SECTION 2
DRAINAGE PLANNING SUBMITTAL REQUIREMENTS

CITY OF WESTMINSTER
STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

SECTION 2 DRAINAGE PLANNING SUBMITTAL REQUIREMENTS

2.1 REVIEW PROCESS

All subdivisions, re-subdivisions, planned unit developments, or other development (excluding some PUD amendments and administrative re-subdivisions as determined by the City Engineer) shall submit drainage reports, construction drawings, and as-built information in accordance with these CRITERIA.

Three copies of all drainage reports shall be submitted to the CITY for review. The CITY will retain two copies. All submitted reports should be clearly and cleanly reproduced. Photostat copies of charts, tables, nomographs, calculations, or any other reference material must be legible. Washed out or unreadable portions of the report are unacceptable and could warrant re-submittal of the report. All reports shall be typed on 8-1/2" x 11" paper and bound. The drawings, figures, plates, and tables shall be bound with the report or included in a pocket attached to the report. The report shall be prepared by or supervised by a professional engineer licensed in Colorado. All reports shall include Standard Statement 1.

All reports shall include a cover letter presenting the report for review as well as a declaration of the type of report submitted (i.e., Phase-I, Phase-II, or Phase-III). City staff will use Standard Form 1 to determine the adequacy of the submittal. Incomplete or absent information may result in the report being rejected for review.

City staff will try to review the drainage reports and provide written review comments and/or acceptance within twenty-one (21) working days of the submittal. City staff will make every effort to effect a complete review within the review period; however, city staff cannot guarantee the review time since the response time varies with the workload being experienced. The drainage reports and/or construction plans cannot be accepted by default.

A pre-application consultation is suggested for all applicants to outline the processing steps in the development process. The applicant shall consult with the City's Engineering Division for general information regarding subdivision regulations, required procedures, possible drainage problems, and specific submittal requirements.

The applicant shall note that approval of construction plans, specifications, and associated engineering reports by the CITY shall only indicate that the plans, specifications, and reports are in general conformance with the City's submittal requirements, current design criteria, standard engineering principles and practices, and previously approved plans and reports. Approval shall not indicate that all assumptions, calculations, and conclusions contained within the drainage reports and/or construction plans have been thoroughly verified by City staff. **At all times, the professional**

engineer submitting the construction plans, specifications, and drainage reports shall be solely responsible for their accuracy and validity.

If during the construction process or at any time within one year following the acceptance by the CITY of the completed improvements, any deficiencies or errors are discovered in the construction plans, specifications, drainage reports, or the actual constructed improvements, the CITY shall have the right to require the developer to make any and all corrections which may be deemed necessary by the CITY. The costs associated with any such corrections shall be the sole responsibility of the developer. (See Section 11-6-5(B)3 of the CODE.)

2.2 PHASE I DRAINAGE REPORT

The Phase I Drainage Report is the first step in the approval process. A Phase I Drainage Report must be submitted during the zoning process as part of the Preliminary Development Plan. This report will review at a conceptual level the feasibility and design characteristics of the proposed development and drainage system. The Phase I Drainage Report shall be in accordance with the following outline and contain the applicable information listed:

2.2.1 Report Contents

I. GENERAL LOCATION AND DESCRIPTION

A. Location

1. All streets and highways within and adjacent to the site or the area to be served by the drainage improvements

2. Township, range, section, 1/4 section

3. All major drainageways and storm drainage facilities within or adjacent to the site

4. Names of surrounding developments

B. Description of Property

1. Area in acres

2. Type of ground cover and vegetation

3. Major drainageways within the property

4. Irrigation facilities such as ditches and canals

5. Proposed land use

6. Identification of all wetland areas and the affected area in acres

II. DRAINAGE BASINS

A. Major Basin Description

1. Reference to applicable major drainageway planning studies, flood hazard area delineation reports (FHAD), and flood insurance rate maps (FIRM) (refer to Table 201 and Figure 201)

2. Major drainage basin characteristics such as existing and proposed land uses within the basin

3. Discussion of existing drainage patterns

4. Identification of all irrigation facilities within 150-feet of the property boundary

5. Identification including ownership of all lakes and ponds which either influence or may be influenced by the local drainage. Identification of all dams under the State Engineer's Office jurisdiction including the dam's current rating, status, and pertinent sections and drawings of the dam breach analysis.

