Storm Drain Design Criteria

The current city design standards for the storm drain system is vague and lacks specifics on design methodology and criteria.

Current city Development & Construction Standards (Updated July 2010):

02.08.080. Drainage.

The developer shall install a storm water drainage system pursuant to standards recommended by the town engineer or his/her designee. Potential groundwater of subsurface drainage problems may require additional requirements; further requirements will be reviewed and approved by the town engineer or his/her designee. Pumping of groundwater across sidewalks or into gutters will not be allowed.

Chapter 02.23. Storm Drains.

02.23.010. General.

These specifications will cover the installation of storm drains. Excavation and backfill of trenches is covered in Section 02.16. All developments will be responsible to provide a storm drain system on-site in the development that will contain a 25-year storm event. The maximum allowable storm water discharge from any development will be limited to .2 cfs/acre of development. In the event that any storm water will be discharged beyond the current town boundaries, the development will be responsible to provide a storm drain system on-site that will contain a 100 year storm event. All storm drain pipes shall have a minimum cover of two (2) feet.

Why does this matter? Because with no specific criteria a developer could easily manipulate the results to require far less detention/retention for their project. An example is shown below for a 100-year storm. All of these methods are acceptable hydrology methods that technically meet Elk Ridge's current requirements.

Storm	Peak Flow (cfs)	Runoff Volume (ac-ft)
100Yr 24Hr Storm (SCS Type II Distribution)	23.3	2.6
100Yr 6Hr Storm (NOAA 1st Quartile Distribution)	5.1	1.2
100Yr 1Hr Storm (NOAA Frequency Distribution)	11.8	0.6

The top scenario is the one we recommend and is typically used by most municipalities. Attached are example requirements we recently put together for Lake Point city that creates a standard methodology and reporting requirement.

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MEMORANDUM

DATE: January 9, 2024
TO: Lake Point City
FROM: Jones and DeMille Engineering
PROJECT: Lake Point Stormwater Drainage Design Criteria
PROJECT NO: 2301-058
RE: Stormwater Drainage Design Criteria

Introduction

The following design standards apply to the design of all stormwater and floodplain improvements for areas within Lake Point City (the City). All hydrologic and hydraulic evaluations and designs for a proposed commercial or industrial site or multi-house development shall be performed in accordance with sound and accepted engineering practices by a professional engineer, licensed in the State of Utah and qualified to perform such work. The overarching objective of this guidance is to:

- Eliminate increased peak runoff which naturally occurs with development due to an increase in impervious surfaces (i.e., do not increase downstream flows from pre-development or existing/natural conditions).
- Implement site-specific solutions for conveyance and detention/retention as required to maintain pre-development flows, thus not creating downstream flooding issues.
- Formalize the process for the design and review of stormwater calculations, designs, etc. between developers and the City.

To this end, the stormwater system design guidelines are provided as outlined below:

1. General Design Criteria
2. Methodology
3. Low Impact Development Guidelines
4. Conveyance Facilities
5. Storage Facilities
6. Other Related Permits
7. Drainage Report

1. General Design Criteria

- The overall storm drainage system must be designed to ensure the downstream total peak flowrate does not increase with additional runoff created by the proposed site or development; or in other words, the downstream post-development peak flowrate must be equal to or less

than the downstream pre-development peak flowrate for the 10-year 24-hour and 100-year 24-hour storm events.

- The capacity of downstream infrastructure should be considered. If the downstream conveyance capacity is insufficient, the developer should work with the City to develop a design that reduces flows sufficient to meet downstream capacities (possibly reducing flows less than the pre-development conditions).
- The stormwater drainage analysis and proposed system should consider on-site and off-site flows. This includes drainage areas upstream of the project site, which drain onto and through the project site. Conveyance and/or storage facilities should be sized to accommodate predicted site drainage as well as historic off-site drainage. Storage facilities do not need to store or retain off-site drainage but must be able to safely pass off-site drainage without affecting the storage of on-site drainage.
- Components of the storm drainage system shall be sized based on the design frequency in the table below:

Facility Type	Design Storm	Description
Minor Conveyance	10-year	Facilities which convey on-site flows only, such as culverts, drainage swales, pipelines, channels. Minor conveyance facilities drain to major conveyance and storage facilities.
Major Conveyance	100-year	Facilities which convey off-site and on-site flows (mixed water) including culverts, pipelines, and channels.
Storage Facilities	100-year	All storage facilities are to be designed for the 100-year storm even if they only store on-site flows. Storage facilities are not required to store or retain off-site drainage as long as the storage facility discharge does not exceed pre-development levels.

