TOWN OF FREDERICK/CITY OF DACONO
STORMWATER OUTFALL SYSTEMS PLAN (OSP)
APRIL 2022 – (FINAL)

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

Dacono Colorado

ICON ENGINEERING

Headwaters CORPORATION

40 Year — ENGINEERING PLANNING SURVEYING

April 7, 2022

Mr. Kevin Ash, P.E.
Town of Frederick
Engineering Director
401 Locust Street
Frederick, Colorado 80530

Mr. A.J. Euckert
City of Dacono
City Manager
512 Cherry Avenue
Dacono, Colorado 80514

RE: Town of Frederick/City of Dacono Stormwater Outfall Systems Plan (OSP)
(DOLA Project No. EIAF 9222; ACE Project No. COTOF03)

Dear Mr. Ash and Mr. Euckert,

Anderson Consulting Engineers, Inc. (ACE), ICON Engineering, Headwaters Corporation, and AVI, p.c. are pleased to submit the following report for the Town of Frederick/City of Dacono Outfall Systems Plan (OSP). This report and the associated technical analyses and recommendations update the previous master planning efforts within the study area. The main objectives of this study are to update the hydrologic and hydraulic modeling of the watersheds within the communities to provide an assessment of existing flooding problems, identify preferred long-term capital improvement projects to address the existing flooding problems, and to provide a planning guide for future development within each community.

This report provides the background analyses and documentation for the hydrologic and hydraulic evaluation of the following major watersheds (drainage basins) located within the planning boundaries of both Frederick and Dacono: (1) Tri-Town; (2) Godding Hollow; (3) Idaho Creek; (4) Sump; (5) Little Dry Creek, and (6) Boulder Creek. The general scope of this OSP includes: (a) data collection and inventory of existing stormwater infrastructure within each watershed; (b) developing existing condition hydrology and assessing current flooding problems; (c) developing future condition hydrology to determine the potential impact of future development on the existing drainage infrastructure if no capital improvements are implemented; (d) formulating and evaluating proposed capital improvement alternatives to alleviate the current flooding problems; (e) selection of a preferred set of improvement projects and development of associated costs for these projects; (f) preparation of a prioritization and funding strategy for the implementation of the preferred set of capital improvement projects.

The selection of a preferred plan of proposed improvements was conducted with input from community staff and was based predominately on: (a) reducing flood risk to the people who live, work, and visit the communities; (b) utilizing existing infrastructure to the fullest extent possible, and (c) providing opportunity for future development within the watersheds to occur based on a comprehensive stormwater drainage and outfall system plan. Digital information has also been provided along with this report that includes electronic copies of the GIS databases, mapping, modeling, and spreadsheets that were developed as part of this study.

We have appreciated the opportunity to work together with the Town of Frederick and City of Dacono on this Stormwater Outfall Systems Plan study. If we can be of further service in the future, or if you require additional information or clarification regarding this submittal, please do not hesitate to contact us.

Sincerely,
Anderson Consulting Engineers, Inc.

Brian A. Smith, P.E. CFM
Principal Engineer/Project Manager

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AA.1 Abbreviations of Commonly Utilized Storm Drainage Terms

BFE	Base Flood Elevation
CMP	Corrugated Metal Pipe
CWCB	State of Colorado Water Conservation Board
EGL	Energy Grade Line
FHWA	United States Department of Transportation Federal Highway Administration
FIS	Flood Insurance Study
HGL	Hydraulic Grade Line
H:V	Horizontal to Vertical ratio of a slope
NAVD	North American Vertical Datum
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
PAC	Percent Annual Chance
RCP	Reinforced Concrete Pipe
ROW	Right of Way
SEO	Colorado State Engineer's Office
SFHA	Special Flood Hazard Area
SWMP	Stormwater Master Plan
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
GIS	Graphic Information System
Q	Flow and/or Discharge
MHFD	Mile High Flood District (Previously Urban Drainage Flood Control District)
USDCM	Urban Storm Drainage Criteria Manual

AA.2 Abbreviations of Commonly Utilized Stormwater Units of Measures

sec	second
min	minute
hr	hour
in	inch
ft	foot
ft^2	square feet
cf or ft^3	cubic feet
ft/ft	foot per foot
in/hr	inches per hour
fps or ft/sec	feet per second
cfs	cubic feet per second
lbs	pounds

AA.3 Acronyms for Commonly Utilized Storm Drainage Terms

TOF	Town of Frederick
COD	City of Dacono
CDOT	State of Colorado Department of Transportation
CLOMR	Conditional Letter of Map Revision
DFIRM	Digital Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HEC-RAS	Hydraulic Engineering Center-River Analysis System (Hydraulics Computer Model)
HEC-HMS	Hydraulic Engineering Center-Hydrologic Modeling System (Hydrology Computer Model)
LOMR	Letter of Map Revision
SWMM	Storm Water Management Model ('SWIM', Environmental Protection Agency's Computer Model)