B. Sub-Basin Description

1. Discussion of any Master Plan improvements designated for the site.

2. Discussion of existing drainage patterns of the property

3. Discussion of the downstream drainage flow patterns and the impact of the proposed development under existing and fully developed basin conditions

III. DRAINAGE FACILITY DESIGN

A. General Concept

1. Discussion of existing drainage patterns

2. Discussion of compliance with off-site runoff considerations both upstream and downstream

3. Discussion of existing drainage problems or concerns both on-site and off-site

4. Discussion of anticipated and proposed drainage patterns and facilities

5. Discussion of wetlands issues (if any) such as mitigation or replacement

6. Discussion of the content of tables, charts, figures, plates, or drawings presented in the report

7. Discussion of assumptions, techniques, and methodologies utilized

8. Discussion of all referenced reports and studies (i.e., are they valid, complete, etc.)

B. Specific Details

1. Determine the major and minor drainage flows for the major basins

2. Discussion of potential drainage problems encountered and solutions at specific design points

3. General discussion of detention pond storage and outlet design

4. Discussion of maintenance and access aspects of the drainage facility design

5. Discussion of the drainage impacts to downstream properties

C. Adaptations from Criteria

1. Identify provisions by section number for which a adaptation is requested

2. Provide specific and detailed justification for each adaptation requested

IV. SUMMARY

A. Overall summary including conclusions and professional opinions on the existing drainage facilities and the proposed facilities

B. Include Standard Statement 1

V. REFERENCES

A. Reference all criteria, storm water master plans, FHADs, FIRMs, and technical information used to support the conceptual design of the proposed drainage system

2.2.2 Drawing Contents

All drawings shall be a maximum 24" x 36" in size.

I. GENERAL LOCATION MAP

A. The map should be at a scale of 1-inch = 1000 feet to 1-inch = 4000 feet.

B. The map shall provide sufficient detail to identify drainage flows entering and leaving the proposed development. The map shall indicate the drainage flow paths from the upstream end of any off-site basin to the receiving major drainageway.

C. The map shall identify any major facilities (i.e., irrigation ditches, existing detention facilities, culverts, and storm sewers) along the flow path to the receiving major drainageway. All major drainageways shall be identified and shown on the report drawings.

D. Major basins are to be identified.

E. Topographic contours are to be included

II. FLOODPLAIN INFORMATION

A. A copy of Figure 201 showing the location of the subject property shall be included with the report

III. DRAINAGE PLAN

A. Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' shall be included. The plan shall show the following:

1. Physical Characteristics

   (a) Existing topography with contours shown in intervals of two feet or five feet for the entire project area

   (b) Proposed topography with contours shown in intervals of two feet or five feet for the entire project, if available

   (c) Existing off-site topography with contours shown in intervals consistent with the on-site information. Off-site topography should extend as follows:

      (1) For projects less than one acre in size, off-site topography for a distance of at least fifty feet in every direction

      (2) For projects larger than one acre in size, off-site topography for a distance of at least one hundred fifty feet in every direction or as directed by the City staff

   (d) Approved grading plans (shown in contour intervals consistent with the on-site information) for all adjacent properties which have not yet been constructed

   (e) Existing vegetation and location, type, and size of significant trees

   (f) All existing wetlands areas

2. All existing drainage facilities both on-site and off-site for a distance as determined in Section 2.2.2(III)A1(c)

3. Major drainageways and the approximate 100-year floodplain limits based on the most current available information

4. Proposed drainage facilities including location of detention ponds, storm sewers, channels, and corresponding outlet flow paths in a detail consistent with the proposed development plan

