

ARTICLE 3 IMPACT STUDIES

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Article 3, Impact Studies provides tools and evaluation techniques for complex development projects. It includes coordination of design and funding of public improvements in response to specific development applications. It is most useful to large developers, land planners, design professionals and engineers.

UNIFIED DEVELOPMENT CODE

ARTICLE 3 IMPACT STUDIES

- 3.1 Transportation Impact Studies
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3.1 Transportation Impact Studies

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3.1.1 General Provisions

- a. **Purposes.** In addition to the general purposes of these regulations, this Article has the following specific purposes. To:
1. Assess the impact which a new development, change in land use, zone change, or an access modification will have on the existing and proposed transportation system, both at the immediate location and in the general area.
 2. Provide information and guidance as plans are developed and decisions made for the approved plan.
 3. Determine the travel demand generated by a proposed development.
 4. Identify deficiencies in the existing and proposed transportation systems.
 5. Assess pedestrian, bicycle, transit and truck connections as a critical component of managing transportation systems.
 6. Identify improvements necessary to maintain acceptable levels of service.
 7. Minimize burdens on the public that result from transportation impacts of proposed development.
 8. Ensure that transportation and land use decisions are linked in accordance with the Comprehensive Plan of the City, and the long-range transportation plans for the community.

b. **Applicability.** Except as specified below in Section 3.1.2, the requirements of this Article apply to:

1. A change in land use;
2. A proposed zoning change;
3. Modification of access points to public streets; and
4. Development or subdivisions of land.

c. **Applicant Responsibilities.** An applicant for any applicable development application shall have the following responsibilities:

1. **Transportation Worksheet.** A Transportation Worksheet (Appendix C) shall be completed and submitted with all applications for development approval. No worksheet is required for residential projects proposing 25 dwelling units or less and instigating no substantial access changes on a collector or arterial roadway.
2. **Scoping Meeting.** After the applicant has completed the Transportation Worksheet, the applicant shall contact the Planning and Development Department and arrange for a meeting to determine base assumptions and the level of TIS required.
 - (a) **Purpose.** The scoping meeting shall determine the parameters for the study of transportation impacts for a specific development project, and document those parameters. The parameters determined in the scoping meeting represent general agreement between the City and the applicant, but they may not be all inclusive. The City retains the right to require any additional pertinent transportation information and/or analysis to complete the evaluation of the proposed development project.
 - (b) **Determination of Study.** The City and applicant and where applicable WYDOT or the County shall mutually agree to the level of detail and extent to which the study addresses each of the following:
 - (1) Study area for the impact analysis.
 - (2) Other developments within the study area.
 - (3) Existing intersection counts.
 - (4) Intersections to be studied in detail.
 - (5) Background traffic volume forecasts (Buildout: 20 to 25 years).

- (6) Transit, bicycle, or pedestrian issues such as location and design of transit stops, pedestrian and bicycle access to transit stops, major bicycle or pedestrian destinations such as schools, parks and neighborhood activity centers, or other similar multi-modal considerations.
 - (7) Special analysis needs (non-traditional peak hour volumes for some uses, neighborhood impacts, access management plans, or other traffic reduction programs).
 - (8) Data availability and requirements. Conclusions of the scoping meeting will be documented and distributed to the applicant by the City.
3. **Preparation of Study.** The applicant is responsible for the study, which shall be prepared by a qualified traffic engineer who is specialized in the preparation of Transportation Impact Studies and is licensed by the Wyoming State Board of Registration for Professional Engineers and Professional Land Surveyors to practice engineering in Wyoming.
 4. **Study Presentation.** Four copies of the traffic study shall be submitted. Reports shall be 8½" x 11" format, with maps no larger than 11" x 17". Additional copies may be required for large or complex projects. The exact number required should be verified at the scoping meeting.
- d. **City Responsibilities.** The City and its engineering staff serve in a review capacity. The City can use the findings of the impact study to suggest or require roadway improvements, changes to site design, and/or operational improvements. The applicant shall revise and resubmit the study as necessary to address review comments provided to the applicant by the City or other affected agencies.
- ### 3.1.2 Levels of Study
- The following levels of analysis apply: (These categories are intended as guidelines and may be revised, when warranted, by the City Engineer.)
- a. **No Transportation Impact Assessment or Study Required.** The City Engineer may elect to not require a study in the following circumstances:
 1. **Exception.** A Transportation Impact Assessment or Study is not required for residential projects consisting of less than 50 dwelling units and instigating no substantial access changes on a collector or arterial roadway.
 2. **Waiver.** Upon submittal of a Transportation Worksheet (Attachment C) by the applicant and written acceptance by the City Engineer, the study requirement may be waived if all of the following are satisfied:
 - (a) Daily vehicle trip-end generation is less than 500 and the peak-hour trip generation is less than 50;
 - (b) There are no additional access requirements on collectors, arterials, or State Highways;
 - (c) The increase in the number of vehicular trips for the proposed use does not exceed the trip generation from the existing use by more than 20 peak-hour trips or 200 daily vehicle trip-ends;
 - (d) Any change in the type of traffic to be generated (i.e., the addition of new truck traffic) does not adversely affect the traffic currently planned for, accommodated within and adjacent to the property;
 - (e) The scale or use of the proposed development or redevelopment is not likely to cause less-than-acceptable levels of service on the adjacent public streets, accesses, and intersections; and,
 - (f) The proposed development or redevelopment is not in the vicinity of a street or intersection with a history of safety and/or accident problems.
 - b. **Transportation Impact Assessment.** A Transportation Impact Assessment (TIA), in lieu of a more detailed study, will be considered if both of the following requirements are met:
 1. Daily vehicle trip-end generation is between 500 and 1,000, and/or the peak-hour trip generation is between 50 and 100; and
 2. Any new access requests are for local streets.
 - c. **Transportation Impact Study.** A full Transportation Impact Study (TIS) may be required for any development that meets one of the following criteria:
 1. Daily vehicle trip-end generation is greater than 1,000 or the peak-hour trip generation is greater than 100;
 2. Access(es) designated as high-volume driveways (50 peak-hour trips) onto Arterials or State Highways are being requested; or
 3. Where large, complex projects are planned or a

project is phased over a multi-year build-out, it may be appropriate to prepare a TIS for the initial land-use action followed by periodic updates for specific phases. The TIS must include overall phasing of improvements to coincide with project phasing. Updates to the TIS shall be submitted with the land-use applications for the specific phases.

- d. **Revisions or Updates.** A revision or update to an approved TIS may be required when previously approved land-use action proposes an expansion, a change to access, or a change in use where new trip generation estimates exceed the original trip-end generation estimates. If the currently approved study was prepared within the last two years, an amendment letter addressing the changes may be accepted and satisfy the requirements of this guideline. The letter must address:
1. An estimate of site trip generation;
 2. Existing site trip generation; and
 3. The differences between anticipated estimates and existing trip generation.

If the original study is older than two years and access and trip generation has not changed, then an amendment to the TIS is required. If the original study is older than two years, and access has changed or trip generation has increased, then an entirely new study will be required by the City Engineer.

Original Report is -	Access Changed* or Trip Generation Increased	Access Not Changed and Trip Generation Not Increased
<i>Less than 2 years old</i>	Letter Amendment Required: Identify and discuss any items that changed	Letter documenting change (no other reports required).
<i>Greater than 2 years old</i>	New Study	Letter Amendment Required: 1. New local ground counts 2. New Trip Generation 3. New LOS Analysis 4. Meet all current requirements of this TIS guideline

* Changed access includes proposed new access or refinement of general access locations not specially addressed in original proposed development.

3.1.3 Study Parameters

- a. **Summary.** The Summary shall be provided as a condensed, stand-alone document. Maps and tables required or provided in individual sections of the report shall be placed in the Summary in the order described and provided in the text of the report. Individual sections of the report may be referenced only as necessary to document a source of information.
- b. **Project Description.** A description of the proposed project shall include the type of land use and size of the proposed project (number of dwelling units or building square footage), proposed phasing, and anticipated completion date. A figure depicting the proposed site plan shall also be included, and the proposed vehicular access locations will be described. This figure shall provide the following:
1. Surrounding street roadway arterial classification
 2. Number of existing and proposed travel lanes
 3. Existing and proposed street width
 4. Existing and proposed right-of-way dimensions
 5. Existing and proposed multi-use driveways and site access points (with turning movements)
 6. Traffic control
 7. Speed limits
 8. Existing and proposed access
 9. Locations of parks, schools, activity centers, and other notable destinations within 1/4 mile of the project edge, and

identify sidewalks, bike routes, lanes, or paths that would be used to get from the project to each destination. Also identify how pedestrian and bicycle access is provided within the project site to facilities at the boundaries.