1 Introduction/Background

The Town of Frederick (TOF) and City of Dacono (COD) continue to experience rapid growth within their growth management boundaries, which cover six significant watersheds consisting of (1) Tri-Town; (2) Godding Hollow; (3) Idaho Creek; (4) Sump; (5) Little Dry Creek, and (6) Boulder Creek. The drainageways within both communities have a long history of flooding, with the most recent flooding event occurring in September 2013 when several roadway embankments along the Godding Hollow and Tri-Town drainageways were washed out due to a large rainfall event along the Colorado Front Range. Several previous stormwater master planning efforts have been conducted for the drainage basins within the communities. These previous planning efforts defined development criteria for detaining future condition stormwater runoff and proposed drainage improvements to reduce the threat of flooding. Since the completion of these previous master plans, several of the proposed improvement projects have been implemented and development pressure is beginning to occur in locations that were not analyzed as part of the previous studies. In addition, advancements in data collection and modeling techniques, revisions to the NOAA Atlas for design rainfall values, and considerable increases in construction costs have also occurred since the completion of the previous master planning studies. Based on these considerations, the TOF and COD have decided to update the previous master planning studies into this comprehensive stormwater Outfall Systems Plan (OSP) study.

Funding for this OSP study has been provided by the TOF and COD, with additional funding obtained through an Energy/Mineral Impact Assistance Fund (EIAF) grant through the Colorado Department of Local Affairs (DOLA). Anderson Consulting Engineers, Inc, (ACE) and their project team, including ICON Engineering (ICON), Headwaters Corporation (Headwaters), and AVI p.c. (AVI) were chosen by the communities to conduct this OSP study through a competitive selection process. Both ACE and ICON engineering conducted hydrologic and hydraulic analysis for the studied watersheds, while AVI provided surveying services and Headwaters conducted the funding evaluation as part of the implementation plan. ACE's agreement with the communities was formalized in August 2020 to begin work on this study.

1.1 Purpose

The purpose of this OSP study is to update the hydrologic and hydraulic modeling within the studied watersheds to identify existing flooding problems, estimate the impact of future development on the existing flooding problem areas, develop a plausible, prioritized plan of future capital improvement projects and associated costs that will address the existing and anticipated future flooding problems, and provide a consistent plan for future development within the communities. This study is intended to be a flexible living road map of the existing and anticipated drainage characteristics within the studied watersheds that can be updated in response new data, updated modeling techniques, and future development decisions. Results of the recently completed Town of Erie OSP study have been implemented into this study to ensure consistency with respect to the upstream portions of the Godding Hollow, Idaho Creek, Little Dry Creek, and Boulder Creek watersheds. Results of this study can be incorporated into future studies to further the development of consistent hydrologic and hydraulic modeling techniques for the Tri-Town Area, which can promote the solution to drainage and flooding issues at a regional level.

The agreed to scope of work for this master plan study generally included the following tasks:

- Data collection and base mapping.
- Community kickoff meeting, including the review of current community drainage criteria and development plans.
- Field reconnaissance and surveying/inventory of existing drainage facilities.
- Existing condition hydrologic modeling.
- Future condition hydrologic modeling, with conceptual on-site detention.
- Evaluation of existing drainage facilities and identification of current flooding problems.
- Formulation, evaluation, and conceptual design of preferred improvements with estimated construction costs.
- Prioritization, implementation, and a funding evaluation.
- Reporting.
- Public outreach and community adoption of the OSP study.

It is important to note that this OSP study did not reevaluate existing regulatory floodplains, nor did it develop any new flood hazard mapping within the study area. It is recommended that additional studies be conducted to update, or identify currently unmapped flood hazards, within the study area utilizing the updated hydrologic analysis associated with this report. It is further recommended that future developments be required to evaluate the potential for unmapped flood hazards on undeveloped sites to ensure future developments are constructed such that they are not susceptible to flooding. Further information with respect to these recommendations is provided in Chapter 13.

1.2 Planning Process

Planning for this project began shortly after the contractual agreements between the communities and ACE were signed in August 2020. On September 14, 2020, a kickoff meeting with consultant and community staff was conducted to discuss and formalize the goals of the project. A general schedule for the completion of project tasks was developed. After the completion of each major task, meetings with community staff were conducted to present the technical findings and obtain community input prior to moving forward with the next task. Notes from these meetings have been provided in Appendix A.