5. Major drainage basin boundaries and sub-basin boundaries

6. Any off-site feature influencing the proposed development and the proposed drainage system

7. Proposed drainage flow paths

8. Legend to define map symbols

9. Title block with revision dates in lower right corner

2.3 PHASE II DRAINAGE REPORT

The purpose of the Phase II Drainage Report is to refine the conceptual drainage system and identify in greater detail the problems, which may occur both on-site and off-site as a result of the proposed development. The Phase II Drainage Report shall be submitted with the application for the Official Development Plan. The Phase II Drainage Report must be written in such a manner and contain enough detail to be self-explanatory (i.e., possession of the Phase I Drainage Report is not necessary to understand the Phase II Drainage Report).

The report shall include either a signed Drainage Agreement Document (Standard Form 2) or an Indemnification Statement (Standard Form 3) and Standard Statement 1.

The developer or his consultant is responsible for obtaining any and all permits, licenses, and any other documentation/correspondence that are necessary to address any additional issues such as wetlands, floodplains, irrigation facilities, groundwater dewatering, and protection of existing utilities.

2.3.1 Report Contents

The Report shall be in accordance with the following outline and contain the applicable information listed:

I. GENERAL LOCATION AND DESCRIPTION

A. Location

1. Township, range, section, 1/4 section

2. All streets and highways including the existing ROW widths within 150 feet of the site

3. Major drainageways and facilities within 150 feet of the site

4. Names of surrounding developments

B. Description of Property

1. Area in acres

2. Ground cover such as the type of trees, shrubs, vegetation, general soil conditions, topography, and slope

3. Major drainageways within and adjacent to the site

4. General project description

5. Irrigation facilities within and adjacent to the site

6. Proposed land use

7. Identification of all wetland areas including the affected area in acres

8. All existing easements within 150 feet of the site

II. DRAINAGE BASINS

A. Major Basin Description

1. Reference to applicable major drainageway planning studies, flood hazard area delineation reports (FHADs), and flood insurance rate maps (FIRMs) (refer to Table 201 and Figure 201)

2. Major basin drainage characteristics including existing and proposed land uses

3. Identification of all irrigation facilities within the basin

4. Identification including ownership of all lakes and ponds which either influence or may be influenced by the local drainage. Identify all dams under the State Engineer's Office jurisdiction including the dam's current rating, status, and pertinent sections and drawings of the dam breach analysis

B. Sub-basin Description

1. Discussion of historic drainage patterns of the site

2. Discussion of off-site drainage flow patterns and the impact of the proposed development under existing and fully developed basin conditions

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference and Constraints

1. Discussion of previous drainage studies (i.e., project master plans, Phase I Drainage Reports, etc.) for the site that influence or are influenced by the proposed drainage facilities

2. Discussion of drainage studies for adjacent properties and their effect on the proposed drainage system

3. Discussion of the drainage impact of site constraints such as streets, utilities, and existing structures

4. Discussion of wetlands issues (if any) such as mitigation or replacement.

B. Hydrological Criteria

1. Identify design rainfall for the design recurrence intervals

2. Identify runoff calculation method

C. Hydraulic Criteria

1. Determination of the capacity of the downstream drainage system and its ability to handle the drainage from the development site

2. Preliminary storm sewer system layout including inlets

3. Identify the allowed detention discharge and storage calculation method

D. Adaptations from Criteria

1. Identify provisions by section number for which a adaptation is requested

2. Provide specific and detailed justification for each adaptation requested

IV. DRAINAGE FACILITY DESIGN

A. General Concept

1. Discussion of the proposed drainage system and typical drainage patterns

2. Discussion of compliance with off-site runoff considerations

3. Discussion of the content of tables, charts, figures, plates, or drawings presented in the report

4. Discussion of the contents of referenced reports, studies, etc.

B. Specific Details

1. Discussion of drainage problems encountered and solutions at specific design points

2. Discussion of detention pond storage and outlet design

3. Discussion of maintenance and access aspects of the proposed design

4. Discussion of the necessity of easements and tracts for drainage purposes including the limitations of use

5. Discussion of the impacts on the downstream properties of flow release from the site

6. Discussion of the impact on existing floodplains of major drainageways and the requirements if altering the existing 100-year floodplain

