

I. INTRODUCTION

The Town of Windsor, Colorado is presently experiencing rapid growth and development within the boundaries of several of its major drainage basins. As growth continues within these basins, the threat associated with flooding also grows. Flooding problems that presently exist will likely be exacerbated as future development occurs within these basins. Consequently, the construction of adequate storm drainage facilities that mitigate both existing and future flooding problems becomes increasingly important.

In support of the need to provide these facilities, the Town of Windsor contracted with Anderson Consulting Engineers, Inc. to develop a master drainage plan for those major drainage basins located within its urban growth management boundary. This report summarizes the results of the master planning efforts for these basins.

1.1 Project Goals and Objectives

The goal of this project was to develop a Master Drainage Plan (MDP) that can be utilized as a tool for making decisions related to stormwater management within the boundary of the Town of Windsor and the associated drainage basins. Completion of the master drainage plan involved the development of a planning document that would:

- (a) identify long-term capital improvements and rehabilitation measures for the existing drainage system;
- (b) be a tool for implementation of future improvements associated with new developments within the basin boundaries;
- (c) provide a basis for prioritizing and scheduling required improvements (implementation plan);
- (d) provide the flexibility to implement improvements that afford flood protection while being cost effective;
- (e) address water quality issues;
- (f) identify uniform criteria for the planning and design of major drainageway facilities and on-site detention requirements; and
- (g) provide the basis for development of basin impact fees to fund construction of the stormwater capital improvement projects.

Sensitivity to these objectives was an important consideration during the preparation of the master drainage plan; however, the primary focus of the planning efforts was the reduction of both existing flooding and the potential for future flooding problems within the Town of Windsor.

1.2 Scope of Work

The scope of work followed during the development of the master drainage plan included the tasks described below.

1. Scoping and Coordination Meetings. This task included a scoping meeting to discuss project goals and objectives, schedule, deliverables, modeling criteria and level of detail, and planning concepts and evaluation procedures. Coordination meetings were also conducted to discuss project status, overall direction of the project and promote the exchange of information. Several workshops were held with members of the Town Board of Trustees and the Town Water and Sewer Board. During the coordination meetings, the scope of the project was often slightly modified to reflect information and results generated during the completion of the planning effort.
2. Data Collection and Field Investigation. A detailed review of all available reports, mapping and data pertinent to the planning efforts was conducted. This information included but was not limited to: (a) existing drainage criteria and policies; (b) existing and ongoing drainage studies; (c) zoning data; (d) pertinent soils, rainfall and runoff data; (e) inventories of existing facilities; (f) available mapping and utility databases; and (g) agreements with various entities including ditch companies and Weld County. In conjunction with the collection and review of available data, a field reconnaissance was conducted to further define and verify locations of existing drainage or flooding problems and formulate plans for conceptual improvements at these locations. Survey requirements were identified along with all existing facilities earmarked for evaluation during the hydraulic evaluation.
3. Mapping and Surveying. All available mapping sources were investigated. These sources included USGS quadrangle maps and mapping generated from existing and ongoing drainage studies. To facilitate the master planning efforts, aerial photography was utilized from a 1999 aerial flight. Survey requirements included the collection of data necessary to define existing structures (bridges, channels, culverts, outlet structures, etc.) with respect to geometric configuration, invert and overtopping elevations, etc.
4. Inventory of Existing Facilities. All information related to the major storm drainage facilities within the major drainageway of each basin was compiled. Existing detention facilities, culverts, bridges, road crossings, drainage channels, irrigation ditches, and major storm sewers were inventoried and evaluated. The capacity of

each structure was determined and the feasibility of integrating existing facilities into the master drainage plan investigated.

5. Hydrologic Analysis and Modeling. A detailed hydrologic model was developed and utilized to simulate the stormwater runoff for four scenarios: (a) existing or "as is" condition; (b) future development conditions with existing facilities and on-site detention; (c) future development conditions with existing facilities and on-site over-detention; and (d) future development conditions with on-site over-detention and proposed improvements.
6. Hydraulic Analysis and Modeling. A detailed hydraulic analysis was completed to evaluate the structures identified during the inventory of existing facilities. All proposed improvements were also evaluated during the hydraulic analysis and modeling efforts.
7. Drainageway Planning and Alternative Development. Storm drainage improvements were identified to mitigate the existing and potential future flood hazard problems. Alternative stormwater management plans were conceptually developed and internally reviewed and refined with input from the staff of the Town of Windsor and the Town Boards.
8. Basin Drainage Criteria. Criteria for the planning and design of drainage facilities were developed in conjunction with the staff of the Town of Windsor Engineering Department. The criteria specifically focused on the planning and design of major drainageway facilities, road crossings and on-site detention requirements.
9. Funding/Fee Assessment. An investigation of various funding mechanisms that could provide monies for the construction of the capital improvements was completed. Proposed modifications to the existing stormwater fee structure were developed. The results of the investigation along with a recommendation were presented to the Town Board of Trustees and Town Water and Sewer Board.
10. Reporting and Technical Documentation. The results of the master planning effort are summarized in this report. All recommended improvements are identified along with conceptual design drawings and detailed cost estimates. An implementation plan for the construction of the proposed improvements is presented. Documentation in the form of technical appendices and a project notebook is provided to allow replication of the steps taken to: (a) generate the design flows, (b) estimate the capacity of the existing and future facilities, (c) develop and evaluate the alternative plans, and (d) generate the cost estimates.