On August 24, 2021, the initial findings of the study were presented to the Mayor and Board of Trustees of Frederick at a Board Work Session. A similar meeting was conducted for the City Manager and Administrative Staff of Dacono on October 8, 2021. On March 1, 2022, an update on the study was presented to the Board of Trustees of Frederick at another Board Work Session. At this meeting, the Board provided permission for the project team to begin the public outreach process for the Town of Frederick. This process was conducted virtually through the development of an ArcGIS StoryMap that was posted on the Town's website for community feedback. It is anticipated that the OSP study will be adopted at the Frederick Town Board Meeting on April 12, 2022. Adoption of this OSP study by the City of Dacono is anticipated to occur shortly thereafter.

1.3 Topography, Survey Datum, and Aerial Photography

1.3.1 Survey Data and Topography

The current study utilized Light Detection and Ranging (LiDAR) elevation data that were collected by Photo Science, Inc. for FEMA after the September 2013 flood. The LiDAR data collection took place from October 2013 to November 2013, and the post-processed LiDAR data had an original resolution of 0.75 meters.

It is noted that the COD is currently partnering with the Denver Regional Council of Governments (DRCOG) to obtain more recent LiDAR and mapping for the community. This LiDAR and mapping collection is being conducted in partnership with the USGS as part of the 2020 Broad Agency Announcement Award. At the time of this study, the LiDAR data collection had been conducted, but was still undergoing post-processing and quality assurance. It is anticipated that the post-processed LiDAR data, recent aerial imagery, and planimetric data will be available later in 2022.

As part of the data collection efforts associated with this study, ground survey data collection of pertinent drainageway crossings, storm sewer systems and detention pond outlet structures was conducted by the licensed land surveyors of AVI, p.c. Ground survey information was initially collected in November 2020, with a supplemental survey conducted in February 2021. Additional field measurements and photo documentation were also collected by ACE and ICON staff throughout the duration of the project. A digital copy of the AutoCAD survey file produced by AVI, along with digital photographic documentation of crossing and detention pond structures, have been included digitally as part of Appendix J.

1.3.2 Vertical Datum and Horizontal Coordinate System

The current study's topographic mapping and survey data utilized the North American Vertical Datum of 1988 (NAVD88). The horizontal datum for the topographic base map and the collected field data is the North American Datum of 1983 (NAD83) HARN (Colorado State Plane North Zone – 0501, WKID 2876, U.S. foot) coordinate system.

1.3.3 Aerial Photography

Several sources of aerial imagery were utilized as part of the study. Aerial images covering the study area were available from the USGS, the USDA, Google Maps, and Google Earth. Google Earth also provided the ability to reference historical aerial imagery for the study area. The 2019 aerial image from the USDA's National Agricultural Imagery Program (NAIP) was utilized as the base photo for figures developed as part of this study.

1.4 Data Collection

Data for the current study was collected from numerous sources including the Town of Frederick, City of Dacono, Town of Erie, Town of Firestone, CDOT, the CWCB, MHFD, and Weld County. Community specific mapping, planning documents, development reports and GIS information were obtained from the respective community's databases and archives. ESRI's World Imagery files were utilized as base mapping for existing land use, soil type, and wetland coverages. Hydrologic soil information utilized for the study was obtained through the Natural Resources Conservation Service (NRCS) Soil Data website and wetland mapping was obtained from the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) database. Documentation of previous noteworthy studies that were utilized as part of this OSP study have been subsequently categorized.

1.4.1 Stormwater Master Planning Studies

Previously completed stormwater master planning and drainage studies were collected and reviewed for this OSP study. These previous master planning studies included the following:

- I-25 Corridor Master Drainage Plan, Godding Hollow and Tri-Town Basins, South Weld County, Colorado, Anderson Consulting Engineers, Inc., September 1999.
- Idaho Creek Master Drainage Study, Civil Resources, LLC, July 2007, Revised December 2008.
- Sump Basin Master Drainage Plan, Colorado Civil Group, Inc., May 2010.
- Boulder Creek Restoration Master Plan, ICON Engineering, Inc., December 2015.
- Town of Erie Outfall Systems Plan (East of Coal Creek), Merrick, January 2020.

1.4.2 Hydrology, Hydraulics, and Floodplain Mapping

FEMA's Map Service Center was utilized to download the currently effective Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) for the TOF, COD, and portions of unincorporated Weld County located within both community planning areas. Review of the information revealed that effective detailed and approximate floodplain mapping exists on flooding sources evaluated as part of this study. Digital flood insurance information that was downloaded from FEMA's Map Service Center has been included digitally as park of Appendix J. Further discussion of the flood history of the study area and effective flood insurance information is provided in Section 2.4.