10. Cheyenne city bus routes and stops.

Similar information for adjacent property shall be provided as well, if available, on the same map. The data presented in this report shall be identical in every respect to the site plan submitted for development approval. For situations where a site plan does not exist, a prototypical site roadway and access system should be assumed for purposes of the study. Subsequent updates will be necessary when a site plan becomes available. This section will also include a description of how pedestrian and bicycle travel will be accommodated within the proposed site plan. This section will also identify how access to the Cheyenne Transit Program (CTP) is provided.

c. **Analysis Horizons.** Three study horizons are required for a Master or Full TIS analysis:

1. Existing (current);
2. Short-range (one year after build-out); and
3. Long-range (20 to 25 years, based on current Cheyenne Area Master Transportation Plan).

It may be acceptable for the short-range and long-range horizons to be identical for some large projects.

d. **Study Area.** The limits of the transportation network to be studied shall be based on the size and extent of the application for development approval, the existing and future land uses and traffic conditions on and near the site. The exact limits of the study area are to be based on good engineering and transportation planning judgment, and an understanding of existing and future land use and traffic conditions at and around the site. The limits of the study area shall be agreed upon at the scoping meeting. At a minimum, the factors to be considered for the establishment of limits of the study should include:

1. All adjacent streets, intersections, and high-volume driveways;
2. Nearest offsite major intersection(s);
3. Internal roads, including establishing the road classification;
4. Pedestrian and bicyclist destinations (existing or planned) within 1,320 feet of the site;
5. Any pedestrian or bicycle routes within 1½ mile of a school (residential land uses only) and

6. Any Cheyenne public bus routes and stops within 1,320' of the project.

e. **Existing and Proposed Uses in Vicinity of Site.** The applicant shall identify existing and anticipated land uses in the general vicinity of the site in order to understand other influences to area traffic patterns. A list of the applicable development approvals shall be included. (This information shall be obtained from the City's records.) Specific attention shall be paid to property adjacent to the site and any undeveloped land in the study area. A map shall be prepared for the project vicinity that graphically depicts the location of approved or proposed developments. Developments within the project study area but in other jurisdictions shall also be identified and documented on the map.

f. **Existing and Committed Transportation Improvements.** The applicant shall prepare a map showing the planned surface transportation improvements for the short-term and long-term planning horizons. Committed/funded improvements by the City and previously approved developments shall be identified for the short- and long-term horizon years. The long-term improvements shall be those documented in the City's Transportation Master Plan and any other long-term improvements adopted through the Cheyenne MPO and/or included in the State Transportation Improvement Program. The description of improvements shall include the nature, extent, implementation schedule, and the party responsible for the improvement.

3.1.4 Evaluation Elements

TISs and TIAs shall utilize sound and commonly accepted traffic engineering standards and procedures and shall utilize the latest edition of the Institute of Transportation Engineers (ITE) trip generation rates—unless better information is available or can be obtained at reasonable cost. TISs and TIAs shall address the following items in sufficient detail (based on the agreed-upon parameters outlined in the scoping meeting) to adequately and accurately represent the traffic conditions and resultant impact of the proposed development request.

a. **Transportation Impact Study.** The key elements of the project impact study (TIS) shall include the following evaluations:

1. *Conformity with the adopted Transportation Master Plan.* The applicant shall identify the roadway

improvements within the study area per the City's Transportation Master Plan.

2. *Existing Traffic Conditions.* The applicant shall provide a description of the existing traffic conditions within the study area and shall include the following:
 - (a) *Traffic Counts.* A map shall be prepared, which presents a.m. and p.m. peak-hour and daily traffic volumes. These volumes shall be no more than two years old — less if the development is in a high-growth area. The source of existing traffic volume information shall be explicitly stated (City counts, new counts by applicant, County counts, etc.). Summaries of current traffic counts shall be included in the description's appendix.
 - (b) *Existing Peak-hour and Daily Level of Service.* Existing a.m. and p.m. peak-hour intersection levels of service shall be determined for signalized and unsignalized intersections within the study area based on procedures described in the latest edition of the Highway Capacity Manual. The existing arterials shall also be analyzed based on a daily volume/capacity ratio analysis where the threshold capacities are defined by arterial designation per the following table. Volume/capacity ratios that exceed 1.00 shall be identified. It should be noted that these are general thresholds for planning purposes only, and a supplementary peak-hour analysis shall be considered. These daily volume/capacity ratios shall be recorded on the existing volume map. Roadway links shall be analyzed. Acceptable maximum traffic volumes allowed for the specific class of roadways are per the following table:

Facility Type	Lanes	Threshold Capacity
Local Residential	2	2,500 ADT
Local Commercial / Industrial	2	3,500 ADT
Collector	2	7,500 ADT
Minor Arterial	2	550 each way peak hour
Arterial	4	1,600 each way peak hour

It is recognized that some of the City's streets currently experience traffic volumes greater than each roadway's classification design volume. The objective of this analysis is to identify whether the

volume (as a point of reference for considering impacts from the proposed development) exceeds the threshold.

- (c) *Crash Analysis.* A three-year accident record shall be collected for adjacent roadways and intersections within the study area. Based on existing traffic volumes, an accident rate for accidents per million vehicle miles of travel for links and accidents per million vehicles at intersections shall be calculated by year. Geometric deficiencies for high-accident locations shall be identified. As part of the analysis, the applicant shall identify problems that currently exist and how the proposed improvements will mitigate these problems.
3. *Future Traffic Conditions without Proposed Development.* Long-term a.m. and p.m. peak-hour and daily link planning horizon traffic forecasts shall be estimated. The short-term planning horizon is one year after full occupancy. The short-term planning horizon traffic forecast shall be the sum of existing traffic volumes plus cumulative development traffic plus ambient growth. The short-term planning horizon traffic forecasts shall also include cumulative development traffic within the study area. The short-term planning horizon year ambient growth-rate traffic forecasts shall be based on:
 - (a) Proportion between existing traffic volumes and build-out regional (Wyoming Department of Transportation) model forecasts;
 - (b) Extrapolation from historical traffic counts to current counts, and/or
 - (c) Planning analysis that considers trends in the area's circulation system through either a proportion or extrapolation estimate.

Whatever method is used to develop the annual growth rate for determining ambient traffic, it is important that the method be documented with sufficient detail to clarify the methodology and replicate the findings. The map of the committed and funded improvements (for each planning horizon) shall be used as a base for determining short-term and long-term planning horizon levels of service. The applicant may identify improvements that would mitigate unacceptable levels of service under the traffic conditions without the proposed development. In addition to needed improvements, identification of when such improvements are needed is also

important. The time that improvements are necessary could be defined by when a traffic threshold is reached or by potential year.

4. *Trip Generation.* Development traffic shall be analyzed based on the traditional trip generation, distribution, and assignment process described as follows:
 - (a) *Project Trip Generation.* The applicant shall estimate project trip generation (total daily traffic and a.m./p.m. peaks) for interim years and build-out based on the development approval application number and size of units. Trip generation shall be calculated from the latest data contained within the Institute of Transportation Engineers' Trip Generation Report or other industry publications such as the ITE Journal. Data limitations, data age, choice of peak-hour or adjacent street traffic, choice of independent variable and choice of average rate versus statistical significant modification shall be presented and discussed. In the event that data is not available for a proposed land use, the applicant shall conduct a local trip generation study following procedures prescribed in the ITE Trip Generation Manual and shall provide sufficient justification for the proposed generation rate. This rate must be acceptable to the City Engineer. For shopping centers, trip generation shall be based on both the shopping center trip generation algorithms and the application of trip generation rates to individual land uses. The greater of the two methods shall be used in the analysis.
 - (b) *Adjustments to Trip Generation Rates.* After first generating trips at full ITE rates, trip-making reduction factors may be used. These factors fall into two categories:
 - (1) *Reassignment of Trips:* This category of adjustments applies when trips to the proposed development currently exist as part of the background traffic stream, referred to as a pass-by trip. Pass-by percentages identified in the ITE Trip Generation Manual or other industry publications may be used. This traffic must continue to be assigned to site driveways and access points, but is not additive to the background stream of traffic. A technical appendix that illustrates the redirection of pass-by trips is recommended.
 - (2) *Remove or Move Trips:* This category of adjustments is for internal site trips, transit use, and TDM (transportation demand management) actions. In general, reductions are not recommended. However, if reductions are claimed, analytic support to show how the figures were derived must be provided.