1.3 Acknowledgments

The preparation of this report along with the supporting documentation involved the dedicated efforts of several representatives of the Town staff, members of the Town Board of Trustees, Town Water and Sewer Board, Town Planning Commission as well as members of the community potentially impacted by the implementation of a master drainage plan. The assistance and cooperation of those entities and individuals identified below are acknowledged and greatly appreciated.

Town Board of Trustees (Mr. Wayne Miller, Mayor)

Town Water and Sewer Board Members (Mr. Kenton Brunner, Chairman)

Town Planning Commission (Mr. Gale Schick, Chairman)

Town of Windsor Staff:

Mr. Rod Wensing, Administrator

Mr. Dennis Wagner, Director of Engineering

Mr. Terry Walker, Director of Public Works

Mr. Joe Plummer, Director of Planning

Mr. Dean Moyer, Director of Finance

Mr. Rick Anderson, Civil Engineer

Mr. John Frey; Frey, Korb, Haggerty & Michaels, P.C. (Town Attorney)

In addition to those individuals and entities listed above, members and representatives of the Eastman Kodak Company, New Cache la Poudre Irrigating Company, Cache la Poudre Reservoir Company; Trollco, Inc. dba Water Valley, TST, Inc., Hall-Irwin, Inc., RMC, Inc., Office of the State Engineer, Weld County Engineering and Planning Departments, and the Colorado Department of Transportation provided invaluable information and details related to the existing facilities, historic flooding, and existing and proposed urban developments within the basins. The information provided by these individuals and entities is also gratefully acknowledged.

1.4 Mapping and Surveying

Digital USGS quadrangle mapping was utilized during this master planning effort. These maps were combined to form a single, contiguous topographic base map that encompassed the drainage boundaries of the major drainage basins. The following USGS quadrangle maps were obtained:

- (a) Bracewell, Colorado, 1950, Photo revised 1980;
- (b) Cobb Lake, Colorado, 1960, Photo revised 1978;
- (c) Eaton, Colorado, 1960, Photo inspected 1975;
- (d) Greeley, Colorado, 1950, Photo revised 1980;
- (e) Nunn, Colorado, 1960, Photo inspected 1975;
- (f) Severance, Colorado, 1960, Photo revised 1971;
- (g) Timnath, Colorado, 1960, Photo revised 1971; and
- (h) Windsor, Colorado, 1950 , Photo revised 1969.

All the quadrangles utilized the NAD29 Vertical Datum and incorporated a contour interval of 10 feet.

In addition to the USGS mapping, digital aerial photographic images were obtained from the Town of Windsor and utilized to illustrate the location of all proposed improvements. Ken Rushing Photographic Services of Drake, Colorado, provided the September 22, 1999 aerial photography to the Town of Windsor.

King Surveying, Inc. of Windsor, Colorado, provided additional surveying and topographic data necessary to complete the project.

1.5 Previous Studies

Previous studies related to stormwater management within the Town of Windsor were collected and reviewed during the completion of this project. Reports documenting stormwater drainage conditions and improvements in the Town of Windsor may be found in the reference section of the project notebook. The information gathered from these reports, including the available design drawings and specifications, were evaluated and utilized during the completion of this master planning effort.

With respect to flood studies within the basins, the Federal Emergency Management Agency (FEMA) has produced flood information and mapping along the Cache la Poudre River and the Law Ditch. Furthermore, FEMA has documented flooding in the Town of Windsor in the following reports:

- (a) Flood Insurance Study, Town of Windsor, Colorado, Weld County, September 27, 1991; and
- (b) Flood Insurance Study, Weld County, Colorado, Unincorporated Areas and Town of Eaton, Colorado; Revised September 27, 1991.