- Existing commercial, industrial or residential properties may be evaluated on an individual basis if improvements required by these guidelines would adversely impacting neighboring properties.

2. Methodology

- Hydrology calculations which require the peak flowrate and volume shall follow the SCS method as outlined in the NRCS National Engineering Handbook.
- The rational method can be used if only the peak flowrate is needed (only conveyance features are required such as culverts and channels).
- Precipitation data shall be obtained from NOAA Atlas 14.
- A minimum time of concentration of 5 minutes shall be used.

3. Low Impact Development Guidelines

Typical storm drain design consists of collect and convey systems to route runoff through and away from developed areas. Low Impact Development (LID) practices utilize storm drain infrastructure to collect, clean, and infiltrate runoff. There are many benefits to LID practices including reducing downstream discharge, groundwater recharge, reduced pollutants, and infrastructure cost savings.

All new developments implement LID design practices to the greatest extent possible, where feasible. "A Guide to Low Impact Development within Utah" which was published by the Utah Department of Environmental Quality should be used as a resource to design LID techniques within new development areas. This manual as well as other LID design resources can be downloaded from the following website.

https://deq.utah.gov/water-quality/low-impact-development

All site and subdivision designs shall control the peak flow rates of storm water discharge associated with design storms specified in this chapter and reduce the generation of post-construction storm water runoff volumes and water quality to pre-construction levels. These practices should seek to utilize pervious areas for storm water treatment and to infiltrate storm water runoff from driveways, sidewalks, rooftops, parking lots, and landscaped areas to the maximum extent practical to provide treatment for both water quality and quantity. Other LID methods are also encouraged.

The 80th percentile storm volume shall be retained on site. Areas with high groundwater or poor soil may be exempt from this requirement due to poor infiltration rates. Evidence supporting claims of poor infiltration such as soils testing or infiltration testing shall be submitted for developments where retention of the 80^{th} percentile storm is unfeasible.

Field testing with a single ring infiltrometer is required to confirm adequate infiltration in all basins where infiltration will be used. A supporting report shall be stamped by a licensed geotechnical engineer and submitted as part of the drainage report.

4. Conveyance Facilities

All conveyance facilities should be designed to carry the design storms listed in the General Design Criteria section. Special criteria for conveyance facilities are as follows:

- The minimum size of all culverts and storm drainage pipe diameter is 18 inches to allow for maintenance such as cleaning. This includes driveway culverts.
- All culverts are to be constructed with an intake apron, for City maintained culverts (under city roadways) a trash grate is required.
- Main drain lines connecting manholes are to be reinforced concrete pipe class III.
- Conveyance systems should be evaluated for scour and erosion.
- Piped conveyance systems should be designed to maintain minimum velocities of 2 feet per second, to allow for flushing of debris and sediment. Open channel conveyance systems should

be designed to not exceed a peak velocity of 5 feet per second to avoid scour and erosion. Special cases not meeting this requirement must be approved by the city.

- Manholes are required every 400 feet for storm drainage pipelines, and at changes in grade or direction.
- Minimum manhole diameters shall follow the following minimum requirements:
    - Four (4) foot minimum manhole diameter for main lines less than 18 inches in diameter
    - Five (5) foot minimum manhole diameter for main lines 18" to 30" in diameter.
    - Six (6) foot minimum manhole diameter for main lines greater than 30" in diameter
    - The minimum structural leg width (6" minimum) between pipe core holes must be maintained when multiple pipes intersect a manhole.
- Use of curb and gutter is prohibited unless approved by the City. Drainage swales within street right-of-way are required for roadside drainage. Swales must be sized to convey the site conditions, having a minimum of 18-inch depth with max side slope of 2:1 (See Lake Point Standard Detail SD-02 – Swale Detail).
- Preserve and protect natural flood water conveyance corridors and channels in easements dedicated to the City and with improvements where necessary.
- Drainage ways that allow infiltration in minor storm events are encouraged.

