's regulations.

410.540 Street Name Signs

All informational and regulatory signs, including, but not limited to, street name signs, stop signs, etc., shall be installed in accordance with the regulations of the ***Manual on Uniform Traffic Control Devices* (MUTCD) and** City of Republic at the expense of the developer.

410.550 Utility Service

Where practical, easements for underground conduits for utility lines shall be provided along front, rear and side lot lines. All utilities, including, but not limited to, electricity, telephone and cable television, shall be buried underground for all major subdivisions.

410.560 Property Corner And Boundary Monumentation

Property monumentation and for permanent and semi-permanent monuments shall comply with the **current** Missouri ~~Minimum~~ Standards for Property Boundary Surveys.

410.570 Final Cleanup Of Developed Lots

The owners and/or developers of all new homes, duplexes, apartments or businesses constructed shall have thirty (30) days from the date of the completion of the structure to get all yards and lots graded and all items of construction removed from said yards and lots within thirty (30) days from the completion of

said structure. If the owner and/or developer fails to properly grade and clean the lot and ~~have its~~**receive** approval by the ~~Building Inspector~~**BUILDS Administrator or their designee** ~~for the City of Republic~~, then each and every day after the thirty (30) day period shall be a separate violation of this Chapter and the owner and/or developer shall be subject to a fine of up to one thousand dollars ($1,000.00) for the violation of this Chapter. The ~~Building Inspector~~**BUILDS Administrator or their designee** shall have, in accordance with the latest adopted Building Code, the authority to extend this requirement at ~~his or her~~**their** discretion.

410.580 Street Lights

A. Public street lights on ~~residential~~ **local** streets shall be spaced between two hundred fifty (250) feet and three hundred fifty (350) feet apart, at street intersections and cul-de-sacs. Street light spacing on all roads with a classification of collector or above shall be determined on a case-by-case basis.
B. Wires connecting street lights in new subdivisions shall be buried underground at the expense of the developer and in accordance with Chapter **410** Subdivision Regulations.
C. All poles installed in new subdivisions for the specific purpose of providing on-street lighting **for public streets** shall be composed of concrete, fiberglass, steel, aluminum or other materials not composed of wood.
D. The developer of the subdivision shall bear the expense associated with meeting these standards. These requirements shall apply only to the installation of new street lights in major subdivisions platted after approval of this Code.
E. Once constructed and dedicated to the City, the ~~Director of Public Works~~ **BUILDS Administrator** is authorized to temporarily de-energize any street light until such time as construction is initiated on a new inhabitable structure within one hundred sixty (160) feet of the location of the street light. Street lights at street intersections and cul-de-sacs shall not be de-energized under this provision.

Article 410-VII Stormwater Management For Public And Private Improvements

410.650 General Provisions

A. ~~*Scope.* These design criteria set forth the minimum standards for design of storm drainage facilities on public right-of-way and private property in the City of Republic.~~

A. ~~*B.*~~ *Authority.*
   1. ~~These design criteria and standards set forth herein~~ **The Stormwater Design Manual** ~~have been~~ **has been** adopted by ~~the Planning and Zoning Commission and~~ the City Council *in accordance with the procedures and authority set forth in the City of Republic*.
   2. Any development or grading begun after the date of passage of these criteria and standards which does not comply with the requirements set forth ~~herein~~ **in The Stormwater Design Manual** shall be deemed to be in violation of the requirements established herein; and shall be subject to enforcement measures and penalties set forth in Section **100.220** — General Penalty.

B. ~~*C.*~~ *Interpretations.*
   1. Where any of the provisions ~~contained herein~~ may be unclear or ambiguous as they pertain to a particular site or situation, interpretations of the policies, criteria and standards set forth herein shall be made in writing by the **BUILDS Administrator or their designee** ~~Community Development Director~~.

2. Such written interpretations shall be kept on file for future reference for use in similar situations and shall be incorporated in subsequent revisions for the standards, if deemed necessary for general reference.

~~D. *Appeals.*~~

~~1. Where disagreements may arise over the interpretation of the requirements set forth herein, appeals may be made to the City Planner upon written request.~~

~~2. Information and supporting documentation for the appeal shall be submitted with the request. The City Planner shall forward the information to the Public Works Director, Community Development Director or the City Engineer within three (3) calendar days following receipt of the information.~~

C. ~~*E.*~~ *Approvals And Permits Required*.

1. *Grading permit*. Storm drainage facilities may not be constructed or altered without review and approval of the plans by the City and issuance of a Grading Permit by the City for subdivisions or for commercial or other sites.
2. *National Pollutant Discharge Elimination System (NPDES) stormwater permit*.
    a. Provisions of the 1987 Clean Water Act require that certain stormwater discharges obtain an NPDES stormwater permit. In Missouri, these permits are administered by the Missouri Department of Natural Resources **(MDNR)**.
    b. Federal rules for NPDES stormwater discharges are contained in 40 CFR Parts 122, 123 and 124 of the Code of Federal Regulations. State NPDES stormwater regulations are contained in 10 CSR 20-6.200 of the Code of State Regulations. Additional provisions for NPDES stormwater permits for land disturbance activities and information regarding the City of Republic General Permit for land disturbance activities are contained in Section **410.710** of these Criteria.
    c. *"404" Permit*.
        (1) For certain activities, which involve the discharge of dredged or fill materials into the waters of the United States a Department of the Army permit may be required as set forth Section 404 of the Clean Water Act. Rules for 404 permits are contained in 33 CFR Parts 320 through 330 of the Code of Federal Regulations.
        (2) Determination of applicability for Section 404 requirements are generally made by the Kansas City or Little Rock District office of the Corps of Engineers.
        (3) A brochure regarding the Corps of Engineers regulatory program may be obtained from the Corps offices.

D. ~~*F.*~~ *Coordination With Other Jurisdictions*.

1. Where proposed storm drainage facilities are located on property adjoining to other local government jurisdictions design of storm drainage facilities shall include provisions to receive or discharge stormwater in accordance with the requirements of the adjoining jurisdiction, in addition to meeting City requirements.
2. In these cases ~~two (2) additional sets of~~ plans shall be submitted and will be forwarded to the adjoining jurisdiction for review and comment.
3. No grading or construction of storm drainage facilities may commence without prior notification of the Missouri One Call utility warning system at 1-800-DIG-RITE, as required by law.

E. ~~G.~~ *Communications And Correspondence*. Communications and correspondence regarding stormwater plan review, policies, design standards, criteria or drainage complaints shall be directed to ~~the City Planner at the City of Republic, 213 N. Main, Republic, Missouri 65738, Phone: 417-732-3354~~**BUILDS Department staff.**

F. ~~H.~~ *Ownership And Maintenance*.

1. *Improvements on public road right-of-way*. Storm drainage improvements on public right-of-way shall, upon acceptance of the constructed improvements, become the property of; and shall be maintained by the City of Republic.
2. *Improvements on private property*.
   - **a.** Storm drainage improvements on private property shall be maintained by the owner of the lot upon which the improvements are located or by the Homeowners' Association for improvements located in common areas. **In such cases as an overland drainage easement is located on a private lot, the area of the drainage easement shall not count toward the minimum square footage required for the lot.**
   - b. All such improvements, which serve a drainage area, shall be located in drainage easement and the public shall have such rights of access to repair or maintain such facilities as set forth in Section **410.680(E)(4)**.

410.660 Stormwater Planning And Design

A. ~~*Stormwater Management Goals*. In order to ensure protection of the general health and welfare of the citizens of the City of Republic, planning and design of stormwater management measures shall meet the following goals:~~

1. ~~Prevent damage to residential dwellings and other building structures from floodwaters.~~
2. ~~Maintain emergency vehicle access to all areas during periods of high water.~~
3. ~~Prevent damage to roads, bridges, utilities and other valuable components of the community's infrastructure from damage due to flood waters and erosion.~~
4. ~~Prevent degradation of surface and groundwater quality from storm water runoff; preserve and protect quality of the environment; and promote conservation of the City's natural resources.~~
5. ~~Minimize floodwater and erosion damage to lawns, recreational facilities and other outdoors improvements.~~
6. ~~Minimize traffic hazards from runoff carried in streets and roads.~~
7. ~~Comply with applicable State and Federal laws and regulations.~~
8. ~~Meet the foregoing goals in a manner which is cost effective and which minimizes the cost of housing and development while encouraging sound development practices.~~
9. ~~Encourage innovative and cost effective planning and design of stormwater management facilities.~~
10. ~~Encourage multiple purpose design of stormwater management facilities, to provide opportunities for recreational use and other benefits to the community wherever possible.~~

~~The standards and criteria set forth herein provide the minimum standards for planning and design of stormwater facilities. Where a particular plan or design may be found to be in conflict with a specific standard, achievement of the goals set forth above will have precedence.~~

B. ~~*General Planning And Design Principles*.~~

1. The City of Republic recognizes that stormwater management is an important component of overall land use planning.
2. The City of Republic further recognizes that proper stormwater planning significantly reduces the long-term costs to the community both in terms of infrastructure cost and property losses due to flood damage. It is much more cost effective to prevent flood damage by proper design and construction, than to repair and remediate problems, which have occurred through poor planning and design.
3. The following general principles must be followed in preparing the grading and storm drainage plans for all development sites:
    a. *Recognize the existing drainage system*. The storm drainage system differs from other utility systems in very important ways:
        (1). There is an existing natural drainage system.
        (2). It is only needed when runoff occurs.
        (3). The capacity of the system varies greatly depending upon how much it rains.
        (4). The system does not have to be constructed of man-made components in order to function.
    b. Because of these characteristics there has been a historic inclination for fragmented planning and design of storm drainage facilities.
    c. Proper planning of storm drainage facilities must begin with the recognition of the existing system, and include necessary provisions for preserving or altering the existing system to meet the needs of proposed development or construction.
    d. Methods of delineating existing watercourses are outlined in Section 410.670.
4. *Allow for increase in runoff rates due to future urbanization*.
    a. As areas urbanize, peak rates of runoff increase significantly. The City of Republic may require temporary detention and storage of increased volumes of urban runoff in order to minimize increases in flow rates as urbanization occurs. However, the cumulative effects of on-site detention are difficult to predict and control and development of comprehensive basin-wide runoff models to determine these effects does not appear likely in the foreseeable future.
    b. For this reason, design of storm drainage improvements must be based upon the assumption of fully urbanized conditions in the area under consideration. No reduction in peak flow rates due to detention, unless an approved runoff model has been developed for the drainage basin under consideration. Any detention storage facilities whose effects are considered must be located within approved drainage easements.

5. *Provide for acceptance of runoff from upstream drainage areas*.
    a. It is critical that provisions be made to receive runoff from upstream drainage areas. Drainage easements or public right-of-way must extend to a point where the upstream drainage area is no greater than five (5) acres.
    b. Drainage easements or public right-of-way must extend to the point where existing watercourses enter the site. Where the upstream drainage area is five (5) acres or greater, but does not discharge onto the site through a defined watercourse, the drainage easement shall extend to the point of lowest elevation.

6. *Provide a means to convey runoff across the site*. Stormwater shall be conveyed across the site in a system of overland drainage ways and storm sewers. Overland drainage ways consists of streets, open channels, swales and overland flow within drainage easements.

7. *Discharge of runoff to downstream properties*.

a. Concentrated runoff shall be discharged only into existing watercourses, drainage easements or public road rights-of-way. Where none of these exist, a drainage easement which extends to the nearest watercourse, drainage easement or public road right-of-way must be obtained from the downstream property owner and proper provisions made for conveyance of the peak flow from the one percent (1%) annual probability (100-year) storm within the drainage easement.

b. One of the typical results of urbanization is that diffuse surface flow or "sheet flow" is replaced with concentrated points of discharge. Where concentrated flows are discharged to downstream properties proper provisions must be made to:

(1). Allow the flow to spread over the same area as would have occurred for the same rate of flow prior to the development, and

(2). Reduce the rate of velocity to rates at least equal to the pre-development values at the same rate of flow.

8. *Assess potential downstream flooding problems*.

a. It is important that a determination be made of conditions in the watershed downstream of each development site. Specifically it is important to determine whether there are existing structures, which are subject to an unacceptable flooding hazard.

b. If areas having an unacceptable flooding hazard occur downstream of a development site, either on-site detention for peak flow control or mutually agreed off-site improvements will be required, as set forth in Section 410.680.