1.4.3 Development Reports and Plans

Drainage information from numerous local development and capital improvement projects were provided by the TOF and COD for use in the development of this study. ACE and ICON staff reviewed pertinent information from these reports as part of the data collection task. In general, information from these reports was utilized to verify the baseline and future condition hydrologic analyses. Relevant information from these drainage reports that was utilized in the development of this study have been provided digitally as part of Appendix J. If needed, full copies of these drainage plans and reports can be obtained directly from the TOF and COD.

1.5 Acknowledgements

This OSP study was prepared in cooperation with staff from the TOF and COD. Representatives involved with the current study are listed below in Table 1.1

Table 1.1 Project Participants

Name	Representing	Title
Kevin Ash, P.E.	Town of Frederick	Engineering Director
Sarah Watson	Town of Frederick	Civil Engineer/Project Manager
Angela Wilson	Town of Frederick	Public Engagement/Communication
Amanda DeBord	Town of Frederick	Invoicing/Grant Compliance
A.J. Euckert	City of Dacono	City Manager
Gary Odehnal, P.E.	City of Dacono (Lamp Rynearson)	City Engineer/Project Manager
John Rabas	City of Dacono	Public Works Director (former)
Jordan Eichem	City of Dacono	City Administration
Brian Smith, P.E., CFM	Anderson Consulting Engineers, Inc.	Project Manager
Greg Koch, P.E., CFM	Anderson Consulting Engineers, Inc.	Technical Advisor
Clark Kephart, P.E.	Anderson Consulting Engineers, Inc.	Project Engineer
Ethan Kondo, E.I.T.	Anderson Consulting Engineers, Inc.	Staff Engineer
Ben Ackert	Anderson Consulting Engineers, Inc.	Senior GIS Analyst
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Darren Harder	ICON Engineering	Project Specialist
George Oamek, Ph.D.	Headwater Corporation	Economist
Adam Deschler, PLS	AVI, p.c.	Surveyor

1.6 Report Organization

This OSP report has generally been formatted to follow the Mile High Flood District's Electronic Planning Study Guidelines. Chapters 2 through 5 discuss general and analytical information that were applied wholistically to all drainage basins analyzed as part of this study. Basin specific descriptions, analysis, results, and conceptual improvements have been provided in Chapters 6 through 11 as identified below:

- Chapter 6 – Tri-Town (analysis completed by ACE).
- Chapter 7 – Godding Hollow (analysis completed by ACE).
- Chapter 8 – Idaho Creek (analysis completed by ACE).
- Chapter 9 – Sump (analysis completed by ACE).
- Chapter 10 – Little Dry Creek (analysis completed by ICON).
- Chapter 11 – Boulder Creek (analysis completed by ICON).

A basin wide prioritization/implementation plan and associated funding evaluation for each community is provided in Chapter 12. A brief summary and list of recommendations resulting from this study are provided in Chapter 13.

2 Study Area Description

2.1 Project Area

The planning areas for the TOF and the COD are generally bounded by: a) Boulder Creek on the west; b) State Highway 119 on the north; c) County Road 21 on the east; and d) County Road 6 on the south. Figure 2.1 shows the community planning boundaries in relationship to the six major drainage basins evaluated as part of this OSP study. The six major drainage basins, and area of each basin analyzed as part of this study, are presented in Table 2.1.

Table 2.1 Studied Drainage Basin Names and Areas

Drainage Basin Name (Abbreviation for Use Throughout this Report)	Total Basin Area (acres)	Basin Area (acres) Within Frederick Planning Boundary	Basin Area (acres) Within Dacono Planning Boundary	Basin Area (acres) Outside Frederick/Dacono Planning Boundaries
Tri-Town (TT)	7,723	2,998	778	3,947
Godding Hollow (GH)	12,112	5,044	3,135	3,933
Idaho Creek (IC)	6,646	4,864	0	1,782
Sump (SB)	7,771	459	0	7,312
Little Dry Creek (LDC)	12,267	1,000	7,231	4,036
Boulder Creek (BC)	5,225	2,077	0	3,148

As depicted on Figure 2.1, upstream portions of the Boulder Creek, Idaho Creek, Godding Hollow, and Little Dry Creek Basins are located in the Town of Erie. Results of the recently completed Town of Erie OSP study have been implemented into this study to provide consistency. Northern portions of the Godding Hollow, Tri-Town, and Sump Basins are located within the Town of Firestone. Results of this study can be incorporated into future studies to further the development of consistent hydrologic and hydraulic modeling techniques for the Tri-Town Area, which can promote the solution to drainage and flooding issues at a regional level. It is further noted that more specific descriptions of each basin are provided in subsequent chapters. Figure 2.2 presents the areas of development that have occurred since the 1999 master plan study was completed.