In all cases, the underlying assumptions of the ITE Trip Generation rates must be specifically described in order for these reductions to be considered and claimed. Optimistic assumptions regarding transit use and TDM actions will not be acceptable unless accompanied by specific implementation proposals that will become a condition of approval. Such implementation proposals must have a reasonable expectation of realization within a 5-year period after project initiation.
 - (c) *Trip-generation Budget.* Major concern will occur if the traffic study identifies a trip-generation rate that is less than what ultimately is experienced once the development is built and occupied. Because entitlement has been granted, the impacts of the traffic from underestimating the trip generation is experienced by the community; modifications or improvements, if possible, become the burden of the public. It is recognized that the trip generation process is ultimately dependent on a number of market and social factors; however, it is imperative that the traffic impact study be sufficiently conservative to account for full impact of the proposed development.
5. *Trip Distribution.* Trip distribution may be based on the WYDOT modeling, market analysis, existing traffic flows, applied census data, and professional judgment. Regardless of the estimates, the procedures and logic for estimating the trip distributions must be well documented. The trip distribution patterns must be presented for each phase if changes in roadway network, access or land use are proposed.
6. *Project Trip Assignment.* This section shall present the forecast of the traffic assignment based on the development's trip generation estimates and project trip distribution. The traffic forecasts shall be graphically presented and include: a.m. peak-hour,

p.m. peak-hour, and total daily site-generated traffic. If trip generation is different for the short-term and long-term planning horizons, both shall be shown on separate graphics. "Pass by" traffic shall be included at driveways and access points.

7. *Future Traffic Forecasts with the Proposed Development.*

The applicant shall present a graphical summary of the short-term and long-term horizon year traffic plus the proposed development traffic for the a.m. peak-hour, p.m. peak-hour, and daily conditions. These volumes shall include turn movements at the key intersections. The base map for this exhibit shall reflect the respective transportation network by planning horizons.

8. *Future Peak-hour Level of Service and/or Peak-hour Intersection and Driveway Level of Service.* An a.m. and p.m. peak-hour intersection level of service analysis shall be conducted for study-area intersections and driveways. This analysis should be based on procedures established in the most current Highway Capacity Manual. Synchro intersection level of service is both acceptable and desirable to assess the impacts of intersection levels of service as part of a system of signalized intersections. Levels of service for signalized intersections shall be based on the signal timings developed for the signal progression analysis. All level of service analysis worksheets shall be included in the Appendix of the submitted study. The principal objective of the intersection level of service traffic impact analysis is to identify whether the traffic from the proposed project when added to the existing, plus short- and long-term planning horizon traffic, will result in a significant impact and an unacceptable level of service. For definition purposes, the threshold for acceptable level of service is C. Significance is defined as: 1) when the added project traffic causes the level of service to deteriorate below level of service D, or 2) when the short-term or long-term horizon year traffic without the project is below level of service D and the project traffic causes a 2% increase in the volume/capacity ratio or delay. For unsignalized intersections, the minimum level of service permitted for outbound left turns is E. An analysis of maximum queue length shall also be performed; and if the queue exceeds five vehicles, then a separate left-turn lane with adequate storage shall be provided.

9. *Appropriateness of Access Locations and Circulation.*

The TIS shall address the appropriateness of the proposed access points. This assessment shall be consistent with requirements set forth in Articles 4 and 6 of these regulations. If the proposed access is to be signalized, then a progression analysis using Synchro shall be conducted to insure that the proposed access can be accommodated within the optimum progression along the roadway on which the access is proposed.

10. *Identification and Location for Turn Lanes or Acceleration/Deceleration Lanes at Accesses or Intersections.* The TIS shall identify recommendations and reasons for acceleration and deceleration lanes—including taper lengths, storage length, and other geometric design requirements per Articles 4 and 6 of these regulations.

11. *Sight Distance.* The TIS shall provide an evaluation and recommendation for intersection and driveway stopping sight distance and intersection sight distance per Articles 4 and 6 of these regulations.

12. *Pedestrian and Bicycle Analysis.* The TIS shall provide in sufficient detail the project's proposal to provide pedestrian and bicycle connections within the site to the local off-site pedestrian and bicycle destinations, using the Pedestrian and Bicycle Guidelines in Appendix E. These destinations include, but are not limited to, schools, parks, local commercial centers, and bike trails. This written and mapped assessment shall describe the directness of the route to and from various parts of the project, the continuity of the pedestrian and bicycle system to reach these destinations and the design elements of the street crossings to assure safe pedestrian and bicycle crossings. If the continuity between the project's pedestrian and bicycle system and that of the off-site destination is incomplete, the applicant shall identify what improvements are necessary to mitigate these continuity or street-crossing impacts. It is further required that if any roadway improvements are proposed, such as adding a left- or right-turn lane, the study should address methods to mitigate the impacts on the pedestrian and bicycle system in these areas—explaining how the routes are to cross these proposed improved streets and intersections. Locations for crosswalks, both internal and external to the site, shall be identified.

13. *Cheyenne Public City Bus Connections.* The applicant shall contact the Cheyenne Public City Bus Office to determine existing and future bus transit routes and stops within the study area. Specific stops within or adjacent to the site (such as signs, pads, shelters, etc.) shall be identified as proposed improvements. This analysis shall also identify direct and continuous pedestrian sidewalks and pathways to reach these stops from the site.
14. *Traffic Control.* The TIS shall provide recommended traffic-control devices for intersections; these may include stop-control and yield-control signs, school flashers, crosswalks, traffic signals or roundabouts. These recommendations shall be in conformity with the City standards, AASHTO and other appropriate professional transportation engineering documents. All proposed signal and stop signs shall require a signal or stop sign warrant analysis per the Manual on Uniform Traffic Control Devices. As signal warrants only describe the minimum requirements for considering a signal, a progression analysis shall be conducted to determine that the impact of the new signal can be accommodated without significant impact to the corridor's signal progression.
15. *Progression Analysis for Signalized Intersections.* A progression analysis is required for all projects which propose the addition of a new signal. Whereas the signal warrant analysis identifies the minimum requirements of whether a signal might be warranted, the signal warrant analysis does not determine if the signal can be accommodated in the overall traffic flow of the corridor. Therefore, the acceptability of the signal locations must be demonstrated through a signal progression (time-space) analysis. The analysis shall consider any existing access or intersections or a possible future signal location along the arterial for a distance of at least one mile in each direction of the proposed signal. (This data is available from the City.) The maximum cycle length that will be permitted is 110 seconds. A travel speed of 45 mph on Principal Arterials and 35 mph on Minor Arterials, unless the existing posted speed limit is less, should be used. A Principal Arterial bandwidth of 50% and a Minor Arterial bandwidth of 40% are considered desirable and must be used where existing conditions allow. Where intersections or other accesses have no signals presently, but are expected to have signals, a 60% mainline, and 40% cross-street cycle split should be assumed. Where more detailed information is available from turning movement projections, other split assumptions may be made. Any access that would reduce the desirable bandwidth if a traffic signal were installed shall be identified. In general terms, that access should remain unsignalized and have turning movements limited by driveway design or median islands, unless the impacts to traffic operation and safety are made even worse by doing so. Distances between signalized intersections (centerline) shall be indicated. Signal progression worksheets (time-space diagrams) shall be included in the Appendix of the submitted study. If it is determined that the minimum green band is reduced by five percent or less, then the signal would be permitted. If the green band for the arterial is reduced by greater than five percent, then the intersection design will need to be modified or relocated to minimize the impact.
16. *Other items as requested by the City Engineer.* In the initial required scoping meeting with the City Engineer, specific additional issues might be raised which require further analysis. Additional concerns might include cut through traffic and residential quality-of-life concerns, truck/bus traffic estimates and pavement design, routes to schools, emergency routes, etc.
- b. **Transportation Impact Assessment.** At a minimum, the following issues shall be considered for submittal in a TIA. Requirements for these issues are defined in the above section on TIS requirements.
1. Existing Traffic Conditions:
 - (a) Traffic Counts,
 - (b) Traffic Growth,
 - (c) Crash Analysis,
 - (d) Peak-hour level of service and/or peak-hour intersection and driveway level of service,
 - (e) Future peak-hour level of service and/or peak-hour intersection and driveway level of service, and
 - (f) Appropriateness of access locations.
 2. Location and requirements for turn lanes or acceleration/deceleration lanes at the access, including recommendations for taper lengths, storage lengths, and other geometric design requirements per City or WYDOT requirements,
 3. Sight distance evaluations and recommendations