9. *Assess potential water quality impacts on receiving waters*. Sediment, erosion and other water quality controls are required as set forth in Section **410.700** and Section **410.710**.

C. Drainage Easements. All areas subject to inundation during the major storm must be included in drainage easements. Specific standards for drainage easements to be provided for storm sewers, open channels and detention facilities are set forth in Section 410.680.

410.670 Stormwater Runoff Calculations

A. This Section outlines acceptable methods of determining stormwater runoff.

1. *General guidelines*.

a. For watersheds with a total tributary area less than two hundred (200) acres and a one percent (1%) annual probability (100-year) fully developed discharge less than three hundred (300) cfs, the design storm runoff may be analyzed using the rational formula.

b. For watersheds with a total tributary area greater than two hundred (200) acres or with a one percent (1%) annual probability (100-year) fully developed discharge greater than three hundred (300) cfs, the design storm runoff shall be analyzed using an approved hydrograph method.

2. *Rational formula*.

a. The rational formula, when properly understood and applied, can produce satisfactory results for urban storm sewer design. The rational formula is as follows:

Q = CIA
Where:

Q = Peak discharge in cubic feet per second.
C = Runoff coefficient which is the ratio of the maximum rate of runoff from the area to the average rate of rainfall intensity for the time of concentration.
I = Average rainfall intensity in inches per hour for a duration equal to the time of concentration.
A = Contributing watershed area in acres.

b. The basic assumptions made when applying the rational formula are:
(1) The rainfall intensity is uniform over the basin during the entire storm duration.
(2) The maximum runoff rate occurs when the rainfall lasts as long or longer than the basin time of concentration.
(3) Runoff response characteristics are relatively uniform over the entire basin.
(4) The time of concentration is the time required for the runoff from the most hydraulically remote part of the basin to reach the point of interest.

c. The drainage basin should be divided into sub-basins of a size where all of the basic assumptions apply.

3. *Time of concentration.*

a. Time of concentration, etc., is calculated by:
tc = ti + tt (5 minutes, minimum);where
ti = initial, inlet or overland flow time in minutes,
tt = shallow channel and open channel flow time in minutes.

b. Overland flow (sheet flow) time shall be calculated as:
ti = (n x L)0.8/(4.64 x S0.4) where
ti = initial, inlet or overland flow time in minutes,
n = Manning's n for sheet flow (from the following table),
L = Overland flow length in feet, (maximum of three hundred (300) feet),
S = Slope in feet per foot.

ROUGHNESS COEFFICIENTS (Manning's n) FOR SHEET FLOW SURFACE DESCRIPTION

Smooth surfaces (concrete, asphalt, gravel or bare soil)	0.011
Fallow (no residue)	0.050
Cultivated soils:	
Residue cover less than or equal to 20%	0.060
Residue cover greater than or equal to 20%	0.170

Grass:	
Short grass prairie	0.150
Dense grasses[1]	0.240
Bermuda grass	0.410
Range (natural)	0.130
Woods:[2]	
Light underbrush	0.400
Dense underbrush	0.800

NOTES:

1 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass and native grass mixtures.

2 When selecting n, consider cover to a height of about 0.1 feet. This is the only part of the plant cover that will obstruct sheet flow.

Shallow channel velocities may be estimated from Figure 3-1 in reference 11.

Open channel flow velocities may be estimated from Manning's equation. Open channel velocities are generally estimated under bank full conditions.

The basin time of concentration calculation techniques are described in detail in TR-55, Chapter 3 (reference 11).

4. *Hydrograph methods*.
    a. Methodologies.
        (1) The most common hydrograph techniques are those developed by the Corps of Engineers and the Soil Conservation Service. These methods are preferred, however other proven techniques will be accepted.
        (2) The Corps of Engineers HEC-1 Flood Hydrograph Package and Soil Conservation Service TR-55 computer models are the preferred runoff models. Other models may be used with approval from the City.
        (3) The runoff model must include the entire drainage basin upstream of the proposed development. The model shall be prepared in sufficient detail to ensure that peak runoff rates are reasonably accurate.
        (4) The runoff model shall be developed for the following cases:

(5) Case 1: Existing conditions in the drainage basin prior to development of the applicant's property.

(6) Case 2: Existing conditions in the drainage basin with developed conditions on the applicant's property.

(7) Case 3: Fully developed conditions in the entire drainage basin.

b. Rainfall.

(1) Rainfall depth-duration-frequency and intensity-duration-frequency curves for the Republic area are included in the standard drawings. The design rainfall intensities were developed from the U.S. Department of Commerce, National Weather Service, Technical Paper 40 (reference 19) and the National Oceanic and Atmospheric Administration publication "HYDRO-35" (reference 9).

(2) Rainfall depths for use with hydrograph techniques shall be taken from "Rainfall Frequency atlas of the Midwest, Bulletin 71" (reference 23).

(3) Rainfall shall be distributed in time using Huffs Distribution or the Pilgrim-Cordery Distribution adapted to local rainfall data (references 20 and 21) as shown in the following table. Other distributions may be used upon approval from the City.

Pilgrim-Cordery Method Synthetic Rainfall Mass Curves

Cumulative Fraction of Depth	Cumulative Fraction of Storm Duration				
	1-Hour	2-Hour	3-Hour	4-Hour	6-Hour
.00	.00	.00	.00	.00	.00
.05	.03	.03	.03	.02	.05
.10	.07	.05	.05	.03	.09
.15	.11	.10	.06	.05	.14
.20	.14	.17	.09	.06	.20
.25	.17	.22	.11	.08	.28
.30	.23	.25	.13	.14	.35
.35	.29	.27	.19	.20	.41
.40	.35	.29	.31	.27	.43

.45	.41	.30	.39	.33	.46
.50	.47	.31	.44	.38	.49
.55	.56	.41	.47	.47	.60
.60	.65	.51	.54	.56	.70
.65	.73	.60	.64	.64	.80
.70	.82	.69	.70	.74	.86
.75	.91	.78	.73	.83	.89
.80	.93	.82	.81	.87	.93
.85	.95	.87	.89	.90	.96
.90	.97	.92	.94	.93	.97
.95	.99	.96	.98	.97	.98
1.00	1.00	1.00	1.00	1.00	1.00

410.680 Stormwater Drainage Structures

A. *Inlets.*

1. *Inlet locations.* Inlets shall be provided at locations and intervals and shall have a minimum inflow capacity such that maximum flooding depths set below are not exceeded for the specified storm; at all sump locations where ponding of water is not desired and where drainage cannot be released at the ground surface.
2. *Inlet interception capacities.*
    a. Inlet capacities shall be determined in accordance with the Federal Highway Administration HEC-12 Manual (reference 5).
    b. Nomographs and methods presented in the Neenah Inlet Grate Capacities report (reference 12) may also be used where applicable.
    c. The use of commercial software utilizing the methods of HEC-12 is acceptable. It is recommended that software be pre-approved for use by the City.
3. *Clogging factors.* The inlet capacities determined as required in this Section must be reduced as follows, in order to account for partial blockage of the inlet with debris:

Inlet Type And Location	Clogging Factor
Type SS Curb Opening Inlets:	
on grades	0.9
in sumps	0.8
Grated Inlets:	
on grades	0.6
in sumps	0.5

Inlet lengths or areas shall be increased as required to account for clogging.

4. *Interception and bypass flow*. It is generally not practical for inlets on slopes to intercept one hundred percent (100%) of the flow in gutters. Inlets must intercept sufficient flow to comply with street flooding depth requirements. Bypass flows shall be considered at each downstream inlet, until all flow has entered approved storm sewers or drainage ways.
5. *Allowable street depths*. Urban streets are a necessary part of the City drainage system. The design for the collection and conveyance of storm water runoff is based on a reasonable frequency and degree of traffic interference. Depending on the street classification, (i.e. local, collector, etc.) portions of the street may be inundated during storm events. Drainage of streets are controlled by both minor and major storm events. The minor system is provided to intercept and convey nuisance flow. Flow depths are limited for the major storm to provide for access by emergency vehicles during most flood events. When the depths of flow exceed the criteria presented in this Section a storm sewer or open channel system is required.
    a. *General design guidelines*.
        (1). *Allowable flow depths:* Flow in the street is permitted with allowable depths of flow as follows:
        (2). *Local streets:* Crown of the street for the runoff from a 5-year rainfall, top of curb for runoff from a 25-year rainfall. Runoff from a 100-year rainfall should be contained within the right-of-way.
        (3). *Collector streets:* The equivalent of one (1) ten (10) foot driving lane must remain clear of water during a 5-year rainfall, top of curb for runoff from a 25-year rainfall. Runoff from a 100-year rainfall should be contained within the right-of-way.

(4). *Arterials and parkways:* Two (2) ten (10) foot lanes must remain clear of water, one (1) in each direction, during a 5-year rainfall. Top of curb for runoff from a 25-year rainfall. Runoff from a 100-year rainfall should be contained within the right-of-way. Where allowable depths are exceeded a storm sewer system must remove the excess water.

(5). *Arterials and parkways:* Two (2) ten (10) foot lanes must remain clear of water, one (1) in each direction for the 25-year storm. For the 100-year storm, a maximum of six (6) inches at the crown, depth at the gutter shall not exceed eighteen (18) inches. Where allowable depths are exceeded a storm sewer system must remove the excess water.

b. *Cross flow*. Cross flow at intersections is permitted up to the following depth.

Street Classification	**5-year Storm**	**25-year Storm**
	Allowable Depth	**Allowable Depth**
Local	6" in cross pan flow line	12" at gutter
Collector	No cross flow permitted	6" at gutter
Arterial or Parkway	No cross flow permitted	No cross flow permitted

c. *Hydraulics*. The allowable storm capacity of each street section with curb and gutter is calculated using the modified Manning's formula for both the 2-year and 25-year storm event.

	Q = 0.56(Z/n)S1/2d8/3
Where,	Q = discharge in cubic feet per second
	Z = cross slope of the street in feet per foot
	d = depth of flow at the gutter in feet
	S = longitudinal slope of the street in feet per foot
	n = Manning's roughness coefficient

6. *Types of inlets allowed.*

a. *Public streets.*

(1). *Curb opening inlets*. Type "SS" standard curb opening inlets as shown Drawing 140 shall be used for public streets with curb and gutter.

(2). *Graded inlets*.

In general the use of grated inlets in streets, which require adjustment when streets are repaved will not be permitted.

Where conditions are such that curb inlets cannot intercept the required rate of flow, necessary to control street flooding depth or to provide diversion of flow to detention, sedimentation or infiltration basins, "trench inlets" with veined grates may be specified with approval of the City.

Other types of inlets will not be permitted unless approved by the City.

b. *Outside of public right-of-way*. The type of inlets specified outside of public right-of-way is left to the discretion of the designer provided the following criteria are met:

(1). Maximum flooding depths for the major or minor storm as set forth above are not exceeded.

(2). General safety requirements set forth below are met.

(3). All inlets shall be depressed a minimum of two (2) inches below the surrounding grade to allow proper drainage to the inlet and prevent inadvertent ponding in the area around the inlet.

(4). Inlets in pavements shall be provided with a concrete apron.

7. *General safety requirements*. All inlet openings shall:

a. Provide for the safety of the public from being swept into the storm drainage system; the maximum allowable opening shall not exceed six (6) inches in width.

b. Be sufficiently small to prevent entry of debris which would clog the storm drainage system;

c. Be sized and oriented to provide for safety of pedestrians, bicyclists, etc.

B. *Storm Sewers*.

1. *Design criteria*.

a. *Design storm frequency*. The storm sewer system, beginning at the upstream end with inlets, is required when the 5-year peak flow in the street exceeds five (5) cfs or when allowable street depths are exceeded. Allowable street depths are specified above.

b. *Construction materials*. Storm sewers may be constructed using reinforced concrete, corrugated metal (steel or aluminum) or plastic pipe. The materials, pipes or appurtenances shall meet one (1) or more of the following standards:

PIPE MATERIAL	**STANDARD**
Reinforced Concrete Pipe — Round	ASTM C-76 or AASHTO M-170
Reinforced Concrete Pipe — Elliptical	ASTM C-507 or AASHTO M-207
Reinforced Concrete Pipe — Joints	ASTM C-443 or AASHTO M-198

Reinforced Concrete Pipe — Arch	ASTM C-506 or AASHTO M-206
Pre-cast Concrete Manholes	ASTM C-478 or AASHTO M-199
Pre-cast Concrete Box Pipe	ASTM C-789/C-850 or AASHTO M-259/M-273
Corrugated Steel Pipe Metallic Coated for Sewers and Drains	AASHTO M-36
Corrugated Aluminum Alloy Pipe and Under Drains	AASHTO M-196
Bituminous Coated Corrugated Metal Pipe and Pipe Arches	AASHTO M-190
Corrugated PVC Pipe	ASTM D-3034 and ASTM F-679
Corrugated Polyethylene Pipe	ASTM D-1248

c. *Vertical alignment*.