2.2 Land Use and Percent Imperviousness

Figure B.1.1 in Appendix B.1 illustrates the existing condition land use within the study area. As shown on Figure B.1.1, approximately 30% of the study area is currently developed, with the majority of the developed areas located within the Tri-Town and Godding Hollow Basins. Existing land use within the study area consists of agriculture, open space, residential, commercial, industrial, and public (schools, government, right of way) zoning. Areas that are currently undeveloped consist mostly of agriculture, estate lots, and some open space.

Future land use values were based on the current community comprehensive land use and zoning plans. Digital copies of the comprehensive land use and zoning plan maps utilized for this study have been provided in Appendix J. Figure B.1.2 in Appendix B.1 illustrates the proposed land use within the study area. As shown on Figure B.1.2, much of the currently undeveloped land is slated for future development. Based on the current comprehensive land use and zoning plans, ultimate buildout will result in approximately 70% of the planning areas being developed.

Percent impervious values for existing and proposed future land use categories were determined based on values provided in the Mile High Flood District's Urban Storm Drainage Criteria Manual (USDCM). Review of the land use classifications and associated percent impervious values was conducted with staff from each community prior to developing the hydrologic subbasin parameters. Table 2.2 provides the land use categories and corresponding percent imperviousness values utilized for this OSP study. It is noted that values reported in Table 2.2 generally match the values utilized for the Erie OSP study, which provides consistency in hydrologic modeling between the studies. More detailed information with respect to the percent impervious values for each basin is provided in the chapters documenting the individual basins.

Table 2.2 Land Use and Percent Imperviousness Values

Land Use Category	% Imperviousness
Agriculture/Estate Residential	2-12
Parks/Open Space	10
Rural Residential	20
Single Family Detached	30
Single Family Attached	45
Multi Use	40-50
Public/Semi-Public	50
Medium Residential	55
Multi-Family Residential	75
Business Park/Light Industrial	75-80
Commercial	85
Pond	90
Streets/Pavement*	100

*Generally incorporated as part of other land use categories

Hydrologic soil information utilized for the study was obtained through the Natural Resources Conservation Service (NRCS) Soil Data website. The Hydrologic Soil Group (Type A, B, C, and D) coverages for the OSP study area were obtained from the GIS information downloaded from the NRCS website and used to define infiltration rates as part of the hydrologic subbasin parameters. Figure B.1.3 in Appendix B.1 illustrates the Hydrologic Soil Group coverages obtained from the NRCS Soil Data website for the current study area.