V. SUMMARY

A. Discussion of compliance with CRITERIA, MANUAL, and major drainageway planning studies

B. Drainage Concept

1. Describe how the drainage design will control damage due to storm runoff both on-site and off-site

2. Influence of the proposed development on the Major Drainageway Planning Studies recommendations

C. Include Standard Statement 1

VI. REFERENCES

A. Reference all criteria and technical information used

VII. APPENDICES

A. Hydrologic Computations

1. Land use assumptions regarding adjacent properties

2. Major and minor storm runoff peaks at specific design points

3. Historic and fully developed runoff peaks at specific design points

4. Time of concentration and runoff coefficients for each basin and sub-basin

B. Hydraulic Computations

1. Existing and proposed culvert capacities

2. Open channel typical sections, capacity, and depths

3. Detention area, volume, and depth

4. Downstream drainage system capacity to the major drainageway system

C. Approval and/or Agreement Letter(s)

1. Approval letter(s) from other jurisdictions, canal companies, pond owners, etc., (if required)

2. All permits, licenses, etc., for any wetland removal or mitigation as required by the USACE.

3. Signed Drainage Agreement Document (Standard Form 2) or Indemnification Statement (Standard Form 3)

2.3.2 Drawing Contents

All drawings shall be a maximum 24" x 36" in size.

I. GENERAL LOCATION MAP

A. The map should be at a scale of 1-inch = 1000-feet to 1-inch = 4000-feet

B. The map shall provide sufficient detail to identify drainage flows entering and leaving the site as well as the drainage flow paths from the upstream end of any off-site basin to the major drainageway

C. The map shall identify any major facilities (i.e., irrigation ditches, existing detention facilities, culverts, and storm sewers) along the entire flow path. All major drainageways shall be identified and shown on the report drawings.

D. Major drainage basins are to be shown

E. Topographic contours are to be included

II. FLOODPLAIN INFORMATION

A. A copy of Figure 201 showing the location of the subject property shall be included with the report

III. DRAINAGE PLAN

A. Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' shall be included. The plan shall show the following:

1. Physical Characteristics:

(a) Existing topography with contours shown in intervals of two feet for the entire site

(b) Proposed topography with contours shown in intervals of two feet for the entire site

(c) Existing off-site topography shown at a maximum of five-foot contour intervals. The off-site topography should extend as follows:

(1) For projects less than one acre in size, off-site topography for a distance of at least fifty feet in every direction

(2) For projects larger than one acre in size, off-site topography for a distance of at least one hundred fifty feet in every direction or as directed by the City staff.

(d) Approved grading plans (shown at a maximum of five-foot contour intervals) for all adjacent properties which have not yet been constructed

(e) First-floor elevations of any existing or approved structure within one hundred fifty feet of the property line of the project.

(f) Cross-sections as required by the City Engineer to illustrate the relationship between the proposed facilities and the existing or approved facilities

(g) All existing wetland areas including their area in acres

2. Existing property lines and easements

3. Streets indicating their ROW width, flowline width, curb type, sidewalk width, and approximate longitudinal slope

4. Existing drainage facilities and structures including irrigation ditches, roadside ditches, cross-pans, drainageways, and culverts. All pertinent information such as material, size, shape, slope, and location shall also be included.

5. Overall drainage basin boundary and sub-basin boundaries

6. The outfall points and flow rates for runoff from the proposed site. Delineation of the off-site flow path to the major drainageway. The drainage facilities necessary to convey the flows to the major drainageway without damaging downstream properties

7. Routing and accumulation of design flows at various critical points for the minor storm runoff using the format shown in Table 202

8. Routing and accumulation of design flows at various critical points for the major storm runoff using the format shown in Table 202

9. Required volumes and release rates for detention pond facilities and general information on the triple stage outlet design

10. 100-year floodplain delineation and corresponding water surface elevations of all existing FHAD and FEMA floodplains affecting the property

11. Locations and elevations (if known) of all existing and proposed utilities affected by or affecting the drainage system design.