(1). The sewer grade shall be such that a minimum cover is maintained to withstand AASHTO HS-20 loading on the pipe. The minimum cover depends upon the pipe size, type and class and soil bedding condition, but shall not be less than one (1) foot from the top of pipe to the finished grade at any point along the pipe. If the pipe encroaches on the street subgrade, approval is required. Manholes will be required whenever there is a change in size, direction, elevation grade and slope or where there is a junction of two (2) or more sewers. The maximum spacing between manholes for storm sewers (cross sectional area less than twenty-five (25) square feet) shall be four hundred (400) feet. For large storm sewers (cross sectional area greater than twenty-five (25) square feet), manholes for maintenance access need only be placed a minimum of every five hundred (500) feet; access to the laterals can be obtained from within the larger storm sewer.

(2). The minimum clearance between storm sewer and water main (for new construction), either above or below shall be twelve (12) inches. Concrete encasement of the water line will be required for clearances of twelve (12) inches or less when the clearance between existing water mains cannot be obtained.

(3). The minimum clearance between storm sewer and sanitary sewer (for new construction), either above or below, shall be eighteen (18) inches. In addition, when an existing sanitary sewer main lies above a storm sewer or within eighteen (18) inches below, the sanitary sewer shall have an

impervious encasement or be constructed of structural sewer pipe for a minimum of ten (10) feet on each side of the storm sewer crossing.

(4). Siphons or inverted siphons are not allowed in the storm sewer system.

d. *Horizontal alignment*.

(1). Storm sewer alignment between manholes shall be straight except when approved by the City. Approved curvilinear storm sewers may be constructed by using radius pipe. The radius requirement for pipe bends is dependent upon the manufacturer's specifications.

(2). A minimum horizontal clearance of ten (10) feet is required between sanitary and water utilities and the storm sewer.

(3). The permitted locations for storm sewer within a street ROW are: (a) on centerline, (b) between centerline and curb and (c) behind the curb. Storm sewer shall not be placed on the area within the wheel lanes of the pavement.

e. *Pipe size*. The minimum allowable pipe size for storm sewers is dependent upon a diameter practical from the maintenance standpoint. For storm sewers less than fifty (50) feet in length the minimum allowable diameter is fifteen (15) inches. All other pipe shall have a minimum diameter of eighteen (18) inches.

f. *Storm sewer capacity and velocity*.

(1). Storm sewers should be designed to convey the design storm (25-year) flood peaks without surcharging the storm sewer. The sewer may be surcharged during larger floods and under special conditions when approved by the City.

(2). The capacity and velocity shall be based on the Manning's n values presented in Table I. The maximum full flow velocity shall be less than fifteen (15) fps. Higher velocities may be approved by the City if the design includes adequate provisions for uplift forces, dynamic impact forces and abrasion. The minimum velocity in a pipe based on full flow shall be two and one half (2.5) fps and the minimum slope shall be one half percent (0.50%) to avoid excessive accumulations of sediment. The energy grade line (EGL) for the design flow shall be no more than six (6) inches below the final grade at manholes, inlets or other junctions. To insure that this objective is achieved, the hydraulic grade line (HGL) and the energy grade line (EGL) shall be calculated by accounting for pipe friction losses and pipe form losses. Total hydraulic losses will include friction, expansion, contraction, bend, manhole and junction losses. The methods for estimating these losses are presented in the following Sections.

g. *Storm sewer outlets*. All storm sewer outlets into open channels shall be constructed with a headwall and wingwalls or a flared end section. Riprap or other approved material shall be provided all outlets.

h. *Hydraulic evaluation*. Presented in this Section are the general procedures for hydraulic design and evaluation of storm sewers. The user is assumed to possess a basic working knowledge of storm sewer hydraulics and is encouraged to review textbooks and other technical literature available on the subject.

i. *Pipe friction losses*. Pipe friction losses are estimated using Equation 1001 and Manning's formula (Equation 1002) which are expressed as follows:

	$Hf = Sf \times L$	(1001)

Where,	Hf = head loss due to friction (feet)	
	Sf = friction slope from Manning's equation (feet per foot)	
	L = length of pipe segment (feet)	
and	$V = 1.49 \times R^{2/3} \times Sf^{1/2}/n$	(1002)
Where,	V = velocity of flow (feet per second)	
	R = hydraulic radius = A/WP (feet)	
	Sf = friction slope (feet per foot)	
	A = area of flow (square feet)	
	WP = wetted perimeter (feet)	
	n = Manning's roughness coefficient (Table I)	

j. *Pipe form losses*. Generally, between the inlet and outlet, the flow encounters, in the flow passageway, a variety of configuration such as changes in pipe size, branches, bends, junctions, expansions and contractions. These shape variations impose losses in addition to those resulting from pipe friction. Form losses are the result of fully developed turbulence and can be expressed as follows:

	$HL = K (V^2/2g)$	(1003)
Where,	HL = head loss (feet)	
	K = loss coefficient	
	$V^2/2g$ = velocity head (feet)	
	g = gravitational acceleration (32.2 ft/sec^2).	

The following is a discussion of a few of the common types of form losses encountered in storm design.

(1). *Expansion losses*. Expansion losses in a storm sewer will occur when the sewer outlets into a channel. The expansion will result in a shearing action

between the incoming high velocity jet and the surrounding outlet boundary. As a result, much of the kinetic energy is dissipated by eddy currents and turbulence. The loss head can be expressed as:

	$HL = Kx (V1^2/2g)(1-(A1/A2))^2$	(1004)
Where,	A = cross section area in square feet	
	V1 = average upstream pipe flow velocity, feet per second	
	Kx = expansion loss coefficient.	

Subscripts 1 and 2 denote the upstream and downstream sections respectively. The value of Kx is about one (1.0) for a sudden expansion (such as an outlet to a channel) and about two tenths (0.2) for a well-designed expansion transition. Table II presents the expansion loss coefficient for various flow conditions.

(2). *Contraction losses*. The form loss due to contraction is:

	$HL = Kc(V2^2/2g)(1-(A2/A1)^2)^2$	(1005)
Where,	Kc = Contraction loss coefficient	

Kc is equal to 0.5 for a sudden contraction and about 0.1 for a well-designed transition. Subscripts 1 and 2 denote the upstream and downstream sections respectively. Table II presents the contraction loss coefficient for various flow conditions.

(3). *Bend losses*. The head losses for bends in excess of that caused by an equivalent length of straight pipe may be expressed by the relation:

	$HL = Kb(V2/2g)$	(1006)
Where,	Kb = Bend coefficient	

The bend coefficient has been found to be a function of: (a) the ratio of the radius of curvature of the bend to the width of the conduit, (b) deflection angle of the conduit, (c) geometry of the cross section of flow and (d) the Reynolds Number and relative roughness. Recommended bend loss

coefficients for standard bends, radius pipe and bends through manholes are presented in Table II.

(4). *Junction and manhole losses*. A junction occurs where one (1) or more branch sewers enter a main sewer, usually at manholes. The hydraulic design of a junction is in effect the design of two (2) or more transitions, one (1) for each flow path. Allowances should be made for head loss due to the impact at junctions. The head loss at a junction for each pipe entering the junction can be calculated from:

	$HL = (V2^2/2g) = Kj(V1^2/2g)$	(1007)
Where,	V2 = the outfall flow velocity	
	V1 = the inlet velocity	
	Kj = junction loss coefficient	

Because of the difficulty in evaluating hydraulic losses at junctions (Reference 6) due to the many complex conditions involving pipe size, geometry of the junction and flow combinations, a simplified table of loss coefficients has been prepared. Table II presents the recommended energy loss coefficients for typical manhole or junction conditions encountered in the urban storm sewer system.

(5). *Partially full pipe flow*. When a storm sewer is not flowing full, the sewer acts like an open channel and the hydraulic properties can be calculated using open channel.

(6). *Storm sewer outlets*. When the storm sewer system discharges into an open channel, additional losses, in the form of expansions losses, occur at the outlet. For a headwall and no wing walls, the loss coefficient Ke is one (1.0). For a headwall with forty-five degree (45°) wing walls, the loss coefficient is about one and fourteen hundredths (1.14). For a flared-end-section (which has a D2/D1 ratio of two (2) and a theta angle of around thirty degrees (30°)) the loss coefficient is approximately one-half (0.5).

(7). *Connection pipes*.

(A). Connector pipes are used to convey runoff from an inlet to the storm sewer. If, however, the storm sewer runs through the inlet, then a connector pipe is not needed. Connector pipes can connect a single inlet to the storm sewer or they can be connected in a series.

(B). These bends, turns and flows through the connector pipe give rise to three (3) hydraulic losses: a change from static to kinetic energy to get the water moving through the connector pipe, an entrance loss

from the inlet to the connector pipe and a friction loss along the length of the connector pipe. The total head loss in the connector pipe can be calculated from the following equation:

	Hcp = Hv + Ke x Hv + Sf x L	(1009)
Where,	Hcp = head loss in the connector pipe (feet)	
	Ke = Entrance loss coefficient	
	Hv = velocity head in the pipe, assuming full pipe flow (feet)	

and the other variables are as previously defined. The value of the entrance loss coefficient is determined from Table II.

(C). If the connector pipes are connected in series, the head loss in each pipe is calculated from Equation 1009 and the total head loss is the summation of the individual head losses.

2. *Easements*. Easements shall be provided for all storm sewers constructed in the City of Republic that are not located within public rights-of-way. The minimum easement widths are as follows:
   a. For pipes forty-eight (48) inches or less in diameter or width the required easement width is fifteen (15) feet.
   b. For pipes and boxes greater than forty-eight (48) inches in width the required easement width is fifteen (15) feet plus half the width of the proposed storm sewer.
   c. Storm sewers greater than eight (8) feet in depth to the flow line may require additional easement width.
   d. All easements required for construction, which are not included on the final plat shall be recorded and filed with the City prior to approval of the construction drawings.

C. *Design Standards For Culverts*.
1. *Structural design*. All culverts shall be designed to withstand an HS-20 loading in accordance with the design procedures of AASHTO "Standard Specifications for Highway Bridges". The designer shall also check the construction loads and utilize the most severe loading condition. The minimum allowable cover is one (1) foot.
2. *Design capacity*. Culverts shall be designed to pass a 25-year storm with one (1) foot of freeboard prior to overtopping the road or driveway.
3. *Headwater*. The maximum headwater for the major storm design flow shall be one and one-half (1.5) times the culvert diameter for round culverts or one and one half (1.5) times the culvert rise dimension for shapes other than round.
4. *Inlet and outlet protection*. For road and driveway culverts larger than fifteen (15) inches, culverts are to be designed with protection at the inlet and outlet areas as provided in Section **410.710** of this criteria. Headwalls or end sections are to be located a sufficient distance from the edge of the shoulder or the back of walk to allow for a maximum slope of 3H:1V to the back of the structure. The type of outlet protection required is as follows:

V<7FPS	7FPS<V<15FPS	V>15FPS
Minimum Riprap protection	Riprap protection or Energy Dissipater	Energy dissipater

5. *Velocity limitations*. The maximum allowable discharge velocity is fifteen (15) feet per second.
6. *Culvert hydraulics*. It is recommended that the procedures outlined in the publication "Hydraulic Design of Highway Culverts" (reference 4) be used for the hydraulic design of culverts. Backwater calculations demonstrating the backwater effects of the culvert may be required.