- (intersection, stopping, passing),
4. Continuity and adequacy of pedestrian and bike facilities within the study area,
 5. Existing and future transit routes and stops in the area,
 6. Appropriateness of the existing roadway signing and striping,
 7. Other items as requested by the City Engineer and agreed upon in consultation with the Applicant's traffic engineer, and
 8. Neighborhood and public input issues.
- c. **Mitigation/Alternatives.**
1. **Improvement Descriptions.** TISs and TIAs shall describe the location, nature, and extent of all transportation improvements that the applicant recommends to yield reasonable operating conditions in each horizon year with the land-use action approved as requested. To identify mitigation and alternatives, the following terms apply:
 - (a) **Planned:** Improvements that are already planned and have committed funding, including those identified in short-term capital improvement programs by the City, State, or others.
 - (b) **Applicant Committed:** When existing plus cumulative traffic, with planned and background improvements, results in unacceptable levels of service, the applicant shall identify mitigation measures to offset project impacts.
 - (c) **Necessary:** Improvements required to mitigate background plus applicant traffic to establish acceptable levels of service, regardless of the amount of traffic contributed by the project.

The reason that "necessary" improvements must be explored is that often the "planned" improvements, plus the improvements that the applicant typically understands and commits to, are not adequate to provide a satisfactory level of service. The applicant shall assure that all practical solutions have been considered when developing the list of "necessary" improvements, so that the resulting operating conditions will approach the accepted level of service.
 2. **Transportation Network Plan and Recommended Improvements.** The applicant shall provide a scaled drawing of the recommended improvements on a transportation network plan. One sheet may be used for both interim and long-term design years if all the improvements can be conveniently described. If not, one or more sheets should be completed for each design year.
 - (a) In general the acceptable level of service for all post-development transportation systems is C. However, all applicable modes of transportation shall be considered and the function of the entire network shall be evaluated in the analysis and recommended improvements, including the Pedestrian and Bicycle Guidelines in Appendix E.
 - (b) Examples of vehicular traffic considerations and improvements include: road widenings, turn lanes, acceleration and deceleration lanes, intersection improvements, traffic control, design-speed adjustments, modifications to access points and truck routes.
 - (c) Examples of pedestrian and bicycle considerations and improvements include: safe, comfortable, and convenient pedestrian services, shorter blocks, tree-lined sidewalks, smaller corner radii, well-defined crosswalks, median refuges, bike lanes, on-street parking and shared-use path connections. Also, design elements that lead to low traffic speeds on local streets should be considered.
 3. **Costs.** For purposes of identifying improvement possibilities (either by the applicant, City, or State) necessary to yield an acceptable level of service, the cost of the improvements shall not be considered a limiting constraint within the context of the study. However, the goal of the evaluation is to identify cost-effective solutions that yield a reasonable level of service. Extremely high-cost solutions may not be cost-effective, but it is important to at least identify solutions so decision makers are cognizant of existing options.
 4. **Design Details.** All recommended improvements shall include right-of-way needs (for roadways), signal or turn-lane improvements (for intersections), and, at a sketch planning level, cost of the improvement. Also, commitment to the improvement shall be identified, either by local governments, districts, or by the applicant (this may include both the "applicant committed" and "necessary" projects). Identification of a project as "not currently committed" may be an appropriate description for many needed projects, including some of those that are "planned." However, the goal of the recommendations shall be to identify a firm program of improvements that will support the

proposed land-use action and background traffic in each design year.

It is further required that all geometric improvements, such as pavement markings, signs, adding through or turn lanes, adding project access and assorted turn lanes, acceleration lanes, and changes in medians, shall be presented in a schematic scaled drawing, preferably on a current aerial map. Sufficient dimensions shall be identified to facilitate review.

4. Mitigate increases in stormwater runoff rates and volumes due to development, wherever possible, through stormwater management controls.
5. Ensure that stormwater management controls pose no threat to public safety and are properly maintained.

b. **Applicability.** This Sub-article 3.2 applies to all land development activities, including platting, re-platting, zoning, re-zoning, site plan applications, grading permit applications, and other development activities. This Sub-article is not applicable to the maintenance of existing pavement (streets, parking lots, etc.).

c. **Waiver.** A request for a waiver of the requirement to submit a drainage impact study shall be made in writing to the City Engineer. The City Engineer shall review the request and either: grant the waiver; specify the level of drainage impact study necessary for approval of a particular proposed development action; or deny the request for waiver. The City Engineer may waive the requirement to submit a drainage impact study based on the following:

1. Information is provided to substantiate there are no potential drainage problems at the site or downstream of the site (including impacts to downstream floodplains).
2. The development or redevelopment will not create drainage problems.
3. The development or redevelopment will not result in an increase in the impervious area.
4. The development or redevelopment of an area is immediately adjacent to a major drainageway that is capable of conveying the fully developed basin 100 year flood without impact to the base flood elevation.

d. **Applicant Responsibilities.**

1. All responsibilities for the planning, design and construction of drainage improvements required in conjunction with land development shall be vested in the person or party who is developing the land (developer).
2. The developer shall be responsible for obtaining all required approvals and permits from regulatory entities (i.e. City, County, State, and Federal agencies) and shall comply with all applicable statutes pertaining to water quality and water pollution control.

3.2 Drainage Impact Studies

- 3.2.1 General Provisions
- 3.2.2 Levels of Study
- 3.2.3 Drainage Design
- 3.2.4 Study Reports
- 3.2.5 Final Acceptance of Drainage Improvements
- 3.2.6 Maintenance
- 3.2.7 Grading and Erosion Control Permit
[Reserved]

3.2.1 General Provisions

- a. **Purposes.** In addition to the general purposes of these regulations, this Section establishes minimum stormwater management requirements and controls to protect the general health, safety, and welfare of the public residing in watersheds within the City. These regulations:
1. Assure stormwater facilities are planned and designed to minimum criteria.
 2. Minimize increases in nonpoint source runoff and pollution caused by stormwater runoff from development to reduce flooding, erosion, increases in stream temperature and maintain the integrity of existing stormwater systems.
 3. Treat stormwater runoff at the source by preserving or enhancing natural flow paths and vegetative cover, preserving or enhancing natural open spaces and riparian areas, disconnecting impervious surfaces, and other measures that replicate pre-development hydrologic conditions to preserve the natural hydrologic functions, stream characteristics and groundwater recharge to the maximum extent practical.

3. The developer shall be responsible for securing approval of a final drainage report and approval of construction plans prior to City issuance of a Grading Permit and prior to construction of any drainage improvements. The requirement for approval of a drainage report will not apply to proposed land disturbance activities or projects where the requirement for a drainage impact study has been waived.
- e. **City Responsibilities.**
1. The City and its engineering staff serve in a review capacity. The City may use the findings of the impact studies to suggest or require drainage improvements, changes to site design, and operational improvements. The applicant shall revise and resubmit the study as necessary to address review comments provided to the applicant by the City or other affected agencies.
 2. The City shall have the right to designate surface water storage areas to serve large land areas, which may include multiple subdivisions, developments and land owners. This right may be exercised when the applicable Drainage Master Plan has designated areas for storage as part of the overall surface water plan, or when, in the opinion of the City Engineer, a single storage facility serving a large area is more efficient to construct, less expensive to maintain, or more easily adapted to multiple land uses.
 3. In such cases, the City Engineer may initiate an Improvement District or utilize the reimbursement provisions of Chapter 1.16 of the Cheyenne City Code as a means of constructing the required improvements. When the Developer constructs these improvements that directly benefit other areas or properties, the Developer may utilize the reimbursement provisions of Chapter 1.16 of the Cheyenne City Code.

3.2.2 Levels of Study

The following levels of analysis apply.