5. Storage Facilities

All storage facilities should be designed based on the design storms listed in the General Design Criteria section. Storage facilities can be either retention (stores 100% of flow with no release) or detention (temporarily stores flows and releases at controlled rate) facilities. Special criteria for storage facilities are as follows:

- Post-developed discharge rates shall not exceed pre-developed discharge rates for the 10-year and 100-year storms. Check both storms and design/size detention pond outlet structures accordingly. In no case shall the storm drain discharge from a development or site exceed 0.20 cfs/acre for on-site runoff. LID practices as described in Section 3 above shall be implemented.
- Retention ponds must be sized to capture and contain the entire 100-year event.
- For detention basins, the entire 100-year storm shall be routed through the principal outlet without activating the emergency spillway. This is typically accomplished with a grate at the top of the outlet structure. The routed 100-year water surface is typically set at the emergency spillway crest elevation.
- All storage facilities shall be designed to completely drain within 3 days of the end of a storm event (retention facilities must be designed to infiltrate in this time, field testing with a single ring infiltrometer is required to confirm adequate infiltration).
- Detention basin principal outlet pipes shall be at least 18-inches in diameter to minimize the chance of clogging and to facilitate cleaning. Orifice plates are to be used on the upstream end of the principal outlet pipe to reduce the maximum release flowrate and must be inside a storm drain box to facilitate cleaning.
- Emergency spillways shall be designed to safely pass the 100-year storm, without endangering life or property downstream, assuming the principal spillway outlet is not functioning.

- A minimum of 1 foot of freeboard above the emergency spillway design water surface elevation is required (routed 100-year storm assuming principal spillway outlet is clogged).
- The invert or lowest point of a storage basin must be 12-inches above groundwater levels.
- All storage facility slopes shall have a maximum slope of 3:1 and must be stabilized with rock or planted vegetation to prevent erosion.
- No part of the bottom of the basin shall have a slope of less than 3% sloped toward the outlet. Within 10-feet of the outlet, the slope of the basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet. In this case, the minimum slope for the concrete apron shall be 0.50%.
- Storage basins should be designed with a maximum water depth of 3 feet. Deeper basin may be permitted as approved by the city but will require at minimum a two-rail perimeter fence.
- Underground systems are not allowed in drinking water source protection zones.
- Underground systems shall provide adequate access for cleaning and maintenance.
- If the detention basin is classified as a dam, the facility shall also comply with prevailing dam safety standards as outlined by the Utah State Dam Safety and the Utah Division of Water Rights. See applicable design standards to determine if the pond should be classified as a dam.

6. Other Related Permits

Other permits may be required for the proposed development. These permits should be considered as part of the proposed drainage system and be referenced in the documentation. Applicable permits may include:

- Stream Alternation Permit
- Floodplain Development Permit (if in FEMA designated floodplain)
- Small Dam Application (assuming pond is classified as a dam per Utah Dam Safety)

This list is not exhaustive. Additional permitting may be identified and required during the approval process.

7. Drainage Report

All proposed developments are required to submit a drainage report for the Cities review and approval. The report is to include enough detail to provide assurance that the development will control stormwater drainage in a safe manner, and not pose a flood risk to residents downstream or within the development. The following information is required at a minimum:

- Drainage Report Outline
    - Introduction
    - References
    - General property description
        - Include known flooding issues
    - Off-site and on-site drainage description

- Include relevant downstream conveyance facilities
- Design runoff computations
  - Map of drainage basins delineated
  - Precipitation
  - Land cover and soil conditions
  - Runoff curve number and/or rational method coefficient
  - Time of concentration
  - Hydrology model results for all drainage basins comparing pre-development and post-development peak flows and volumes, considering on-site and off-site areas
- Design of drainage facilities
  - All hydraulic and hydrologic calculations used to design conveyance facilities
  - All hydraulic and hydrologic calculations used to design storage facilities
  - Operation and maintenance considerations
  - LID design summary and/or limiting factors including retention basin drain times
- Other related permits
  - Indicate implications to streams, wetlands, FEMA designated floodplains, if ponds should be classified as a dam, etc. – and indicate if permitting is needed (e.g., stream alteration permit, Floodplain Development Permit, Small Dam Application, etc.)
- Statement of compliance
  - Include stamp by professional engineer
- Appendix
  - Modeling results, hydrographs, tables, etc.
  - Maps of drainage basin characteristics, existing and proposed contours, including drainage basin delineation, land cover, soils, drainage paths, etc.
  - FEMA floodplain maps, if applicable