D. *Design Standards For Bridges.*

1. *Structural design*. All bridges shall be designed to withstand an HS-20 loading in accordance with the design procedures of AASHTO "Standard Specifications for Highway Bridges" (reference 13). The designer shall also check the construction loads and utilize the most severe loading condition.
2. *Design capacity*. Bridges shall be designed to pass the 100-year storm with one (1) foot of freeboard between the water surface and the bridge low chord.
3. *Backwater. "Backwater"* is defined as the rise in the water surface due to the constriction created by the bridge approach road fills. The maximum backwater for the 100-storm design flow shall be one (1) foot.
4. *Velocity limitations*. Discharge velocities through bridge openings shall be limited to fifteen (15) feet per second. Abutment and channel scour protection shall be provided at all bridges.
5. *Bridge hydraulics*. All bridge hydraulics shall be evaluated using the procedures presented the publication "Hydraulics of Bridge Waterway" (reference 14). Backwater calculations demonstrating the effects of the bridge and approach fills compared to the existing flood stages shall be submitted for all bridges.

E. *Design Standards For Open Channels*.

1. *General design guidelines.*
    a. *Natural channels*. The hydraulic properties of natural channels vary along the channel reach and can be either controlled to the extent desired or altered to meet the given requirements. Natural channels used as part of the drainage system must be evaluated for the effects of increased peak flow, flow duration and volume of runoff due to urbanization.
    b. *Grass lined channels*. Grass lined channels are the most desirable of the artificial channels. The channel storage, lower velocities and the greenbelt multiple use benefits obtained create significant advantages over other artificial channels. Unless existing development restricts the availability of right of way, channels lined with grass should be given preference over other artificial types. The minimum slope in a grass lined channel shall be one percent (1.0%) unless a concrete low flow channel is installed.
    c. *Concrete lined channels*. Concrete lined channels are sometimes required where right of way restrictions within existing development prohibit grass-lined channels. The lining must be designed to withstand the various forces and actions, which tend to overtop the bank, deteriorate the lining, erode the soil beneath the lining and erode unlined areas. The minimum slope in a concrete lined channel shall be one half percent (0.50%).

d. *Rock lined channels*. Rock lined channels are constructed from ordinary riprap or wire enclosed riprap (gabions etc.). The rock lining permits higher design velocity than for grass lined channels. Rock linings will normally be used only for erosion control at culvert/storm sewer outlets, at sharp channel bends, at channel confluences and at locally steepened channel sections.

e. *Other lining types*. The use of fabrics and other synthetic materials for channel linings has increased over the past several years. Proposed improvements of this type will be reviewed on an individual basis as for applicability and performance.

2. *Hydraulics*. An open channel is a conduit in which water flows with a free surface. The calculations for uniform and gradually varied flow are relatively straightforward and are based upon similar assumptions (e.g. parallel streamlines). The basic equations and computational procedures are presented in this Section.

a. *Uniform flow*. Open channel flow is said to be uniform if the depth of flow is the same at every section of the channel. For a given channel geometry, roughness, discharge and slope, there is only one possible depth, the normal depth. For a channel of uniform cross section the water surface will be parallel to the channel bottom for uniform flow.

b. The computation of normal depth for uniform flow shall be based upon Manning's formula as follows:

	$Q = (1.49/n)AR^{2/3}S^{1/2}$
Where,	Q = Discharge in cubic feet per second (cfs)
	n = Roughness coefficient (Table I)
	A = Cross sectional flow area in square feet
	R = Hydraulic radius, A/P, in feet
	P = Wetted perimeter in feet
	S = Slope of the energy grade line (EGL) in feet/foot

For channels with a uniform cross section the EGL slope and the bottom slope are assumed to be the same.

c. *Critical flow*. The design of earth or rock channels in the critical flow regime (Froude numbers from 0.9 to 1.2) is not permitted. The Froude number is defined as follows:

	$F = V/(gD)^{0.5}$

Where,	F = Froude number
	V = Velocity in feet per second (fps)
	g = Acceleration of gravity, 32.2 ft/sec^2
	D = Hydraulic depth in feet = A/T
	A = Cross sectional flow area in square feet
	T = Top width of flow area in feet

The Froude number shall be calculated for the design of all open channels.

d. *Gradually varied flow.*

(1). The most common occurrence of gradually varied flow in storm drainage is the backwater created by culverts, storm sewer inlets or channel constrictions. For these conditions the flow depth will be greater than normal depth in the channel and the water surface profile must be computed using backwater techniques.

(2). Backwater computations can be made using the methods presented in Chow (reference 1). Many computer programs are available for computation of backwater curves. The most widely used program is HEC 2, Water Surface Profiles, developed by the U.S. Army Corps of Engineers (reference 2) and is the program recommended for backwater profile computations. Another program by the Federal Highway Administration is WSPRO and is acceptable for use in backwater computations.

3. *Design standards.*

a. *Flow velocity*. Maximum flow velocities shall not exceed the following:

Channel Type	**Max. Velocity**
Grass lined*	5 fps
Concrete	15 fps

Rock Lined	10 fps
*Refer to item f. below	

b. *Maximum depth*. The maximum allowable channel depth of flow is three (3) feet for the design flow.

c. *Freeboard requirements*.

(1). "*Freeboard*" is defined as the vertical distance between the computed water surface elevation for the design flow and the minimum top of bank elevation for a given cross section.

(2). For all channels one (1) foot minimum of freeboard is required.

(3). Freeboard shall be in addition to super elevation.

d. *Curvature*. The minimum channel centerline radius shall be three (3) times the top width of the design flow.

e. *Super elevation*. Super elevation shall be calculated for all curves. An approximation of the super elevation h may be calculated from the following formula:

	$H = V^2T/(gr)$
Where,	h = Super elevation in feet
	V = Velocity in fps
	T = Top width of flow area in feet
	G = Acceleration of gravity, 32.2 ft/sec^2
	r = radius of curvature in feet

Freeboard shall be measured above the super elevated water surface.

f. *Grass channels*.

(1). Side slopes shall be three (3) (horizontal) to one (1) (vertical) or flatter. Steeper slopes may be used subject to additional erosion protection and approval from the City.

(2). For design discharges greater than fifty (50) cfs, grade checks shall be provided at a maximum of two hundred (200) feet horizontal spacing.

(3). Channel drops shall be provided as necessary to control the design velocities within acceptable limits.

(4). Vertical drops may be used up to three (3) feet in height. Drops greater than three (3) feet shall be baffled chutes or similar structures.

(5). The variation of Manning's n with the retardance and the product of mean velocity and hydraulic radius as shown in Figure 7.23 in reference 17 shall be used in the capacity calculations. Retardance curve C shall be used to determine the channel capacity and retardance curve D shall be used to determine the velocity.

4. *Easements*.

a. Easements shall be provided for all open channels constructed in the City of Republic that are not located within public rights of way. The minimum easement width for open channels is the flow width inundated by a 100-year event plus fifteen (15) feet.

b. All easements required for construction, which are not included on the final plat shall be recorded and filed with the City prior to approval of the construction drawings.

410.690 Stormwater Detention Design

A. *Purpose*.

1. Detention facilities are used to reduce storm water runoff rates by storing excess runoff.

1. ~~2~~. The usual function of a detention facilities is to provide sufficient storage such that peak runoff rates are not increased when development occurs. **A secondary function may be to settle pollutants such as sediment from the stormwater before discharge to the natural drainageway.**

2. All Detention/Retention basins shall follow design guidelines outlined in the latest version of the Republic Stormwater Design Manual.

B. *Policy*. The primary goal of the City of Republic stormwater management program is the prevention of flood damage to residential, commercial and public property. In adopting this policy, City of Republic recognizes that:

1. There are many areas in the City where residential flooding occurs because of inadequately sized drainage ways.

2. Flooding depths and frequency will increase as development occurs upstream of these areas.

3. Detention basins are the only effective "on-site" means which can be used to control peak runoff storm water rates as areas develop.

4. The City of Republic further recognizes that:

a. The best means to assure effective performance of a detention basin utilize is perform reservoir routing calculations using hydrographs.

b. Such methods have not been in widespread use in this area, but rather a method known as the "Simplified Volume Formula" has been the basis of City detention policy.

c. Use of the Simplified Volume Formula frequently does not result in adequately sized detention facilities.

d. The inaccuracy of the Rational Method upon which the Simplified Volume Formula is based increases as the area under consideration increases.

~~e. Even though the Simplified Volume Formula has severe limitations, requirement of detailed analytical methods may not be justified in all cases.~~

~~f. Detention basins designed using the Simplified Volume Formula do provide a minimal amount of flooding protection and potential water quality benefits by functioning as sediment basins.~~

~~5. Therefore, in order to provide a reasonable level of flood protection to homes and businesses, while maintaining a climate favorable for development and economic growth, City of Republic has established the following policy for design of detention facilities.~~

~~C. *Methods of Analysis*. The method of analysis to be required for the design of detention facilities will be determined as follows:~~

~~1. Detailed analysis will be required in the following cases:~~

~~a. In areas where residences or other structures located downstream of a development can be shown to have an imminent flooding hazard a detailed analysis using hydrographs and reservoir routing techniques will be required.~~

~~b. Residences or other structures will be defined as having an imminent flooding hazard when the lowest point, at which surface runoff may gain entry, is located at or below the estimated flooding level which would result from a storm with an annual probability of one percent (1%) or greater under conditions existing in the basin prior to development of the applicant's property (i.e., affected by the "100-year" storm).~~

~~c. Consideration of downstream flooding problems will be limited to the area which may reasonably be expected to be significantly affected by runoff from the applicant's property.~~

~~d. Detailed analysis will be required for all detention facilities where the peak runoff rate from the area upstream of the detention facility (off-site and on-site) exceeds fifty (50) cfs (cubic feet per second) for a storm with an annual probability of one percent (1%) (the "100-year" storm) under fully developed conditions. (Note: This would be the rate of flow from approximately twelve (12) acres for residential areas or five (5) acres for fully paved commercial areas.)~~

~~2. Simplified analysis will be permitted in the following cases: For areas where there are no imminent downstream flooding problems and where the peak runoff rate from the drainage area (off site and on site) upstream of the detention facility does not exceed fifty (50) cfs for the one percent (1%) annual probability ("100-year") storm under fully developed conditions, the Simplified Volume Formula may be used.~~

D. *Alternatives to detention*.

1. *Residential subdivisions*. Unless otherwise approved by the City, through review of stormwater calculations and criteria referenced herein, detention shall be required in all major residential subdivisions. Upon request by a developer, the City may consider alternatives to detention in cases where it can be proven that the absence of detention will not adversely affect downstream property owners. Each request will be evaluated on a case-by-case basis and an alternative to detention may be established for the purposes of regional improvements within the watershed or abroad in the City.

2. *Justified exceptions*. The City may consider, upon request, a waiver of detention for sites, in which the alteration of the site is inconsequential and will not substantially increase the runoff. A justified exception will be granted for sites based on the following criteria.

a. Existing sites in which the addition of impervious surface will not increase more than five thousand (5,000) square feet.

b. **Sites in which existing gravel, chat or stone parking lots or driveways are paved with asphalt cement or concrete surfaces shall be considered 50% of the sf of an increase in impervious surface. This shall not apply to parking areas or circulation routes in which vegetation has consumed the site and altered the ability to shed or absorb runoff. The BUILDS Department shall exercise strict discretion with respect to approving exceptions based on these criteria.**

c. **Sites in which a change in use has occurred, that does not increase the impervious area of the site.**

d. **Subdivisions meeting the definition of a minor subdivision or the development of individual single-family-residential homes on individual lots in existing subdivisions.**

E. ***Procedure*. A request for approval of an alternative to detention must begin with the applicant providing the BUILDS Department with stormwater calculations for the increased runoff from the development. In addition to providing calculations, the applicant must submit a request for alternative design based on the criteria established above. The BUILDS Department will review the and/or other departments impacted by the request. If the City determines the request is justified the City will notify the applicant or his representative of the approval and the necessary improvements required in lieu of installing detention.**

F. ***Innovation in design*.**

1. **It is the desire of the City that detention facilities be designed and constructed in a manner to enhance aesthetic and environmental qualities of the City as much as possible.**
2. **The City of Republic therefore encourages designs, which utilize and enhance natural settings and minimize disturbance and destruction of wooded areas, natural channels and wetlands.**

G. ***Interpretation*.**

1. **Interpretations of the detention policy will be made by the BUILDS Administrator or their designee in writing.**

3. ~~*Alternatives to detention*~~.