- a. **Less than 20,000 square feet (sf).** For new, infill, or re-development with a total area of the project site less than 20,000 sf when all phases are complete the Developer shall complete the Drainage Worksheet. Drainage Impact Studies and detention and water quality requirements are waived, except as provided by Subsection e. of this Section.
- b. **Infill or re-development 20,001 sf to 40,000 sf.** A Drainage Impact Study shall be completed and the Water Quality Capture Volume (WQCV) shall be treated in a post-construction BMP. Detention requirements to control the peak discharge are waived, except as provided by Subsection e. of this Section.
- c. **Infill or re-development 40,001 sf to 75,000 sf.** A Drainage Impact Study shall be completed, the WQCV shall be treated in a post-construction BMP, and detention for the 10-year storm shall be provided. Detention requirements to control the 100-year peak discharge are waived, except as provided by Subsection e. of this Section.
- d. **Infill or re-development greater than 75,000 sf or new development greater than 20,000 sf.** A Drainage Impact Study shall be completed and all water quality and detention requirements shall be complied with to the maximum extent feasible.
- e. A waiver may not be available if: 1) the site is located in an area of known drainage problems; 2) the site is located within a floodplain; 3) there is a channel, swale, or other drainage conveyance on the site; or 4) the topography immediately downstream from the site obstructs the run-off in a way that may cause risk to buildings or roadways.

3.2.3 Drainage Design

- a. **General.**
 1. Design shall preserve existing natural features, drainage features and historical flow patterns to the extent they can be incorporated into the site development plan and fit the context and urban design principles for the general area.
 2. Drainage facilities shall be designed and constructed in accordance with accepted engineering practices. Primary resources include the City Construction Specifications, the current adopted City Stormwater Management Manual and the current UDFCD Urban Storm Drainage Criteria Manual (UDFCD Manual).
 3. Provisions shall be made in the planning and development of land to provide for the mitigation of surface water run-off increases due to

development. Mitigation shall be provided to the extent that the peak rate of flow from the project area after development exceeds the specified peak rate of flow prior to development, in accordance with the design standards as established herein.

- (a) The City Engineer is authorized to require a lower allowable discharge rate in specific basins or sub-basins if, in the exercise of professional judgment, a lower allowable discharge rate is required to prevent additional adverse impacts on downstream properties. A lower allowable discharge rate shall be documented in writing and be supported by reproducible engineering calculations, referenced to the Drainage Master Plan.
- (b) An individual development will not be required to provide mitigation, or may provide partial mitigation if it can be demonstrated, subject to City approval, that: (1) the increased volume and rate of runoff caused by a proposed development, when considered in combination with other existing or planned developments or land uses, will not cause the design criteria specified in this Sub-article 3.2 to be exceeded; or (2) the required mitigation is provided in an off-site facility.

4. City rainfall Intensity-Duration-Frequency information is presented in Table 1 and Figure 1.

Duration (Minutes)	Rainfall Intensity (inches per hour)					
	(2 Yr)	(5 Yr)	(10 Yr)	(25 Yr)	(50 Yr)	(100Yr)
5	3.42	4.75	5.70	6.98	8.00	9.07
10	2.64	3.66	4.38	5.40	6.12	6.90
15	2.20	3.04	3.60	4.36	4.96	5.56
30	1.34	1.96	2.42	3.06	3.56	4.12
60 (1 hr.)	0.73	1.10	1.41	1.87	2.27	2.73
120 (2 hr.)	0.41	0.63	0.83	1.16	1.46	1.84
1440 (24 hr.)	0.06	0.08	0.10	0.13	0.15	0.18

Data Source: USGS Water Resources Investigation (WRI) 87-4225 Precipitation Records and Flood-Producing Storms, Cheyenne, Wyoming.

5. Drainage planning and design shall evaluate rainfall event frequencies of a 5-Year, 10-Year, 50-Year, and 100-Year peak runoff. Design rainfall events from drainage master plans, Federal Emergency Management Agency (FEMA) Flood Insurance Studies,

and subsequent references to those documents shall generally be accepted. Engineers, designers and developers should contact the City Engineer for appropriate design parameters early in the planning stages of a project.

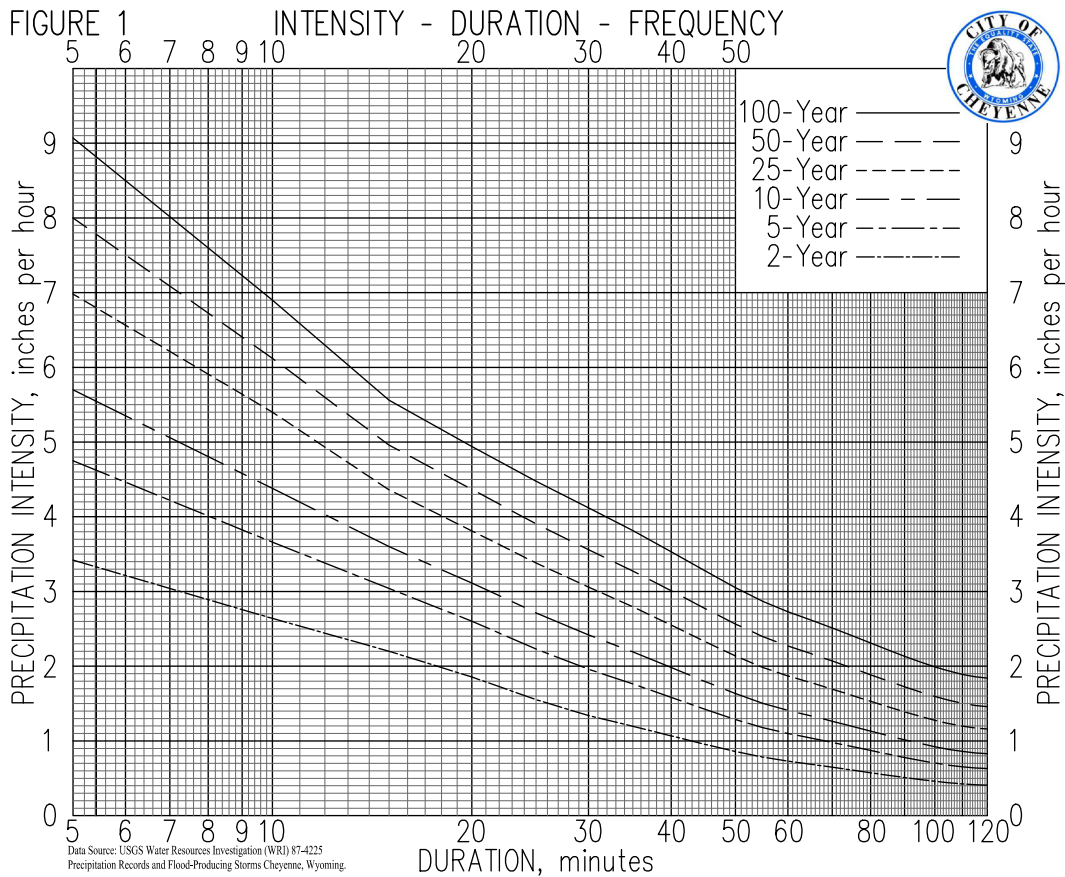
6. Drainage planning shall provide for conveyance from areas upstream of, and within, a project to be sized for a 100-Year frequency storm event.
7. All drainage improvements shall be designed to convey a minimum of the Minor Storm, with provisions for the conveyance of the Major Storm as outlined in Table 2 below:

Zoning District/Land Use	Minor	Major
Parks/Open Public Lands	2-Year	100-Year
Agricultural/Rural Residential	5-Year	100-Year
Urban Residential	5-Year	100-Year
Commercial	10-Year	100-Year
Industrial	10-Year	100-Year

8. Drainage facilities shall be designed to minimize mosquito breeding.
9. Potential impacts of groundwater or sub-surface water shall be quantified, to the extent possible, and considered during drainage planning and design.
10. The developer shall be responsible for obtaining approvals for new bridges and large span culverts from the Wyoming Department of Transportation.
11. To ensure proper construction, maintenance, and access to the drainage system, drainage easements shall be provided in all areas traversed by channels, storm sewers and detention or storage areas.
12. Existing stormwater management facilities on redevelopment sites are not required to be retrofitted to meet the current design standards if the existing facilities remain hydraulically isolated from the redevelopment area.
13. The City encourages the use of LID principles.

b. **Design Criteria and Parameters.**

1. Storm Sewers
 - (a) Storm sewers shall not be designed to surcharge in the minor storm (surcharge is a depth of flow greater than 80 percent of the height). The maximum hydraulic head shall be 0.5 feet below the lip of drop inlets for the minor storm.



Hydraulic grade lines (HGLs) shall be shown on design profiles.