12. Routing of off-site drainage flow through the site

13. Legend of map symbols

14. Title block with revision dates in lower right hand corner

2.4 PHASE III DRAINAGE REPORT

The purpose of the Phase III Drainage Report is to finalize the proposed drainage system discussed in the Phase II Drainage Report and to present the final design details and calculations. This report must be written in such a manner and contain enough detail to be self-explanatory (i.e., possession of the Phase I Drainage Report or Phase II Drainage Report is not necessary to understand the Phase III Drainage Report).

The Phase III Drainage Report shall be submitted with the final construction drawings. The Phase III Drainage Report (which updates the Phase II Drainage Report) must be reviewed and accepted by the Engineering Division before the final plat will be signed by the CITY.

The report shall contain Standard Statement 1 and Standard Statement 2.

The Phase III Drainage Report shall be prepared in accordance with the outline shown in Section 2.3.1 with the exception of Part VII-B. For the Phase III Drainage Report, Part VII-B shall read as follows:

B. Hydraulic Computations

1. Existing and proposed culvert capacities

2. Storm sewer profiles including energy grade line (EGL) and hydraulic grade line (HGL) elevations with the associated hydraulic computations

3. Gutter and street cross-section capacities compared to the maximum allowable street flows

4. Storm inlet capacity including inlet control rating at connection to storm sewer

5. Open channel design: depth, capacity, velocity, and Froude number calculations

6. Check drop and/or channel drop structure design calculations

7. Detention area, volume, design depths, and outlet capacity

8. Detention pond outlet design

9. Downstream drainage system capacity to the major drainageway

10. Rip-rap design calculations

The report drawings shall follow the requirements presented in Section 2.3.2 with the following three items added to Section 2.3.2.(III)A:

15. Proposed gutter type, street capacity, roadside ditch, slope, flow directions, and cross-pans.

16. Proposed storm sewers including inlets, manholes, culverts, and other appurtenances

17. Proposed open channels with rip-rap protection

2.5 CONSTRUCTION PLANS

Where drainage improvements are to be constructed, plans for these improvements shall be part of the construction drawing package for the site improvements and shall be accompanied by the Phase III Drainage Report. Acceptance of the final construction plans by the City Engineer is a condition of issuance of construction permits. The construction plans for the drainage improvements will include:

1. Storm sewers, inlets, outlets, and manholes with pertinent elevations, dimensions, type, and horizontal control indicated

2. Culverts, end sections, and inlet/outlet protection with dimensions, type, elevations, and horizontal control indicated

3. Channels, ditches, and swales (including side/rear yard swales) with lengths, widths, cross-sections, slopes, and erosion control (i.e. rip-rap, concrete, grout) indicated

4. Check dams, channel drops, and other required erosion control facilities

5. Detention pond grading, trickle channels, and outlets

6 Other drainage related structures and facilities (including underdrains, sump pump lines, and irrigation diversion structures)

7. Maintenance and access easements and paths

8. Overlot grading plan

9. Detailed grading plan providing rear lot elevations, front lot elevations, and flow direction

10. An erosion and sedimentation control plan

11. Any and all wetland mitigation details

The information required for the construction plans shall be in accordance with sound engineering principles, these CRITERIA, and the STANDARD. The construction documents shall include geometric, dimensional, structural, foundation, bedding, hydraulic, and other details as needed to construct the storm drainage system. The accepted Phase III Drainage Plan shall be submitted with the construction documents. The construction plans shall be signed by a professional engineer registered in the State of Colorado certifying that the accepted drainage report and drawings are in accordance with the CRITERIA.