~~a. *Fee in lieu of detention*. In cases where channelization or other improvements can be shown to be more effective than detention in reducing the flooding hazard to downstream properties and where no adverse effects to downstream properties will result from construction of such improvements, the City may enter into an agreement with the applicant to accept compensation in lieu of constructing on-site detention facilities.~~

~~b. The City has established the following formula for the fee in lieu of detention: Fee = K * (Ia) acres of impervious surface added~~

~~Where Ia is the increase in impervious area (roofs, pavement, driveways, patios, etc.) in acres and K shall be determined as follows:~~

~~K shall equal ten thousand dollars ($10,000.00) up to and including forty three thousand five hundred sixty (43,560) square feet (one (1) acre) of impervious area added plus five thousand dollars ($5,000.00) for impervious area added in excess of forty three thousand five hundred sixty (43,560) square feet (one (1) acre). K is a factor determined by the City. This factor is based upon the net financial~~

gain, which the developer would realize if the detention facility is not built. This amount will generally be equal to the construction cost of the detention facility plus revenue from sale of additional lots or increased value of lots, less the cost of developing the lots, including utilities and streets, financing costs, sales costs and reasonable profit. The City shall evaluate this formula annually and make the appropriate adjustments.

c. *Criteria for approving an alternative to detention*. The City will evaluate each request for an alternative design or fee in lieu of detention based on the following criteria. The City of Republic reserves the right to set precedent with each case considered depending upon the unique circumstances surrounding each request.

(1). Size of site in relation to the stormwater generated.*

(2). Size of the site in relation to the drainage area.*

(3). Impact on properties downstream of site.*

(4). Areas of concern as identified by the City of Republic's Stormwater Master Plan.

(5). Location of the site with respect to floodplains, streams or other large watercourses.

(6). Location of the site with respect to environmentally sensitive areas.

(7). Approval of previous requests.

* Downstream impacts shall generally be considered insignificant when the added upstream impervious area is less than ten percent (10%) of the total contributing watershed area. Exceptions to this rule include development where downstream areas are known to have an imminent flooding hazard as defined in Section **410.690**.

d. *Residential subdivisions*. Unless otherwise approved by the City, through review of stormwater calculations and criteria referenced herein, detention shall be required in all major residential subdivisions and the fee in lieu of detention established in Section 410.690(C-3(a)) shall apply. Upon request by a developer, the City may consider alternatives to the fee in lieu of detention in cases where it can be proven that the absence of detention will not adversely affect downstream property owners. Each request will be evaluated on a case-by-case basis and a fee in lieu detention may be established for the purposes of regional improvements within the watershed or abroad in the City.

e. *Justified exceptions*. The City may consider, upon request, a waiver of detention and the fee in lieu for sites, in which the alteration of the site is inconsequential and will not substantially increase the runoff. A justified exception will be granted for sites based on the following criteria.

(1). Existing sites in which the addition of impervious surface will not increase more that five thousand (5,000) square feet.

(2). Sites in which existing gravel, chat or stone parking lots or driveways are paved with asphalt cement or concrete surfaces. This shall not apply to parking areas or circulation routes in which vegetation has consumed the site and altered the ability to shed or absorb runoff. The City shall exercise strict discretion with respect to approving exceptions based on these criteria.

(3). Sites in which a change in use has occurred, that does not increase the impervious area of the site.

~~(4). Subdivisions meeting the definition of a minor subdivision or the development of individual single-family residential homes on individual lots in existing subdivisions.~~

~~f. *Procedure*. A request for approval of an alternative to detention must begin with the applicant providing the City with stormwater calculations for the increased runoff from the development. In addition to providing calculations, the applicant must submit a request for alternative design based on the criteria established above. The City Planner will coordinate review of the request with the Public Works Department, City Engineer or other departments impacted by the request. If the City determines the request is justified the City Planner will notify the applicant or his representative of the approval and the fee required in lieu of installing detention.~~

~~g. *Minimum fee in lieu of detention established*. The City of Republic has established a minimum fee of one thousand one hundred fifty dollars ($1,150.00) in lieu providing detention to be paid upon approval by the City.~~

~~4. *Innovation in design*.~~

~~a. It is the desire of the City that detention facilities be designed and constructed in a manner to enhance aesthetic and environmental quality of the City as much as possible.~~

~~b. The City of Republic therefore encourages designs, which utilize and enhance natural settings and minimize disturbance and destruction of wooded areas, natural channels and wetlands.~~

~~5. *Interpretation*.~~

~~a. Interpretations of the detention policy will be made by the City Engineer or City Planner in writing.~~

~~b. Appeals of the decisions of the City Engineer or City Planner may be made, in writing, to the Community Development Director.~~

H. ~~*D.*~~ *Design Criteria*.

1. *General*.
   a. Detention facilities shall discharge into a drainage easement or public right-of-way.
   b. One (1) foot of freeboard shall be provided between the maximum water surface elevation (maximum stage for a one percent (1%) annual probability event) and the minimum top of berm or wall elevation.
   c. Embankment slopes steeper than three (3) horizontal to one (1) vertical (3H:1V) are not permitted.
   d. In certain instances, such as when the existing development conditions runoff from a watershed would exceed the capacity of the existing downstream facilities, retention basins (i.e., no outlet or with a release rate at the capacity of the downstream facilities) for the storm runoff may be required by the City.
   e. Dry detention basins shall maintain a minimum bottom slope of two (2) feet per hundred (100) feet (two percent (2%)).
   f. Trickle channels shall have a minimum slope of one-half (0.5) foot per hundred (100) feet (one-half percent (0.5%)).

g. The maximum allowable depth of ponding for parking lot detention is twelve (12) inches.

h. Parking lot detention may not inundate more than ten percent (10%) of the total parking area.

i. All parking lot detention areas shall have a minimum of two (2) signs posted identifying the detention pond area. The signs shall have a minimum area of one and one-half (1.5) square feet and contain the following message:

WARNING: This area is a storm-water detention pond and is subject to periodic flooding to a depth of twelve (12) inches.

j. The sign shall be reflective and have a minimum height of forty-eight (48) inches from the bottom of the sign to the parking space finished grade. Any suitable materials and geometry of the sign are permissible, subject to approval by the City.

2. *Detailed analysis*.

~~a.~~ **Analysis shall be conducted as outlined in Republic Stormwater Design Manual.** ~~Detailed analysis shall be performed using hydrograph methodologies and reservoir routing techniques.~~

~~b. The most common techniques are those developed by the Corps of Engineers and the Soil Conservation Service. These methods are preferred, however other proven techniques will be accepted.~~

~~c. Detention basins designed by detailed methods shall be designed on the basis of multiple storm recurrence frequencies to ensure that they function properly for both frequent storms and large infrequent storms.~~

~~d. A minimum of three (3) recurrence frequencies, the fifty percent (50%), ten percent (10%) and one percent (1%) annual probability storms (the "2-year, 10-year and 100-year" storms) must be considered.~~

~~e. The runoff model must include the entire drainage basin upstream of the proposed detention pond. The model shall be prepared in sufficient detail to ensure that peak runoff rates are reasonably accurate.~~

~~f. The runoff model shall be developed for the following cases:~~

~~(1). Case 1: Existing conditions in the drainage basin prior to development of the applicant's property.~~

~~(2). Case 2: Existing conditions in the drainage basin with developed conditions on the applicant's property.~~

~~(3). Case 3: Fully developed conditions in the entire drainage basin.~~

~~(4). Cases 1 and 2 are utilized to determine the required detention volume and the type of outlet structure to be provided and shall be analyzed for the three (3) storm recurrence frequencies required above.~~

~~(5). The detention facility shall be designed such that peak outflow rates from the facility for Case 2 are no greater than the rates determined in Case 1 for each of the three (3) storm recurrence frequencies required.~~

~~(6). The storage volume provided shall not be less than the difference in total runoff volume between Case 1 and Case 2.~~

~~(7). Case 3 is used determine the size of the overflow spillway. Case 3 need only be analyzed for the one percent (1%) annual probability ("100-year").~~

(8). The overflow spillway will, in most cases, be combined with the outlet structure.

3. *Submittals*. The following information must be submitted for detention ponds designed by detailed methods:

a. Information regarding analytical methods and software to be used, including:

(1). Name of software to be used.

(2). Type and distribution of precipitation input.

(3). Method for determining precipitation losses.

(4). Type of synthetic hydrograph.

(5). Method for routing hydrographs.

(6). Method used for reservoir routing.

b. Map(s) showing sub-basin delineation, topography, presumed flow routes and pertinent points of interest; soil types; existing basin development conditions used in the model; fully developed conditions used in the model.

c. Routing diagram for the runoff model.

d. A summary of sub-basin characteristics used for program input.

e. Stage-area or stage-storage characteristics for the basin in tabular or graphic form.

f. Stage-discharge characteristics for the outlet structure and overflow spillway in tabular or graphic form; hydraulic data for weirs, orifices and other components of the control structure.

g. A printout of the input data file.

h. A summary printout of program output, including plots of hydrographs. (These are intended to be the printer plots generated by the software.)

4. *Simplified analysis*.

a. *Method of evaluation*. Differential runoff rates shall be evaluated by equation:

	R = (Cd X I100) - (Cu X I100)
Where,	R = Differential Runoff Factor
	Cd = Runoff Coefficient for developed conditions
	Cu = Runoff Coefficient for developed conditions
	I100 = Intensity for 100-year storm

b. "C" values shall be determined from the following table:

SUGGESTED RUNOFF COEFFICIENTS	
"C" Value	**Surface Conditions**

.10—.15	Tall grass, brush
.15—.20	Parks, golf courses, farms and one (1) acre single-family residences
.35	Single-family residences on lots of not less than 15,000 sq. ft.
.45	Single-family residences on lots of not less than 10,000 sq. ft.
.47	Single-family residences on lots of not less than 7,500 sq. ft.
.51	Single-family residences on lots of not less than 6,000 sq. ft.
.90	Gravel surfaces.
.95	Asphalt and concrete surfaces.
1.00	Buildings and other structures.

c. *Volume of Detention*. Volume of detention shall be determined according to the "Simplified Volume Formula", as follows:

V = R X A X tc (min.) x 60 (sec./min.)
V = Total volume of detention (cu. ft.)
R = Differential Runoff Factor
A = Area of project in acres
tc = Time of concentration (5 minutes, minimum)

d. *Time of Concentration*.

(1). *SCS Method*. The preferred method for determining time of concentration shall be the method set forth in Chapter 3 of the Soil Conservation Service Technical Release No. 55, "Urban Hydrology for Small Watersheds", 2nd Edition, 1986.

(2). *Other Methods*.