- (b) Minimum velocity is 3 feet per second (fps) at 25 percent of height. Maximum velocity is 18 fps, or in accordance with manufacturer specifications.
- (c) Manholes shall be placed at junctions, or wherever there is a change in size, direction, or grade. Maximum spacing is 350 feet.
- (d) Minimum clearance between adjacent pipes within manholes or inlets is 12 inches (measured outside to outside).
- (e) All conduits 54" and greater shall have headwalls and wingwalls. Smaller conduits shall have headwalls and wingwalls or flared-end sections. Flared-end sections shall require joint fasteners and toe walls extending 3 feet below the invert.
- (f) Headwalls and wingwalls shall have guardrails, handrails, or fencing in conformance with local building codes and roadway safety requirements. Handrails shall be required in areas frequented by pedestrians or bicycles. Handrail heights shall be

42 inches for pedestrian walkways or open areas, and 54 inches for bicycle traffic.

- (g) Maximum headwater depth is 1.5 times the storm sewer height for the design storm ($HW/D = 1.5$). This criteria does not apply to stormwater detention pond outlets.
- (h) Storm sewer flows exceeding 5 fps velocity or 5 feet of depth shall provide outlet protection. Outlets shall be protected with riprap, concrete or a stilling basin in accordance with the UDFCD Manual.
- (i) Storm sewers and appurtenant structures within anticipated drive areas shall be designed to withstand HS-20 loading.

2. Channels

The following criteria apply to proposed channels with a 100-year discharge exceeding 100 cfs.

- (a) Channels shall be designed for the 100-year flood assuming a fully developed watershed, with freeboard of 1.0 foot. The freeboard is measured vertically from the design water surface elevation

to the top of bank. Freeboard requirements do not apply to swales designed in accordance with the UDFCD Manual.

- (b) Grass-lined channels are desirable. A low-flow channel with a minimum capacity of 1/3 the 2-year flood shall be provided. Low-flow channel requirements do not apply to swales designed in accordance with the UDFCD Manual.
 - (c) Maximum velocities are 5 fps for erosive soils and 7 fps for non-erosive soils.
 - (d) The centerline radius shall be a minimum of 2 times the 100-year flood topwidth.
 - (e) Bank slopes a minimum of 4:1 (horizontal to vertical) are desirable; steeper slopes require review and approval. Riprap bank protection is required for bank slopes steeper than 4:1 and to stabilize channels along the outside of bends. Riprap bank protection shall consist of soil riprap, buried with 6 inches of topsoil and revegetated. Riprap bank protection shall extend to the depth of the 2-year flood, or as approved by the City Engineer.
 - (f) A 15 foot maintenance access shall be provided along one side, adjacent to the top. Maintenance access requirements do not apply to swales designed in accordance with the UDFCD Manual.
3. Detention
- (a) Detention of stormwater shall be based on the more restrictive of: 1) no increases in peak discharge rates; 2) 100-year post-project peak rate no greater than the 50-year pre-project peak rate; 3) the downstream conveyance capacity of a project; or 4) as provided for in Section 3.2.3.a.3(a). Drainage facilities shall be designed to, at a minimum, not adversely impact downstream properties. Proposals to increase downstream conveyance capacity of an area may be considered in-lieu of over-detention on a project, with justification.
 - (b) Drainage planning shall not include the use of right-of-way or road embankments as detention storage areas unless approved by the City Engineer.
 - (c) Drainage planning and design shall provide for stormwater detention based on a design storm up to a 100-Year frequency. The design shall maintain post-development runoff rates to pre-development rates for return periods up

to the 50-year frequency. The 100-year post-development rate shall be held to the 50-year pre-development rate, or as provided for in Section 3.2.3.a.3(a).

- (d) The 10-year peak discharge and volume for infill or re-development project sites of 40,001 sf to 75,000 sf shall be based on the following equations:

$$Q_{10} = \text{Area} * 0.23$$

$$\text{Volume}_{10} = \text{Area} * [(0.95 * I - 1.90) / 1000]$$

where

Area is the project area, in acres

I is the project imperviousness, in percent

Q₁₀ is the allowable 10-year peak release rate, in cfs

Volume₁₀ is the 10-year detention volume, in acre-feet

- (e) A waiver for any detention storage requirements shall include all information necessary to substantiate the detention waiver request.
- (f) Minimum longitudinal slopes are 0.5 percent for concrete and 2 percent for grass. Minimum cross slope is 2 percent. Detention facilities designed with underdrains may reduce the longitudinal and cross slopes to 1 percent.
- (g) Outlet structures shall be functional for controlling the design release rates, provided with oversized safety/debris grates to reduce the potential for debris plugging, to promote ease of maintenance, and designed with favorable aesthetics. Grate sizing shall be in accordance with the UDFCD Manual.
- (h) Embankments shall be no steeper than 4:1 below the 100-year water surface elevation and no steeper than 3:1 above the 100-year water surface elevation. Embankment top width shall be 40 percent of the maximum dam height plus 4 feet, consistent across the entire dam. Earthen slopes shall be covered with 6 inches of topsoil and vegetated.
- (i) Emergency spillways shall be included in the design planning for detention facilities. The emergency overflow spillway shall be sized to convey the 100-year inflow peak. Spillway design velocities exceeding 5 fps shall require buried soil riprap.
- (j) A 15 foot maintenance access with an 8 foot all weather surface shall be provided as needed to

assure access to all pond components.

- (k) Retaining walls within ponds are generally discouraged.
- (l) Two signs, with a minimum area of 3 sf shall be provided. The signs shall be fabricated using red lettering on a white background with the following message:

WARNING

THIS AREA IS A STORMWATER FACILITY
AND IS SUBJECT TO PERIODIC FLOODING

- (m) Parking lot detention criteria include:
 - (1) The maximum allowable design depth above pavement surfaces is 3 inches for the water quality volume, and 9 inches for the 100-year flood.
 - (2) All parking lot detention areas shall have a minimum of two signs posted identifying the detention pond area. The signs shall have a minimum area of 1.5 sf and contain the following message:

WARNING

THIS AREA IS A DETENTION POND AND
IS SUBJECT TO PERIODIC FLOODING
TO A DEPTH OF 9 INCHES OR MORE

- (n) Detention certification is required prior to occupancy, and includes at a minimum:
 - (1) The volume at the design elevation;
 - (2) Size and elevations of the inflow and outflow structures;
 - (3) Spillway and top of dam elevations;
 - (4) Size and elevations of other structures, if applicable; and
 - (5) Embankment compaction meets or exceeds the requirements of Section 2210 of the City of Cheyenne Construction Specifications.
- 4. Water Quality
 - (a) Construction projects meeting any of the following criteria are required to submit for review and approval 1 copy (signed) of the applicable Construction Activity WyPDES Permit and 1 copy of the SWPPP in conjunction with the grading permit application pursuant to Title 15 of City Code:
 - (1) Any project required to submit site construction plans to the City for review and approval, excluding building permit plans;
 - (2) Any project that disturbs 1.0 acre or more;

- (3) Installation or repair of utility lines in excess of 1000 linear feet (outside of the City Right-of-Way);
 - (4) Installation of utilities for a new development exceeding one single-family residence and appurtenant structures, prior to the start of overlot clearing or grading;
 - (5) Any clearing, grubbing, grading or filling operations located within 100 feet of a major drainageway or designated flood hazard area;
 - (6) Fill or excavation of 50 or more cubic yards of material, not related to building of a detached single family residential unit;
 - (7) Any building demolition project; or
 - (8) Any project that the City Engineer determines to have a potential impact to the health, safety and welfare of people or the environment.
- (b) Post-construction BMPs are required to treat a minimum of the WQCV as defined in the UDFCD Manual. The WQCV shall be added to the detention volumes up to the 50-year, and may be incorporated within the 100-year detention volume.
 - (c) Reducing Directly Connected Impervious Area (DCIA) is required. At least 20 percent of the upstream impervious area shall be disconnected and drain through a receiving pervious area comprised of at least 10 percent of the upstream disconnected impervious area. The receiving pervious area shall consist of some combination of grass buffers, swales or porous pavement, designed in accordance with the UDFCD Manual.
 - (d) Exemptions from Post-Construction BMP Requirements may be granted for: 1) Single-family residential lots with a disturbed area less than 0.5 acres, not part of a larger subdivision; 2) Projects with a total imperviousness less than 10 percent for any given acre; 3) Roadway improvement projects that add less than 1.0 acre of new pavement; 4) Subwatershed areas less than 0.5 acre draining off a site; or 5) Other projects determined by the City to have negligible effect on stormwater quality.
5. Roads
 - (a) General. New culverts shall not impound runoff to cause inundation of surrounding properties

unless associated with a designed stormwater detention facility. Crossings in floodplains shall meet the City Floodplain and Surface Water Management Regulations and FEMA National Flood Insurance Program requirements. The major storm shall be contained within the public right-of-way or easements.