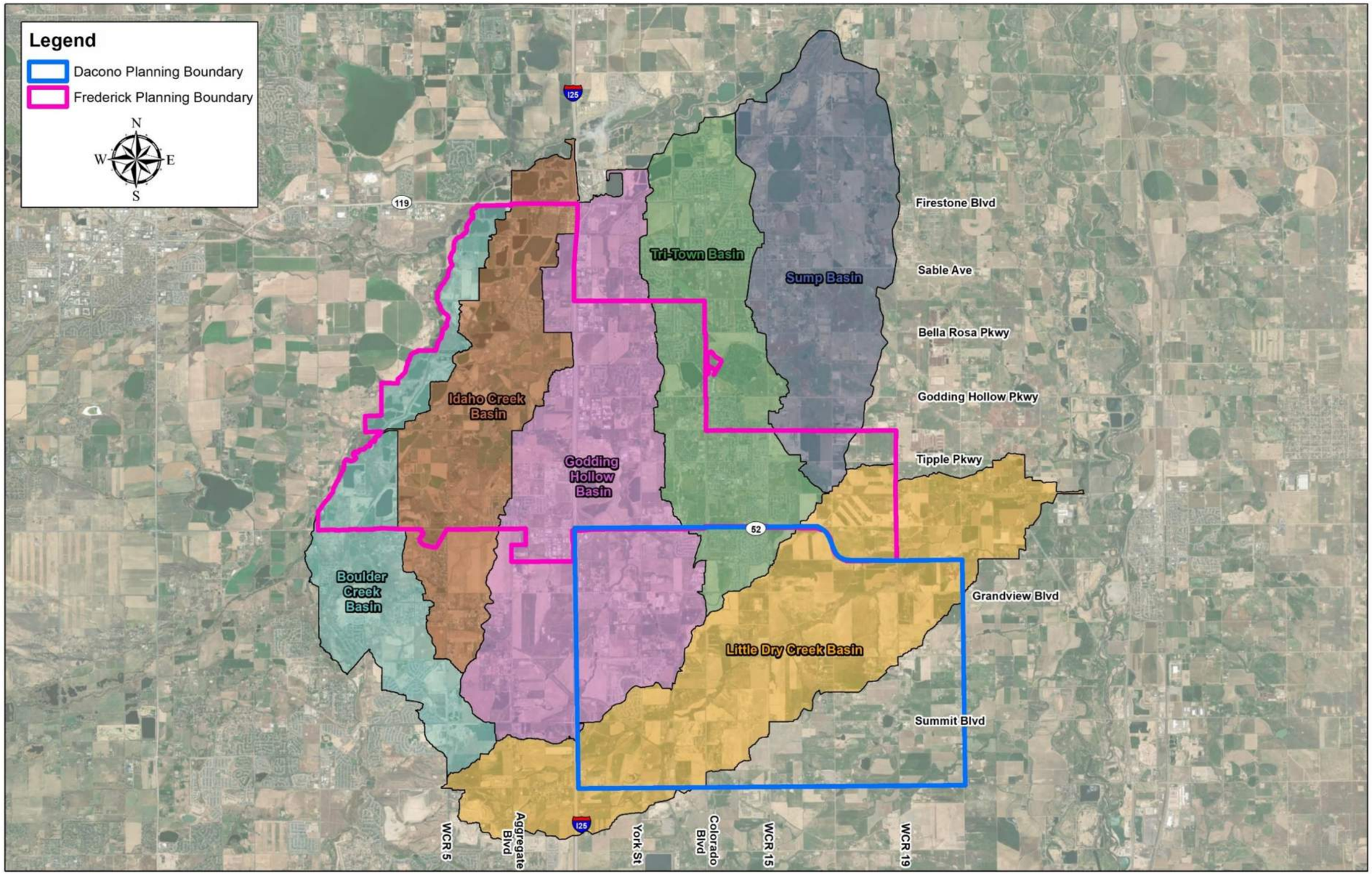

Figure 2.1 Study Area

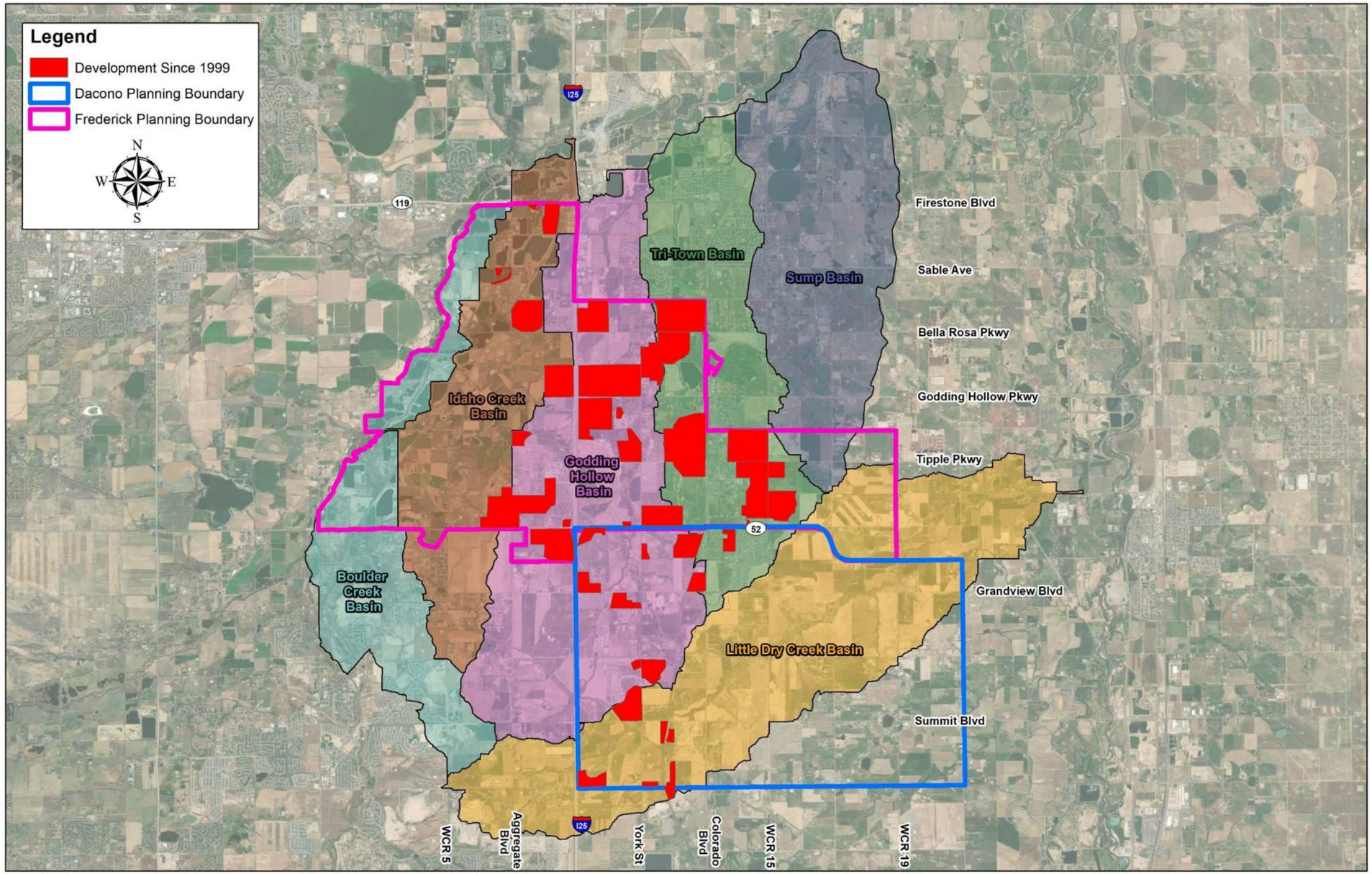

Figure 2.2 Major Areas of Development Since 1999

2.3 Major Drainageway/Outfall Descriptions

As shown on Figure 2.1, this OSP study area covers six individual watersheds. The Tri-Town, Godding Hollow, Idaho Creek, and Sump Basins generally drain to the north and are direct tributaries to St. Vrain Creek. The upper portion of the Boulder Creek Basin evaluated as part of this study generally drains to the northeast and is tributary to Boulder Creek. Boulder Creek confluences with St. Vrain Creek on the south side of State Highway 119. Little Dry Creek generally drains northeast and is a tributary to the South Platte River. More specific basin and drainageway descriptions are provided in chapters documenting the individual basins.

2.4 Flood History

As previously mentioned, FEMA's Map Service Center was utilized to download the currently effective Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) for the TOF, COD, and portions of unincorporated Weld County located within both community planning areas. According to the currently effective FIS [FEMA, 2016], major floods within Weld County are typically caused by intensive rainstorms or cloudbursts that normally occur between May and August. Runoff from snowmelt can also augment flooding problems caused by rainstorms. Significant floods along the Tri-Area (Tri-Town) Drainageway have occurred in 1957, 1961, 1975, and most recently 