1. Time of concentration may also be calculated by other accepted methods providing reasonable results.
2. The time of concentration used in the formula shall be determined based upon existing conditions.

e. *Rainfall Intensity*. Rainfall intensity shall be determined from Drawing 20.

f. *Required Volume*. The required volume of detention shall be determined from the following Table:

Calculated Volume	**Required Volume**

~~1 cu. ft. thru 500 cu. ft.~~	~~500 cu. ft.~~
~~501 cu. ft. through 5,999 cu. ft.~~	~~Round up to nearest 500 cu. ft.~~
~~5,000 cu. ft. through 9,999 cu. ft.~~	~~Round up to nearest 1,000 cu. ft.~~
~~10,000 cu. ft. thru 49,999 cu. ft.~~	~~Round up to nearest 5,000 cu. ft.~~
~~Above 50,000 cu. ft.~~	~~Round up to nearest 10,000 cu. ft.~~

~~5. *Control structures.*~~

~~a. Detention facilities designed by the simplified analysis shall be provided with obvious and effective outlet control structures. These outlet structures may include v-notch weirs or rectangular weirs, as well as pipe. Plan view and sections of the structure with adequate detail shall be included in plans.~~

~~b. The design discharge (Q) for the low-flow outlet shall not exceed the existing runoff for the one-year storm. The maximum discharge shall be designed to take place under total anticipated design head conditions. The design head storage volume is not to be considered a part of the volume of detention required.~~

~~c. Sizing of a low-flow pipe shall be by inlet control.~~

~~d. Low-flow pipes shall not be smaller than four (4) inches in diameter to minimize maintenance and operating problems, except in parking lot and roof detention where minimum size and configuration of opening shall be designed specifically for each condition.~~

~~e. Overflow spillways will be required on all detention facilities, which have storage volumes of one thousand (1,000) or more cubic feet.~~

~~f. The overflow opening or spillway shall be designed so that the combination flow of the low-flow outlet and the flow over the spillway will not exceed the total peak runoff for the improved area. The total peak runoff is to be determined from a 25-year frequency rain for drainage areas less than one (1.0) square mile and from a 100-year frequency rain for drainage areas one (1.0) square miles or greater.~~

410.700 Sinkholes And Karst Features

A. *General.* **Refer to Section 9 of Republic Stormwater Design Manual for design criteria involving sinkholes and karst features on a site.**

1. ~~The City of Republic is located on the Springfield Plateau of the Ozarks physiographic region. This area is underlain by Mississippian Age limestone, which is highly susceptible to solutional weathering. As a result, sinkholes, springs and caves are common.~~
2. ~~In many areas of the City special consideration must be given to flood hazards and potential for groundwater contamination due to the presence of sinkholes, caves, losing streams, springs and other features associated with karst geology.~~
3. ~~The requirements set forth herein, are intended to provide specific criteria for design and construction for any site upon which sinkholes or other karst features are located.~~

4. ~~Interpretations of these requirements shall be made and appeals may be made according to the procedures set forth in these Design Criteria.~~

B. *Policy.* In keeping with the intent of the City Development Regulations the following policy is set forth for development in areas containing sinkholes:
   1. Development in sinkhole areas will be based upon the following axioms:
      a. Avoidance.
      b. Minimization.
      c. Mitigation.
   2. Construction in sinkholes shall be avoided. Exceptions will be made only in situations where it can be conclusively demonstrated that there are no practical alternatives to such construction.
   3. These situations are mostly likely to arise where:
      a. An underground cavity has caused a collapsed sinkhole to form, after subdivision approval or building construction.
      b. A sinkhole has been altered or filled either unknowingly or prior to passage of these regulations.
      c. Maintenance and operation is required for existing roads and utilities.
      d. Location of existing streets or utilities would render access or utility service to a property impractical or cost prohibitive.
   4. In these types of cases, measures, which will have minimal impact on the sinkhole or receiving water, may be proposed. Plans for minimal alteration can be approved provided it is conclusively demonstrated that the proposed plan is the minimum practical alternative.
   5. In these cases potential impacts of construction on the sinkhole and receiving waters must be studied and assessed and recommendations made for mitigation of potential impacts upon surface flooding and groundwater quality before the plans can be approved. The degree and sophistication of study required will increase in proportion to the potential impacts. **A remediation plan will need to be submitted for review by the City. The remediation plan will need to be stamped by a Qualified Professional Geotechnical Engineer licensed in the state of Missouri.**

C. Definitions. As used in this Section, the following terms shall have these prescribed meanings:

ALTERED SINKHOLE
A sinkhole that has been filled, excavated or otherwise disturbed.

COLLAPSED SINKHOLE
A subsidence or cave-in of the ground surface caused when soil overburden can no longer be supported by underlying strata due to the presence of subsurface solution cavities.

HEAVY EQUIPMENT
Motorized equipment having a gross weight of more than six (6) tons.

LIGHT EQUIPMENT
Motorized equipment weighing six (6) tons or less.

QUALIFIED GEOLOGIST
A person who has met or exceeded the minimum geological educational requirement and who can interpret and apply geologic data principles and concepts and who can conduct field or

laboratory geologic investigations (per RSMo.) and who by reason of experience and education, has an understanding of local karst geology.

QUALIFIED PROFESSIONAL GEOTECHNICAL ENGINEER
A person registered to practice engineering according to the laws of the State of Missouri and who by reason of technical education and experience has a background in the fundamentals of storm drainage and karst **geology.**

SINKHOLE
Any depression in the surface of the ground, with or without collapse of adjacent rock that provides a means through which surface water can come into contact with subsurface water.

Sinkhole depressions may be gradual or abrupt; they may or may not have a well defined eye. While most sinkholes can be defined as the area within a "closed contour", some sinkholes such as those located on the sides of hills may not.

All sinkholes provide discreet points of recharge to groundwater.

SINKHOLE CLUSTER AREA
An area containing two (2) or more sinkholes located in close proximity, generally interconnected by groundwater conduits.

SINKHOLE EYE
Generally, a visible opening, cavity or cave in the bottom of a sinkhole, sometimes referred to as a swallow hole.

SINKHOLE FLOODING AREA
The area inundated by runoff from a storm with an annual exceedance probability of one percent (1%) and a duration of twenty-four (24) hours.

SINKHOLE RIM
The perimeter of the sinkhole depression. The sinkhole rim will generally vary in elevation.

SINKHOLE WATERSHED
The ground surface area that provides drainage to the sinkhole. This area extends beyond the sinkhole depression and generally crosses property boundaries.

TERMINAL SINKHOLE
The lowest sinkhole in a sinkhole cluster to which any surface water overflowing from other sinkholes in the cluster will flow.

UNALTERED SINKHOLE
A sinkhole that has never been altered or disturbed.

D. *Permits Required*.
   1. *Grading permit*. A grading permit must be obtained prior to any alteration of sinkholes associated with new subdivision construction in accordance with the City's Subdivision

Regulations. Procedures and requirements for grading permits are set forth in Section **410.710**.

2. *Other permits*. Other permits from State or Federal agencies may be required, as outlined in Section **410.650** of these Design Criteria, depending upon the size and nature of the proposed activity.

E. *General Plan Requirements*. General requirements for grading and drainage plans are set forth in **the latest version of Republic Stormwater Design Manual** ~~Sections **410.670, 410.680**~~ and **Section 410.710** of these Design Criteria.

F. ~~*Sinkhole Evaluation*. An evaluation including the following information shall be made for all sites upon which sinkholes are fully or partially located:~~

~~1. The site plan for the proposed development must show the following items with respect to location of proposed construction, proposed or existing property lines and existing structures:~~

~~a. Sinkholes.~~

~~(1). Location and limits of the area of the sinkhole depression as determined by field surveys or other reliable sources as may be approved. Location of sinkholes based solely upon USGS 7-1/2 Minute Series Quadrangle Maps will not be considered sufficient unless field verified.~~

~~(2). Location and elevation of the sinkhole eye where visible or known.~~

~~(3). Topographic contours at maximum intervals of two (2) feet and spot elevations sufficient to determine the low point on the sinkhole rim and the profile of the potential overflow area.~~

~~(4). Minimum entry elevations of any existing structures located within the sinkhole rim.~~

~~(5). Elevation of any roadway located within or adjacent to the sinkhole.~~

~~b. *Water supply sources*.~~

~~(1). The approximate location of public or private water supply sources such as springs or wells, as determined from information available from the City and Missouri Department of Natural Resources.~~

~~(2). Boundaries of any known recharge areas to wells or springs as determined from information available from the City and Missouri Department of Natural Resources.~~

~~c. *Other geologic features*. Location of caves, springs, faults and fracture trends, geologic mapping units based upon information from the City or other reliable sources.~~

~~d. Flooding limits for the sinkholes determined as set below.~~

~~2. A drainage area map showing the sinkhole watershed area. Where the site is located in a sinkhole cluster area, this map shall be extended to include the watershed area any sinkholes located downstream of the site which may receive overflow drainage from the site.~~

~~3. Assessment of potential impacts on groundwater quality and proposed water quality management measures as set forth below.~~

~~G. *Flooding Considerations*~~

~~1. *Minimum flooding analysis*.~~

~~a. Maximum estimated flooding elevations shall be determined for each sinkhole for both pre-development and post development conditions, assuming no subsurface outflow from the sinkhole.~~

b. Where the estimated volume of runoff exceeds the volume of the sinkhole depression, the depth, spread and path of overflow shall be estimated and shown on the map.

c. The overflow volume shall be included determining the maximum estimated flooding elevations in the next downstream sinkhole. This analysis shall continue downstream until the lowest sinkhole of the sinkhole cluster is reached or overflow reaches a surface watercourse.

d. The volume of runoff considered shall be that which results from a rainstorm with an annual probability of one percent (1%) (100-year storm) and a duration of twenty four (24) hours (eight and two tenths (8.2) inches for Republic).

e. The runoff volume shall be determined by the method set forth in Chapter 2 of the SCS TR-55 Manual (Reference).

f. No further flooding analysis will be required provided that:

(1). The post-development flooding area of any sinkhole which receives drainage receiving drainage from the site is located entirely on the site.

(2). A drainage easement covering the post development flooding area is provided for any off-site sinkhole or portion of a sinkhole which receives increased peak rates of runoff from the site. If the receiving sinkhole is not contiguous to the site, an easement must also be provided for the waterway that connects the site to the sinkhole.

(3). The minimum entry elevation of any existing structure is at least one (1) foot higher than the estimated flooding elevation from the one percent (1%) annual probability 24-hour storm.

(4). The flooding depth on any existing public road does not exceed the maximum depths set forth in Section **410.680**.

2. *Detailed flooding analysis*.

a. In cases where the conditions set forth above cannot be met, a detailed flooding analysis will be required if any increase in runoff volume is proposed. For detailed flooding analysis a runoff model must be made for the sinkhole watershed and reservoir routing analysis performed using hydrograph techniques as set forth in Section **410.690**.

b. The following alternative methods may be used singly or in combination to keep flooding levels at predevelopment levels:

(1). *Diversion of excess runoff to surface watercourses*. Where feasible, increased post-development runoff may by diverted to a surface watercourse, provided that:

(A). Any increase in peak runoff rate in the receiving watercourse does not create or worsen existing flooding problems downstream; and

(B). The diverted stormwater remains in the same surface watershed.

(C). Storm sewers, open channels and other appurtenances provided for diversions shall be designed in accordance with applicable sections of these Design Criteria.

(D). The effect of diverted water on downstream watercourses and developments and requirements for additional detention facilities prior to release of runoff to the surface watercourse shall be determined as set forth in Section **410.690**, Detention Facilities.

(E). Effects of the diversion shall be shown by reservoir routing analysis. Routing of excess runoff shall be considered satisfactory when it can be demonstrated that the post-development flooding elevation in the sinkhole does not exceed the pre-development flooding elevation within reasonable tolerance (generally one-tenth (0.1) foot).

c. *Storage of excess runoff within the sinkhole watershed*.

(1). Where feasible, detention facilities may be constructed within the sinkhole watershed or in perimeter areas of the sinkhole. These detention facilities must be located outside the sinkhole flooding area determined for post development conditions.

(2). The flooding considerations set forth in this Section will be met if it can be demonstrated that:

(A). Inflow rates to the sinkhole can be reduced to a degree that, in conjunction with the observed outflow rate, the post-development flooding elevation in the sinkhole does not exceed the pre-development flooding elevation within reasonable tolerance (generally one-tenth (0.1) foot).

(B). Sediment and erosion control and water quality considerations as set forth elsewhere in this Section can be satisfied.

H. *Water Quality Considerations*.

1. Sinkholes provide direct recharge routes to groundwater. As a result water quality in wells, caves and springs may be affected by discharge of runoff from developed areas.
2. The Sinkhole Evaluation must consider potential impacts of the proposed construction on receiving groundwater and propose measures to mitigate such impacts.
3. Four (4) primary factors must be considered:
   a. Receiving groundwater use.
   b. Relative groundwater contamination hazard associated with the proposed development.
   c. Ability to capture pollutants.
   d. Management measures to be provided to reduce pollutant levels.
4. *Receiving groundwater use*.
   a. The Sinkhole Evaluation Report shall identify whether the site lies within a critical area based upon information available from the City.
   b. Where disagreements may arise over whether a site is located within a particular recharge area dye tracing may be required for confirmation of the destination of water discharges through a sinkhole.
   c. *Critical areas*. The following areas are classified as critically sensitive to contamination from urban runoff:
      (1). Recharge areas of domestic water supply wells.
      (2). Recharge areas of springs used for public or private water supply.
      (3). Recharge areas of caves providing habitat to rare or endangered species such as the Ozark cave fish.
   d. *Sensitive areas*. All other sinkhole areas will be classified as sensitive to contamination from urban runoff.
5. *Groundwater contamination hazard*. The relative potential for groundwater contamination will be classified as low, moderate or high depending upon the type of land use, development

density and amount of directly connected impervious area. The Sinkhole Evaluation shall identify whether the proposed development poses a low, moderate or high hazard to groundwater uses, as defined below:

a. *Low hazard*. The following land uses are classified as posing a relatively low hazard to groundwater contamination:

(1). Wooded areas and lawns.