2.6 RECORD DRAWINGS AND FINAL ACCEPTANCE CERTIFICATE

Reproducible record drawings and digital files in DXF format for all improvements are to be submitted to the CITY with the developer's request for acceptance of the improvements. Affirmation of the record drawings is required as follows:

1. Registered Land Surveyor: A land surveyor registered in the State of Colorado shall affirm the as-built detention pond volumes and surface areas at the design depths; outlet structure sizes and elevations; storm sewer sizes and invert elevations at inlets, manholes, and discharge locations; and representative open channel cross-sections and slopes; and dimensions of all the drainage structures.

2. Registered Professional Engineer: The responsible design engineer shall state that "I have observed the drainage facilities and to the best of my knowledge, belief, and opinion, the drainage facilities were constructed in accordance with the design intent of the accepted drainage report and construction drawings."

The City Engineer will compare the record drawing information with the construction drawings to ensure that:

1. The record drawing information demonstrates that the construction is in compliance with the design intent.

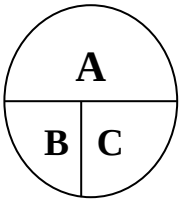
2. The record drawings are affirmed by both a registered land surveyor and the responsible design engineer.

Table 201
Listing of Floodplain Information for the City of Westminster

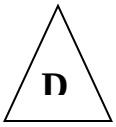
Participating Municipality	Area Number [1]	Streams Studied	Study Director	Report Title	Consultant	Completion Date
Westminster	1	Big Dry Creek Tanglewood Creek N. Cotton Creek Middle Cotton Creek S. Cotton Creek Airport Creek N. Branch Airport Creek N. City Park Creek S. City Park Creek Middle Branch Hylands Creek N. Branch Hylands Creek Walnut Creek Countryside Creek N. Branch Walnut Creek	UDFCD	Flood Hazard Area Delineation	Greiner Engineering	12/88
Westminster Broomfield Adams County Jefferson County	1	Big Dry Creek and Tributaries	UDFCD	Outfall Systems Planning Study	Muller Engineering	1/89
Westminster	1	Big Dry Creek and Tributaries	FEMA	Flood Insurance Study	Greiner Eng.	9/88
Westminster Arvada Adams County Jefferson County	2	Little Dry Creek Tributary B Tributary C Shaw Heights Tributary	UDFCD	Flood Hazard Area Delineation	Merrick and Co.	6/78
Westminster Arvada Adams County Jefferson County	2	Little Dry Creek Tributary B Tributary C Shaw Heights Tributary	UDFCD	Major Drainageway Planning	Merrick and Co.	4/79
Westminster	2	Tributary B	FEMA	Flood Insurance Study	Greiner Eng.	9/88
Westminster Arvada Adams County	3	Hidden Creek Bates lake	UDFCD	Major Drainageway Planning	HydroTriad Ltd.	11/75
Westminster Broomfield	4	Nissen Reservoir Basin City Park Basin Windmill Basin	UDFCD	Flood Hazard Area Delineation	Wright-McLaughlin Engineers	6/79
Westminster Broomfield	4 and 5	Broomfield and Vicinity	UDFCD	Outfall System Planning	Greenhorne & O'Mara	12/85
Westminster Broomfield	4	Nissen Reservoir Channel	FEMA	Flood Insurance Study	Greiner Eng.	9/88
Westminster Broomfield	4	Direct Flow Area 3207	UDFCD	Major Drainageway Plan	Wright-McLaughlin Engineers	11/79
Westminster Broomfield	5	Quail Creek McKay Lake Basin Tributary A	UDFCD	Flood Hazard Area Delineation	Greenhorne & O'Mara	7/86
Westminster Thornton Adams County	6	Shay Ditch	UDFCD	Flood Hazard Area Delineation	Wright Water Engineers	7/89
Westminster Thornton Adams County	6	Shay Ditch	UDFCD	Outfall Systems Planning	Wright Water Engineers	11/89

[1] Refer to Figure 201

Table 202
Drawing Symbol Criteria and Hydrology Review Table



A = Basin Designation
B = Area in acres
C = Composite Runoff Coefficients
D = Design Point Designation



Summary Runoff Table
(to be placed on the drainage plan)

Design Point	Contributing Area (acres)	Runoff Peak 5-year event (cfs)	Runoff Peak 100-year event (cfs)