2013. In June 1961, between 2 and 4 inches of rain fell within a 2-hour period and caused flooding in Firestone, Frederick, and Dacono. In September 2013, a multi-day rainfall event caused significant flooding and damage along the Colorado Front Range. This flood event caused several roadway embankments within the study area to wash out. An example of a washed-out roadway along the Godding Hollow Drainageway resulting from the 2013 is shown in Figure 2.3.

Review of the effective FIS and FIRMs revealed that detailed and approximate flood hazards have been developed for some of the flooding sources within the current study area. As shown on Figure B.2.1 in Appendix B.2, flood hazard information and floodplain delineations have been developed for the following flooding sources:

- Boulder Creek – approximate floodplain mapping from the confluence with St. Vrain Creek upstream to County Road 20.5;
- Boulder Creek – detailed floodplain mapping with Base Flood Elevations (BFEs) and a floodway from County Road 20.5 upstream to the Weld/Boulder County boundary;
- Godding Hollow – approximate floodplain mapping from the confluence with St. Vrain Creek upstream to County Road 16;
- Tri-Area (Tri-Town) Drainageway – detailed floodplain mapping with BFEs and a floodway from downstream of County Road 18 upstream to Second Street in the COD; and
- Little Dry Creek – approximate floodplain mapping from downstream of State Highway 52 (Hwy 52) upstream to the Weld/Broomfield County boundary.