(2). Parks and recreation areas.

(3). Residential developments on sewer, provided directly connected impervious areas discharging to the sinkhole is less than one (1) acre.

(4). Low density commercial and office developments provided directly connected impervious areas discharging to the sinkhole is less than one (1) acre.

(5). Discharge from graded areas less than one (1) acre having required sediment controls per Section **410.710**.

b. *Moderate hazard*.

(1). Concentrated discharge from streets and parking lots and roofs and other directly connected impervious areas having an area greater than one (1) acre and less than five (5) acres.

(2). Multi-family residential developments and higher intensity office developments provided the directly connected impervious areas discharging to the sinkhole is less than five (5) acres.

(3). Discharge from graded areas greater than one (1) acre and less than five (5) acres having required sediment controls per Section **410.710**.

c. *High hazard*.

(1). Collector and arterial streets and highways used for commercial transport of toxic materials.

(2). Railroads.

(3). Concentrated discharge from streets and parking lots and roofs and other directly connected impervious areas having an area greater than five (5) acres.

(4). Commercial, industrial and manufacturing areas.

(5). Individual wastewater treatment systems.

(6). Commercial feedlots or poultry operations.

(7). Discharge from graded areas greater than five (5) acres having required sediment controls per Section **410.710**.

6. *Capturing and filtering pollutants*.

a. The majority of sinkholes drain a limited watershed area. For sinkholes where the surrounding drainage area is small enough that the area draining to the sinkhole flows predominantly as "sheet flow", potential impacts on water quality can be addressed by erecting silt control barriers around the sinkhole during construction and providing a vegetative buffer area around the sinkhole to filter out potential contaminants.

b. When the volume of runoff into the sinkhole increases to the point where flow becomes concentrated, the degree of effort required to capture and filter out contaminants increases significantly.

c. Concentrated inflow occurs naturally when the sinkhole watershed area reaches a sufficient size for watercourses leading into the sinkhole to form. Concentrated surface flows result as urbanization occurs due to construction of roads, storm

sewers, drainage channels. Subsurface flows can become concentrated through utility trenches.

d. The Sinkhole Evaluation shall include maps showing any existing watercourse which flows into the sinkhole and location of any proposed concentrated storm water discharges into the sinkhole.

7. *Water quality management measures*.

a. *Sediment and erosion control*.

(1). *Non-concentrated flow (sheet flow)*. In critical areas, existing ground cover shall not be removed within twenty-five (25) feet of the sinkhole rim and a silt barrier shall be provided around the outer perimeter of the buffer area.

(2). *Concentrated flow*. A sediment basin will be required at each point where concentrated flows are discharged into the sinkhole. Sediment basins shall be designed according to the procedures set forth in Section **410.710**.

b. *Minimizing directly connected impervious area*.

(1). The groundwater contamination hazard category for impervious areas may be reduced by reducing the amount of Directly Connected Impervious Area. This is the area of roofs, drives, streets, parking lots, etc. which are connected via paved gutters, channels or storm sewers.

(2). Directly Connected Impervious Areas can be reduced by providing properly sized grass swales, vegetative filter strips or other Best Management Practices to separate paved areas.

c. *Diversion of runoff*.

(1). Concentrated discharges to sinkholes can be reduced to manageable levels or avoided by diverting runoff from impervious areas away from sinkholes where possible.

(2). Diversions shall be done in a manner that does not increase flooding hazards on downstream properties and, generally, shall not be directed out of the surface watershed in which the sinkhole is located.

d. *Filtration areas*.

(1). For areas having a low or moderate groundwater contamination hazard and where flow into the sinkhole occurs as sheet flow, water quality requirements can be satisfied by maintaining a permanent vegetative buffer area with a minimum width of thirty (30) feet around the sinkhole.

(2). Use of pesticides and fertilizers will not be permitted within the buffer area. Animal wastes will not be permitted to accumulate in the buffer area.

e. *Grassed swales and channels*.

(1). For areas having a low groundwater contamination hazard concentrated flows from directly connected impervious areas of less than one (1) acre may be discharged into the sinkhole through grassed swales and channels.

(2). Swales and channels shall be designed for non-erosive velocities and appropriate temporary erosion control measures such as sodding or erosion control blankets provided.

f. *Storage and infiltration*.

(1). Storage and infiltration will be required in the following cases:

(A). All areas having a high groundwater contamination hazard.

(B). Areas having a moderate groundwater contamination hazard where concentrated inflow occurs.

~~(2). Storage and infiltration basins shall be designed to capture the runoff from storms up to one (1) inch and release runoff over a minimum period of twenty-four (24) hours and maximum period of forty-eight (48) hours.~~

~~(3). Standards outlet structures for sedimentation and infiltration basins are shown in the standard drawings.~~

I. *Development Requirements*.

1. ~~*Stormwater detention in sinkholes*. Where flooding considerations and water quality considerations, as set forth in Section **410.710**, can be met, the volume of runoff storage in sinkholes can be counted toward storm water detention requirements, provided that proper sediment and erosion control measures are provided as set forth in Section **410.710**. The volume of required detention storage shall be determined as set forth in Section **410.690**. Excavation within the sinkhole flooding area to provide additional detention storage will not be allowed.~~
2. ~~*Modification of sinkholes to increase outflow rates*. Increasing outflow rates in sinkholes by excavating the sinkhole eye or installing disposal wells for diverting surface runoff to the groundwater system is prohibited, unless clear and imminent danger to the public health and safety can be demonstrated.~~

1. ~~*3*~~. *Setbacks and use restrictions*.
    a. No new construction of any of the following shall be permitted within thirty (30) feet of the sinkhole rim:
        (1). Residential, commercial or industrial structures.
        (2). Swimming pools.
        (3). Streets, highways or parking lots.
        (4). Storage yards for materials, vehicles and equipment.
        (5). Sanitary sewer lines.
    b. Use of pesticides and fertilizers within thirty (30) feet of the sinkhole rim is prohibited.
    c. Use of heavy construction equipment in unaltered sinkholes is prohibited.
    d. Construction of underground utilities is prohibited within the sinkhole rim.
    e. Recreational facilities such as hiking, jogging and bicycling trails, playgrounds, exercise courses and grass playing fields are permitted within the sinkhole area provided they are not located within the eye of the sinkhole.
    f. Golf courses are permitted subject to approval of a Management Plan for use of pesticides and fertilizers.
    g. Clearing and pruning of trees and undergrowth and limited grubbing of roots is permitted.
    h. Landscaping and minor gardening is permitted outside of the sinkhole eye provided erosion and sediment discharge is limited through use of minimum tillage and mulches.
    i. Construction of light incidental landscaping and recreational structures such as gazebos, playground equipment, etc. is permitted except in the sinkhole eye.
2. ~~*4*~~. *Collapsed sinkholes*.
    a. Collapsed sinkholes may be stabilized and filled using approved techniques. A Grading Permit must be issued prior to performing any construction.

b. The probable cause of the collapse and potential adverse impacts of filling the collapse shall be investigated and information submitted with the Grading Permit application.

3. ~~5.~~ *Altered sinkholes*.
   a. Filling or altering of sinkholes without a Grading Permit constitutes a violation of these regulations. In such cases corrective measures must be proposed within the time period specified in the Zoning Regulations for enforcement of such violations. No corrective or remedial measures shall be undertaken until the proposed remediation plan has been reviewed by the City and a Grading Permit issued.
   b. No Building Permits will be issued or zoning or subdivision approvals granted, until the remedial measures specified in the Grading Permit have been completed and approved.

410.710 Grading, Sediment And Erosion Control

~~*A. Goals And Objectives. The goal of the regulation is to effectively minimize erosion and discharge of sediment by application of relatively simple and cost effective Best Management Practices. This goal can be attained by meeting the following objectives:*~~

~~*1. Minimize the area disturbed by construction at any given time.*~~

~~*2. Stabilize disturbed areas as soon as possible by re-establishing sod, other forms of landscaping and completing proposed structures, pavements and storm drainage systems.*~~

~~*3. Provide for containment of sediment until areas are stabilized.*~~

~~*4. Provide permanent erosion controls.*~~

~~*B. General Design Guidelines. The following items must be considered in preparing a sediment and erosion control plan:*~~

~~*1. Temporary versus permanent controls.*~~

~~*a. The greatest potential for soil erosion occurs during construction. Temporary controls are those that are provided for the purpose of controlling erosion and containing sediment until construction is complete.*~~

~~*b. Temporary controls include straw or hay bale dikes, silt fences, erosion control blankets etc., which are not needed after the area is stabilized.*~~

~~*c. Permanent controls consist of riprap, concrete trickle channels, detention basins, etc., which will remain in place through the life of the development.*~~

~~*d. It is possible for the same facility to serve both a temporary and permanent purpose. The difference between temporary and permanent erosion control should be clearly recognized in preparing a sediment and erosion control plan.*~~

~~*2. Sheet flow versus concentrated flow.*~~

~~*a. In areas where runoff occurs primarily as sheet flow, containment of sediment is relatively simple. In these areas straw or hay bales, silt fences and vegetative filter areas can be very effective.*~~

~~*b. Where concentrations of flow occur containment of sediment becomes more difficult as the rate and volume of flow increase. In these areas more sophisticated controls such as sedimentation basins must be provided.*~~

~~*3. Slope. Control of erosion becomes progressively more difficult as the slope of the ground increases. Areas with steeply sloping topography and cut and fill slopes must be given special consideration.*~~

~~4. Soils and geologic setting. Area soils and the geologic setting must be considered in preparing the plan and any special considerations deemed necessary for a particular site provided.~~

5. ~~Environmentally sensitive areas. Where construction occurs within the vicinity of permanent streams, springs, sinkholes, lakes or wetlands, special attention must be given to preventing discharge of sediment.~~

A. ~~C.~~ *Grading Permits*.

1. *Permit requirements*. Grading permits are required for all construction sites with the following exceptions:
    a. Grading for single-family or duplex residences constructed in subdivisions where approved sediment and erosion controls have been constructed.
    b. Emergency construction required repairing or replacing roads, utilities or other items affecting the general safety and well being of the public.
    c. For emergency construction sites which would otherwise be required to obtain a permit and for which remedial construction will take more than fourteen (14) calendar days, application for the permit must be made within three (3) calendar days from the start of construction.
    d. The following activities, provided that they are not located within twenty-five (25) feet of a spring, sinkhole, wetland or watercourse:
        (1) Gardening or landscaping normally associated with single-family residences that cover less than one-half (1/2) acre.
        (2) Grading and repair of existing roads or driveways.
        (3) Cleaning and routine maintenance of roadside ditches or utilities.
        (4) Utility construction where the actual trench width is two (2) feet or less.
2. *Permit procedure*. The following items must be received prior to issuance of a Grading Permit:
    a. An approved grading, sediment and erosion control plan. The submittal and approval procedure is as follows for subdivisions, commercial and other sites.
        (1) The sediment and erosion control plan shall be submitted for review along with the plans for the proposed improvements.
        (2) Grading permits for commercial, multi-family or major subdivisions will be issued by the City Planner after the project plans have been approved.
3. *Plan requirements*. Plans must be prepared by and bear the seal of~~,~~ an engineer registered to practice in the State of Missouri. Plan requirements are set forth in ~~Section~~**Chapter 410**~~**410.660**~~ and in this Section. Plans will not be required in the following cases:
    a. Grading associated solely with a single-family residence.
    b. Grading or filling of less than one (1) acre if located outside of the allowable building areas and not located within twenty-five (25) feet of spring, sinkhole, wetland or watercourse. In these instances a grading permit can be issued, providing an inspection of the site by a representative of the City does not reveal conditions that would warrant preparation of a detailed plan.

B. ~~D~~. *Other Permits*.

1. *NPDES storm-water permit*. ~~Effective October 1, 1992, construction~~ sites where the area to be disturbed is five **(1)**~~(5)~~ acres or more must apply for a storm-water discharge permit from the Missouri Department of Natural Resources. Permit requirements are set forth in 10 CSR 20-6.200 of the Missouri Clean Water Laws.