(b) Urban

(1) Local Street Storm Sewer/Street Networks:
Minor Storm – No curb overtopping. Maximum depth of 6” in cross pans.

Major Storm – Maximum depth 12” above gutter flowline.

(2) Collector/Minor Arterial Street Storm Sewer/Street Networks:

Minor Storm – No curb overtopping and one 10 foot interior drive lane clear of spread. Maximum depth of 6” in cross pans, where allowed.

Major Storm – Maximum depth 12” above gutter flowline. Maximum depth of 12” at cross street intersections.

(3) Major Arterial Street Storm Sewer/Street Networks:

Minor Storm – No curb overtopping and two 10 foot interior drive lanes clear of spread. No cross street flows allowed.

Major Storm – Maximum depth 12” above gutter flowline. Maximum depth of 6” at cross street intersections.

(c) Rural

(1) Public Roads: Culverts - Minor Storm;
Roadside ditches - Major Storm.

(2) Drainage Channels or Swales (Major Storm within easement).

6. Easements. Permanent drainage easements shall be provided in any scenario whereby drainage from one property must cross another property prior to entering the public drainage system. Permanent drainage easements shall also be provided in all areas traversed by a creek, channel, public storm sewer or storage area. Easements shall be accessible from the public right-of-way and shall be useable for maintenance vehicles. Drainage easements shall be shown in the drainage impact study, and platted, dedicated, established by affidavit or otherwise recorded prior to the issuance of a Certificate of Occupancy. Drainage easements shall be kept clear

of impediments to the flow.

(a) Storm Sewers

Table 3: Minimum Acceptable Storm Sewer Easement Widths	
Pipe Size	Easement Width
Less than 36-inch diameter	25 feet *
36-inch diameter and larger	30 feet *

* Or as required to meet Occupational Safety and Health Administration (OSHA) and construction requirements

- (1) When relatively large diameter pipes are proposed or when design depths are excessive, greater easement widths will be required, as determined by the City Engineer.
- (2) The pipe shall be constructed at one-third of the easement width to allow for stockpiling of material on one side of the storm sewer trench.
- (3) Storm sewer easements should be designed to convey above ground flows in the event the storm sewer or inlet becomes clogged or full. It is therefore necessary to limit uses within the easement to ensure that surface conveyance redundancy and maintenance access is not impaired. Minor landscaping, such as rock or shrubs, may be appropriate where it can be demonstrated that the function of the easement is not compromised by the presence of the materials. Pavement over a storm sewer easement is allowable, providing the property owner assumes responsibility for replacement in the event it is necessary to remove it to access the pipe. Improvements that are not allowed on storm sewer easements include structures of any kind, retaining walls, permanent fencing, trees and other objects if determined by the City to be inconsistent with the design intent of the easement or costly to replace. Surface treatments on drainage easements shall be shown in the drainage impact study, and accepted by the City.
- (4) Storm sewer easements shall not be required for pipes collecting and transporting water solely within a single parcel.

(b) Channels

- (1) To ensure that drainageways and the associated conveyances are adequately preserved and properly maintained, all drainageways that convey flows from other properties should be placed on tracts of land owned by a public entity (e.g. special district, City, or other regional agency), by a homeowner's association, or by approval by the City Engineer. Easements are allowed for drainage swales between individual lots.
- (2) Required easement widths for natural drainageways need to provide for conveyance of design flow rates, required freeboard, and access for maintenance. Any banks allowed to remain in place at a slope steeper than 4 to 1 shall have the easement line set back from the top of the bank to allow for some lateral movement or future grading improvements to the bank. The easement line shall be no closer than the intersection of a 4 to 1 line extending from the toe of the slope to the proposed grade at the top of the bank, plus an additional width of 15 feet for an access bench, if access is not feasible within the floodplain.
- (c) Ponds. The minimum easement requirements for detention basins are as required to contain storage and WQCV including freeboard, associated facilities, and adequate maintenance access around the perimeter.

c. **Special Flood Hazards.** The drainage requirements and regulations for the development of land located in and adjacent to permanent or periodic streams subject to flooding, and identified and designated as potential flood areas by FEMA, or the City's Special Flood Hazard Area map, shall also be in accordance with Chapter 13.24 of the Cheyenne City Code – FLOODPLAIN AND SURFACE WATER MANAGEMENT.

d. **Alternative Compliance Measures.** The developer may propose and the City Engineer may approve alternative compliance measures. Alternative compliance measures include new technologies, overall system improvements, innovative procedures, and new materials. It shall be the developer's responsibility to demonstrate that alternative compliance measures meet these criteria and meet the Purposes of this Sub-article 3.2. The review of alternative compliance measures shall be based upon:

1. Whether the alternative compliance proposed is part of a plan to improve stormwater management on a larger scale beyond the immediate site.
 2. The extent that alternative site design strategies construct all or a portion of the larger-scale improvements in the chain of treatment and comply with this Sub-article 3.2 standards to the fullest extent possible.
 3. Data and calculations, studies, industry publications, or additional evidence such as successful use in other jurisdictions to demonstrate any of these criteria.
- e. **Exceptions.** Where, due to the physical limitations of the project site, topography or ground slopes, soil or rock conditions or other physical or context limitations, meeting the mitigation Standards and Design Criteria is not feasible, the City Engineer may grant exceptions to the standards. Review of requested exceptions shall be based upon:
1. Whether the situation giving rise to the requested exception is due to the developer's actions.
 2. Whether the alternative compliance proposed will cause temporary or permanent harm to offsite properties.
 3. Whether the requested exception complies with this Sub-article 3.2 to the fullest extent possible.

The City may condition any exception in any way that ensures the above criteria are met, including participation in the funding of any off-site improvements, the formation of a local improvement district, or other stormwater master planning strategies and facilities that ensure the Purposes of this Sub-article 3.2 are met.

3.2.4 Study Reports

The primary purpose of a drainage impact study is to identify drainage related issues and outline a plan to mitigate all potential negative impacts resulting from the proposed development action. Developers and design representatives are encouraged to contact the City Engineer early in the design process to discuss drainage related issues and potential mitigation alternatives.

Final drainage reports will be valid for two years from the date of City Engineer's approval. If construction drawings have not been developed and accepted by the City Engineer within two years, the final drainage report must be submitted for re-

acceptance. Review and re-acceptance will be based upon any new criteria or standards adopted since the drainage report was initially accepted.

a. General Requirements.

1. A cover sheet with project name and location, type of report (Conceptual, Preliminary, or Final), name of firm or agency preparing the report, date of the report, table of contents, and page numbers.
2. A certification sheet with the following statement, and appropriate signatures:

"I hereby attest that this report for the (Conceptual, Preliminary or Final) drainage design of (Name of Development) was prepared by me, or under my direct supervision, in accordance with the provisions of City of Cheyenne Unified Development Code for the responsible parties thereof. I understand that the City of Cheyenne does not and shall not assume liability for drainage facilities designed by others."

Registered Professional Engineer

State of Wyoming No. _____ (Affic Seal)

3. A vicinity map (if not included with a plat map) along with applicable addresses, Township, Range, and Sections and Quarter (1/4) Sections. Identify adjacent existing and proposed streets and subdivision names.
4. Discussion of the major drainage basin and subbasins, if applicable.
5. Discussion of the existing property and adjacent rights-of-way impacted by the project and predevelopment drainage characteristics. This shall include identifying current floodplain and flood hazard areas.
6. Discussion of any upstream properties and existing upstream drainage characteristics.
7. Discussion of existing conveyance downstream of project to nearest major drainageway. This shall include identifying potential downstream conveyance and capacity issues.
8. Discussion of proposed stormwater management plan to mitigate post-development drainage impacts. This shall include outlining a plan to maintain conveyance from upstream projects and proposed stormwater detention systems on the site.