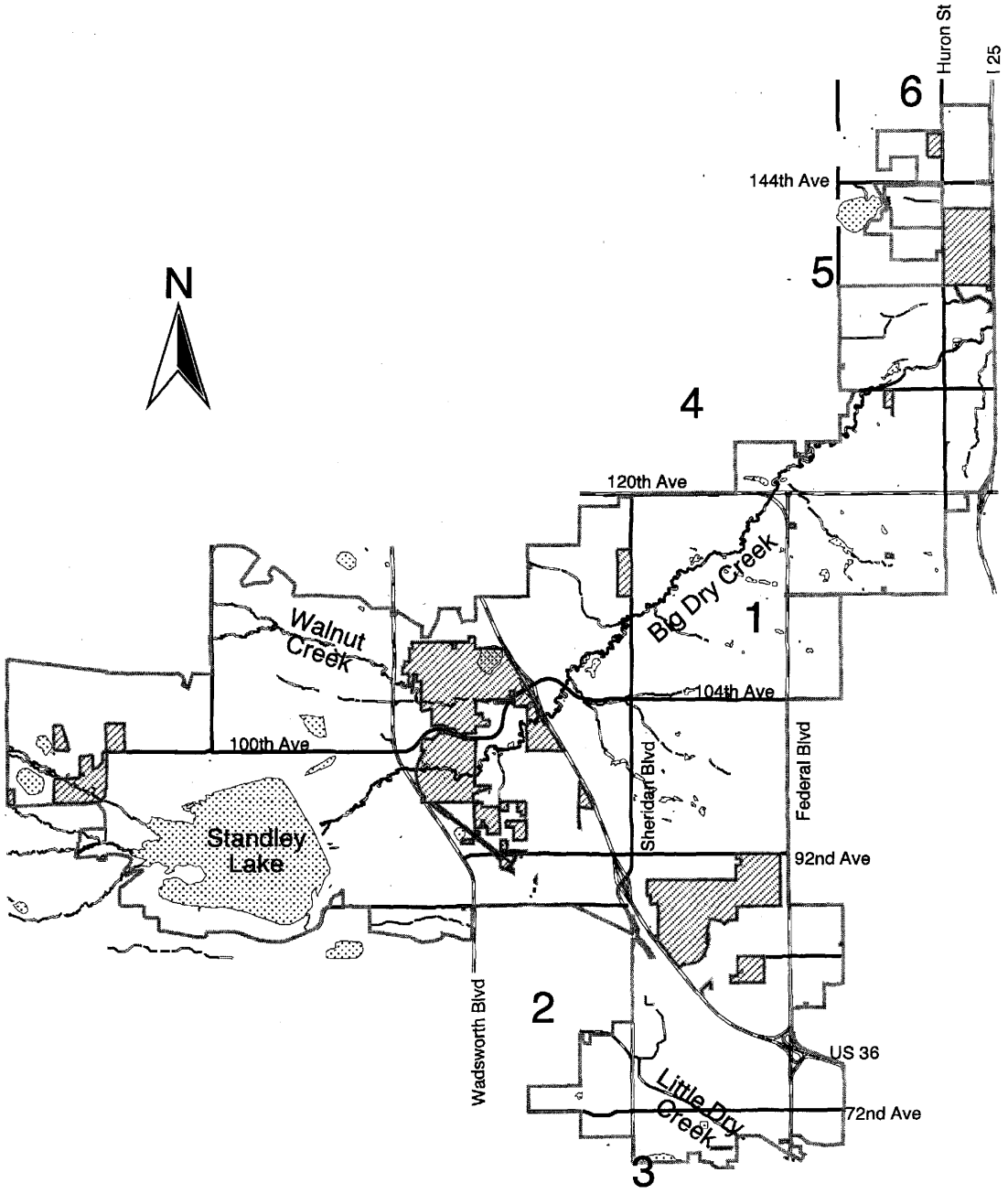



Figure 201
Floodplain Information for the City of Westminster