2. *"404" permit*. Grading activities in streams or wetlands may require a Department of the Army Permit under Section 404 of the Clean Water Act.

C. ~~*E*~~*. Design Standards And Criteria*. **Refer to Republic Stormwater Design for Design Standards and Criteria relating to Grading, Sediment and Erosion Control.**

1. ~~*Grading.*~~

~~a. *Maximum grades*. Cut or fill slopes shall not exceed four (4) to one (1).~~

~~b. *Maximum height*. Cut or fill slopes shall not exceed fifteen (15) feet in vertical height unless a horizontal bench area at least five (5) feet in width is provided for each fifteen (15) feet in vertical height.~~

~~c. *Minimum slope*. Slope in grassed areas shall not be less than one percent (1%).~~

~~d. *Construction specifications*. Construction for streets must comply with specifications set forth by the City of Republic. For all other areas, construction specifications stating requirements for stripping, materials, subgrade compaction, placement of fills, moisture and density control, preparation and maintenance of subgrade must be included or referenced on the plans or accompanying specifications submitted.~~

~~e. *Spoil areas*.~~

~~(1) Broken concrete, asphalt and other spoil materials may not be buried in fills within proposed building or pavement areas.~~

~~(2) Outside of proposed building and pavement areas, broken concrete or stone may be buried in fills, provided it is covered by a minimum of two (2) feet of earth.~~

~~(3) Burying of other materials in fills is prohibited.~~

~~f. *Stockpile areas*. Location of proposed stockpile areas shall be outlined on the plans and specifications for proper drainage included.~~

~~g. *Borrow areas*. The proposed limits of temporary borrow areas shall be outlined in the plans and a proposed operating plan described on the grading plan. Temporary slopes in borrow areas may exceed the maximums set forth above. At the time that borrow operations are completed, the area shall be graded in accordance with the criteria set forth above and reseeded.~~

~~2. *Sediment containment*.~~

~~a. *Existing vegetative filter area*. Existing vegetative filter areas may be used where:~~

~~(1) Unconcentrated sheet flow occurs;~~

~~(2) An area of existing vegetation a minimum of twenty-five (25) feet in width can be maintained between the area to be graded and a property line, watercourse, sinkhole, spring, wetland or classified lake;~~

~~(3) Existing ground slope is no greater than five (5) to one (1) (twenty percent (20%));~~

~~(4) The existing vegetative growth is of sufficient density and in sufficiently good condition to provide for filtration of sediment.~~

~~(5) Vegetative filter areas are a temporary and permanent practice.~~

~~b. *Hay/straw bale dike or silt fence*. Containment areas constructed of hay or straw bales or silt fence may be provided in areas where:~~

~~(1) Unconcentrated sheet flow occurs,~~

~~(2) An area of existing vegetation a minimum of twenty-five (25) feet in width cannot be maintained between the area to be graded and a property line, watercourse, sinkhole, spring, wetland or classified lake,~~

(3) Existing ground slope is no greater than five (5) to one (1) (twenty percent (20%)),

(4) Concentrated flow from an area no greater than one (1) acre occurs and a minimum volume of one thousand (1,000) cubic feet per acre is contained behind the dike. Either cereal grain straw or hay may be used for bale dikes. Straw/hay bale dikes shall be constructed as shown in Drawing 50. Straw/hale bale dikes and silt fences are temporary practices.

c. *Temporary containment berms*.

(1) Temporary containment berms may be provided for areas where concentrated flow from areas greater than one (1) acre and less than five (5) acres occurs. Temporary containment berms must contain a volume of one thousand (1,000) cubic feet per acre of drainage area.

(2) Temporary containment berms shall have a riprap outlet with a sediment filter as shown in Drawing 40 or a perforated pipe outlet as shown in Drawing 80.

(3) Details for temporary containment berms are shown in Drawing 30.

(4) Temporary containment berms and accumulated sediment may be completely removed after the tributary area is stabilized and must be removed prior to final acceptance and release of escrow.

d. *Sedimentation basin*.

(1) Sediment basins shall be provided for all areas where concentrated flow occurs from an area of five (5) or more acres. Sediment basins shall be designed to detain the runoff from one (1) inch of rainfall for a period of at least twenty-four (24) hours.

Runoff shall be calculated using the methods contained in Chapter 2 of TR-55 (Reference 11), using the recommended curve number for newly graded areas from Table 2-2a.

Note: For construction sites in Republic an average value of runoff volume from one (1) inch of rainfall is approximately one thousand two hundred (1,200) cubic feet per acre, using a Curve Number of 90, as indicative of a mixture of type B and C soils. This value may be used in sizing sediment basins or the runoff volume determined using the values from Figure 2-1 of TR-55.

(2) Sediment basins shall be provided with an outflow structure consisting of:

(A). A flow restriction device which provides for the required detention time,

(B). An outfall pipe sized to carry the maximum estimated outflow rate,

(C). Protective structures at the pipe outlet to prevent crushing or damage of the end of the pipe,

(D). Protective structures to prevent blockage of the pipe with debris,

(E). Erosion protection at the pipe outlet. A typical outlet structure is shown in Drawing 140.

(3) An overflow spillway capable of discharging the peak flow rate for the four percent (4%) annual probability (25-year) storm while maintaining a minimum freeboard of one (1) foot.

(4) Overflow spillways may be sodded where the depth of flow at the crest is limited to no greater than six (6) inches and outlet channel velocities do not exceed five (5) feet per second for the minor (5-year) storm.

(5) Overflow spillways not meeting these restrictions must be constructed of riprap, concrete or other approved, non-erodible material.

3. *Erosion protection.*

a. *Seeding and mulching.*

(1) *Permanent seeding*. Permanent seeding fertilizer and mulch shall be applied at the rates set forth in Drawing 10 or according to other specifications, which are approved with the Grading Permit.

(2) Permanent seeding seasons are from March first (1st) to May fifteenth (15th) and August fifteenth (15th) to October fifteenth (15th).

(3) *Mulching.* Where slopes are less than four (4) to one (1), cereal grain mulch is required at the rate of one hundred (100) pounds per one thousand (1,000) square feet (four thousand five hundred (4,500) pounds per acre). Cereal grain mulch shall meet the requirements of Section 802 of the State Specifications (Reference 17) for Type 1 mulch.

(4) Where slopes are four (4) to one (1) or greater Type 3 mulch ("hydromulch") meeting the requirements of Section 802 of the State Specifications (Reference 17) shall be used.

(5) *Temporary seeding*. Whenever grading operations are suspended for more than thirty (30) calendar days between permanent grass or seeding periods, all disturbed areas must be reseeded with temporary cover according to Drawing 10. Temporary seeding season runs from May fifteenth (15th) to November fifteenth (15th).

(6) *Overseeding.* During the winter season (November fifteenth (15th) to March first (1st)) temporary seed and mulch shall be placed in on all completed areas or areas where grading is suspended for more than thirty (30) calendar days. During this period seed, mulch and soil amendments shall be applied at the following rates: Lime: 100% of specified quantity.* Fertilizer: 75% of specified quantity. Seed: 50% of specified quantity. Mulch: 100% of specified quantity. * Per Drawing 10. Areas seeded during this period shall be reseeded and mulched during the next permanent seeding season according to seeding requirements.

(7) *Maintenance.* Seeded areas must be maintained for one (1) year following permanent seeding.

b. *Cut and fill slopes*. Cut and fill slopes shall be protected from erosion by construction of straw bale dikes, silt fences, diversion berms or swales along the top of the slope.

(1) Where drainage must be carried down the slopes, pipe drains, concrete flumes, riprap chutes or other impervious areas must be provided. Suitable erosion control measures such as riprap stilling basins, must be provided at the bottom of the slope.

(2) Diversions shall be maintained until permanent growth is firmly established on the slopes.

(3) Typical diversion details are shown in Drawing 30. Riprap chute details are shown in Drawing 70.

c. *Channels and swales*. Permanent channels and swales shall be provided with a stabilized invert consisting of one of the following materials:

(1) *Sod*. Where the average velocity of flow is five (5) feet per second or less and there is no base flow, the channel shall be lined with sod.

(A). For channels with a bottom width less than fifteen (15) feet, sod shall extend up the side slope to a minimum height of six (6) inches above the toe. (Drawing 90).

(B). Channels with a bottom width of fifteen (15) feet or greater, shall be graded as shown in Drawing 90 and a low flow area, fifteen (15) feet in width lined with sod.

(C). The remainder of the channel slopes shall be seeded and mulched as provided above.

(2) *Erosion control blanket*. Commercial erosion control blankets may be used in lieu of sod provided that samples are submitted and approved by the City. The guaranteed maintenance period shall be one (1) year.

(3) *Non-erosive lining*. In grass channels where base flow occurs, a non-erosive low flow channel of riprap or concrete must be provided. Low flow channels shall have a minimum capacity of five (5) cubic feet per second. Other suitable non-erosive materials may be specified with approval of the City.

(4) For channels which have an average velocity of five (5) feet per second or greater a non-erosive lining of riprap concrete or other approved material must be provided.

d. *Storm sewer and culvert outlets*. Erosion protection shall be provided at storm sewer and culvert outlets. Minimum erosion protection shall consist of a concrete toe wall and non-erosive lining, meeting the City's specifications for public improvements.

(1) The required length of non-erosive lining will not be decreased where flared end sections or headwalls are provided unless calculations and data to support the decrease in length are submitted and approved.

(2) Non-erosive lining shall consist of riprap, unless otherwise specified and approved. Field stone, gabions or riprap shall extend to the point at which average channel velocity for the peak flow rate from the minor (5-year) storm has decreased to five (5) feet per second maximum.

(3) The length of riprap to be provided shall be as follows: (See Drawing 120)

Average outlet velocity less than five (5) feet per second:
L = three (3) times the pipe diameter or culvert width.

Average outlet velocity less than five (5) to ten (10) feet per second:
L = length determined using Drawing 120.

Average outlet velocity greater than ten (10) feet per second:

(4) Use MHTD standard energy dissipater headwall. (Reference 17) The height of erosion protection shall be as shown in Drawing 120.

(5) Minimum toe wall dimensions are shown in Drawing 120. Where headwalls or flared end sections are specified, toe walls must be provided at the downstream end.

e. *Curb openings*. Where drainage has been approved by the City to flow from paved areas to grass areas through curb openings erosion protection shall be provided as shown in Drawing 130.

f. *Ditch checks and drop structures*. In grass channels grades and velocities may be controlled by use of ditch checks and drop structures. Riprap ditch checks may be required in natural channels where average velocity for the peak flow rate from the 5-year storm exceeds five (5) feet per second for post-development conditions.

g. *Spillways*. Erosion protection must be provided at spillways and outlet structures for detention ponds. Erosion protection shall extend to the point where flow has stabilized and average velocity in the outlet channel is five (5) feet per second or less.

4. *Temporary construction entrance*.

a. A minimum of one (1) temporary construction entrance is required at each site. Additional temporary entrances may be provided if approved. The location of each construction entrance shall be shown on the plan.

b. Only construction entrances designated on the sediment and erosion control plan may be used. Barricades shall be maintained if necessary to prevent access at other points until construction is complete.

c. Construction entrances shall be constructed of crushed limestone meeting the following specifications:

(1) Construction entrances shall be a minimum of twenty-five (25) feet wide and fifty (50) feet long.

(2) Minimum thickness of crushed limestone surface shall be six (6) inches. Additional two (2) inch lifts of crushed limestone shall be added at the discretion of the County if the surface of the initial drive deteriorates or becomes too muddy to be effective.

(3) In locations where an existing drive or street extends at least fifty (50) feet into the site, the existing drive may be designated as the construction entrance and construction of a new gravel entrance is not required, unless job conditions warrant as set forth in the preceding paragraph.

5. *Cleaning streets*. Streets both interior and adjacent to the site shall be completely cleaned of sediment at the end of construction and prior to release of security.

6. *Dust control*. The contractor will be required to use water trucks to water all roads and construction areas to minimize dust leaving the site when conditions warrant.

7. *Sequencing and scheduling*. Costs of sediment and erosion control can be minimized if proper consideration is given to sequencing and scheduling construction. Any special sequencing and scheduling considerations should be noted in the grading plan. A detailed schedule must be received from the contractor at the Pre-Construction Conference.