9. Other items of discussion may be included to provide additional background information or substantiate the proposed drainage plan.
10. For projects anticipated to be sold off for future development by others, the conceptual drainage report shall outline a conceptual drainage plan (anticipated surface and storm drain conveyances along with detention requirements) for the entire development. This shall include accounting for all initially anticipated improvements.
11. An overall drainage plan map is required for projects larger than 2 acres or at the request of the City Engineer. Drainage map(s) shall be a minimum of 11" x 17" in size with a scale of 1"=20' to 1"=100' as required to show sufficient detail. The overall drainage plan map(s) shall include the following:
 - (a) Outline of upstream area including existing and proposed inflow points;
 - (b) Outline of overall project area, including property lines, street rights-of-way, and all easements;
 - (c) Outline of downstream conveyance path to nearest major drainageway;
 - (d) Outline of proposed drainage features;
 - (e) Existing and proposed drainage patterns. Contours shall be at 2 foot intervals unless otherwise approved by the City Engineer, with proposed elevations sufficient to analyze drainage patterns extending 100 feet beyond property limits. Contour elevations shall be referenced to USGS vertical datum where contours are taken from USGS maps, or referenced to the most current aerial mapping of the City and County. Locate and label all drainage basins, sub-basins and floodplains;
 - (f) Proposed outfall location of point discharges and ultimate receiving drainageway.
12. References to master plans or other relevant local studies shall be included in the conceptual report narrative.
13. For hydrology computations, include and clearly identify the following, if applicable:
 - (a) Any computer modeling software and version used with an analysis;
 - (b) Precipitation/runoff methodology/model used for analysis on the project (i.e. Rational Method, Kinematic Wave, SCS Unit Hydrograph, EPA SWMM, CUHP, etc.). Rational Method may be used for tributary acres of 30 acres or less;

- (c) Rainfall data or design storm source references;
 - (d) Rainfall loss method (i.e. runoff coefficient(s), curve number, Horton, Green-Ampt, etc.) and input parameters;
 - (e) All other input parameters and calculations (area, timing, connectivity, rating curves, etc.);
 - (f) Summarized results with complete computer modeling (hard copy and digital).
14. For hydraulic computations, include and clearly identify the following, if applicable:
- (a) Any computer modeling software and version used with an analysis;
 - (b) Parameters (materials, lengths, size, roughness, rating curves, etc.);
 - (c) Summarized results with complete computer modeling (hard copy and digital).
15. Geotechnical investigations and reports are required.
- b. **Conceptual Plan.** Conceptual drainage reports are primarily for development projects which are being developed before or during a preliminary plat or preliminary development plan stage and anticipated to evolve into final drainage plans with future development action submittals. The intent of the Conceptual Drainage Report is to outline drainage planning for the project in narrative and visual format for review by the City Engineer prior to preparing more detailed studies and designs. The conceptual report shall include all the above general requirements.
- c. **Preliminary Plan.** Preliminary drainage reports are primarily for projects which are being developed before or during a final plat or final development plan stage. The Preliminary Drainage Report is an intermediate drainage planning report to provide sufficient detail required for projects anticipated to evolve into future construction plans or site plans. The intent of the Preliminary Drainage Report is to finalize drainage planning for the project in narrative, visual, and computational format for review by the City Engineer. For large development or multi-stage, multi-lot projects, the preliminary drainage plan shall serve as a reference document for future drainage planning when improvements are not fully completed by the developer requesting the development action.

The Preliminary Drainage Report shall contain the following information:

1. All the above general requirements as provided in Subsection a., of this Section.
2. Overall drainage map and plans with increased detail.
3. Detailed runoff computations from the pre-development area (on-site, upstream).
4. Detailed computations on existing downstream conveyance systems to be utilized with the project.
5. Preliminary computations on proposed street and drainage conveyance systems.
6. Preliminary computations on proposed detention systems and outlet controls, including time of total evacuation. Volume computations shall include a detention systems storage volume in cubic feet or acre-feet and the proposed volume in terms of inches of storage for gross tributary area. For areas being platted specific for detention, the preliminary design of the detention facility shall be included showing preliminary design contours.
7. Computations and computer modeling results to substantiate findings and recommendations.
8. For projects being approved without final details such as a Final Plat, a letter shall be submitted with the drainage report which includes the following:

"<Name of Developer/Property Owner> hereby acknowledges that the stormwater management planning outlined in <drainage report title & date> was prepared for <development action> without final design details or construction plans. I understand that acknowledgement of receipt of this drainage plan by the City of Cheyenne does not constitute any formal endorsement of a final drainage plan until final designs and details can be reviewed and approved. I also acknowledge that future final drainage design reports and details shall be required by the City prior to construction or acceptance of drainage facilities for the < subdivision or project name>."

<Developer/Property Owner>

Authorized Agent

Date

- d. **Final Plan.** Final drainage reports are primarily for projects in the Construction Plan or Site Plan review state. The intent of the Final Drainage Report is to outline final drainage design details for review by the City Engineer. The Final Drainage Report shall include all information to

substantiate the final design. If no substantial changes are required to a Preliminary Drainage Report, the Final Drainage Report may be submitted as an amendment to the Preliminary Drainage Report. Final Drainage Reports shall be submitted to the City Engineer's Office in digital format.

The Final Drainage Report shall contain the following information:

1. All requirements of the Preliminary Drainage Report, with the exception that final design computations shall be included for all proposed drainage facilities.
2. Detailed Drainage, Grading and Site Plans including finalized:
 - (a) Proposed storm sewer improvements locations and all details;
 - (b) Proposed channel improvements with typical cross-sections and major flow limits;
 - (c) Proposed culvert locations and all details;
 - (d) Permanent drainage easements.
3. Comparison tables and graphs of pre-development and post-development runoff rates for major and minor storms events.
4. Detention area(s) summary table(s) and curve(s) showing the following:
 - (a) Stage vs. Area;
 - (b) Stage vs. Volume;
 - (c) Stage vs. Discharge (or outflow).
5. The report shall include the following certification:

"I, <Name of Developer/Property Owner> hereby certify that the drainage facilities <name of development> shall be constructed according to the design presented in this report. I understand that the City of Cheyenne does not and will not assume liability for the drainage facilities designed and certified by my engineer. I understand that the City of Cheyenne reviews drainage plans but cannot, on behalf of <Name of Developer/Property Owner>, guarantee that final drainage design review will absolve <Name of Developer/Property Owner> or their successors or assigns, of future liability for improper design. I further understand that approval of the <Final Plat or Final Site Plan> does not imply approval of my engineer's drainage design.

<Developer/Property Owner>

Authorized Agent

Date

3.2.5 Final Acceptance of Drainage Improvements

A request for final acceptance of drainage improvements shall be made to the City Engineer. Final acceptance requires the submittal of construction drawings clearly labeled as "Record Drawings", "As-built Drawings", or "As-Constructed Drawings". The drawings shall be made by a Wyoming Licensed Professional Engineer or Professional Land Surveyor and include the following notation:

"I hereby attest that the installed drainage facilities as shown on <construction plan name, date> have been constructed in accordance with the approved drainage design for the <name of development>. The stormwater drainage facilities installed at this location conform to the approved design plans. Stormwater detention facilities constructed for this project facility meet or exceed storage volumes requirements outlined in the <Final Drainage Report> dated <date of final report> by <firm preparing Final Drainage Report>. Detention pond volumes for <name of detention facility or number> is <volume>. Deviations from the approved plan include <outline list of changes >."

Registered Professional Engineer/Land Surveyor
State of Wyoming No. _____ (Affix Seal)
<Date>

3.2.6 Maintenance

- a. **Private Maintenance.** All components of the drainage system constructed on private property shall be maintained by the property owner or a representative of the owner. Maintenance responsibilities shall be defined on final plats and site/construction plans. Such maintenance shall include periodic cleaning, weed and grass cutting, repairs to pipe and underground structures and all else which is reasonably expected of a publicly owned and operated utility system.

In the event the owner fails to inspect, report, or properly

maintain the system within 30 days after written notice by the City to the owner of such deficiencies, the City may enter upon the property and take whatever steps it deems necessary to maintain or repair the system and bill the owner for such expense. However, if the owner's failure to properly maintain the system could cause damage to property, loss of life or a violation of a NPDES MS4 Permit, the City may take immediate action, without notice to the owner, to maintain or repair the Facilities.

It is expressly understood and agreed that the City is under no obligation to maintain or repair the system.

- b. **Public Maintenance.** The City shall maintain those components of drainage systems that are constructed within the City right-of-way or on land owned by the City. The City shall maintain components of drainage facilities located on private property in areas within drainage easements only when said systems are constructed to manage stormwater for a broad area that extends beyond the confines of the property where the facility is located and only when said systems have been formally accepted for public maintenance pursuant to a written instrument executed by the Mayor or other authorized official of the City.

3.2.7 Grading and Erosion Control Permit [Reserved]

3.3 [RESERVED]