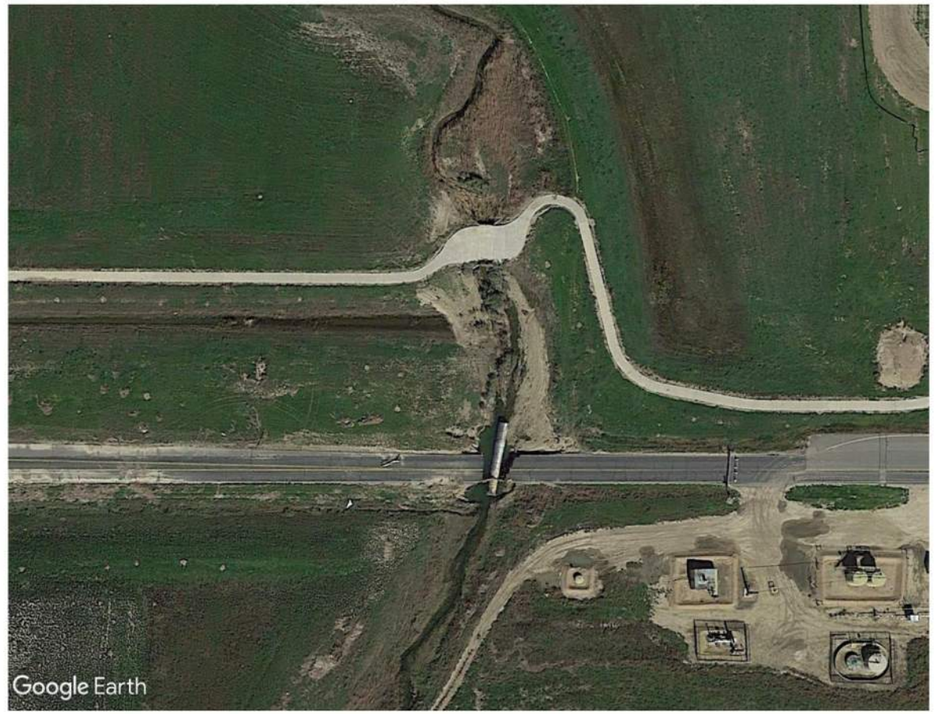

Figure 2.3 Washed Out Crossing of Godding Hollow Parkway (WCR 18) From 2013 Flood

The effective detailed analysis for Boulder Creek was conducted by the Soil Conservation Service in 1974 and the detailed analysis for the Tri-Town Drainageway was conducted by Gingery Associates, Inc. in 1977. The approximate floodplain delineation on Godding Hollow and Little Dry Creek were conducted as part of the hydraulic analysis for the original FIS that went effective for these communities in 1979. It is noted that an updated detailed study of Boulder Creek was recently completed by AECOM in 2018 as part of FEMA's RiskMAP project. This study updated the detailed floodplain mapping, BFEs, and floodway along Boulder Creek from the confluence with St. Vrain Creek to approximately 11 miles upstream of the Weld/Boulder County boundary. A preliminary FIS and FIRMS for this study were issued by FEMA in August 2020, with the formal adoption of this study still pending. The preliminary floodplain mapping associated with the 2018 study is illustrated on Figure B.2.2 in Appendix B.2.

It is important to reiterate that this OSP study did not reevaluate existing regulatory floodplains, nor did it develop any new flood hazard mapping within the study area. It is recommended that additional studies be conducted to update, or identify currently unmapped flood hazards, within the study area utilizing the updated hydrologic analysis associated with this report. It is further recommended that future developments be required to evaluate the potential for unmapped flood hazards on undeveloped sites to ensure future developments are constructed such that they are not susceptible to flooding. Further information with respect to these recommendations is provided in Chapter 13.

2.5 Environmental Assessment and MS4 Permitting

The U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) database was utilized to develop the wetland mapping shown on Figure B.3.1 in Appendix B.3. In general, the wetland mapping appears to be consistent with aerial imagery and present-day site conditions. However, some inconsistencies in the mapping were noted in the Idaho Creek Basin where gravel mining operations have been occurring. It is recommended that more detailed, site-specific environmental assessments be conducted as new drainage projects and developments are constructed.

As part of the Clean Water Act, the United States Environmental Protection Agency (EPA) authorized the creation of the Municipal Separate Storm Sewer System (MS4) permit system to authorize public entities to discharge pollutants from public stormwater systems to waters of the United States. MS4 systems are defined as "conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, man-made channels, or storm sewers) that are designed or used for collecting or conveying stormwater and are owned and operated by a city, county, or other governmental entity". The permit requires the permittee to determine and implement Best Management Practices (BMPs) to reduce the quantity of pollutants entering into and/or discharging from MS4s.

The EPA's implementation of the MS4 program was conducted in two phases. The first phase became regulatory in 1990 and targeted large and medium MS4 systems, which are defined based on the population served. Large MS4 systems were defined as cities and counties with populations of 250,000 or more. Medium MS4 systems were defend as cities and counties with populations between 100,000 and 250,000. The second phase of the EPA's implementation program became regulatory in 1999 and targeted the smaller MS4 systems. A small community is required to enter the program if it falls within a census designated population of 10,000 or more and has an urban area population density of at least 1,000 people per square mile.

Based on the 2020 census, it is presumed that the City of Dacono's population will remain under the MS4 threshold. However, it is anticipated that the Town of Frederick's population will surpass the threshold criteria and that the Town will be designated to become included as part of Weld County's MS4 Phase II Stormwater Management Program. Once designated, Frederick will be responsible to identify what the Town will be committed to achieving for each of the six Minimum Control Measures (MCMs) as part of their Colorado Department of Public Health & Environment (CDPHE) MS4 Phase II Permit. A summary of the six MCMs are provided below. Further information with respect to these six MCMs can be found on the EPA's website.

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

The following provides a summary of the EPA's process that will need to be followed once Frederick has been designated to be included as part of program:

1. A Notice of Intent (NOI) will serve as the application for the general permit. The permittee complies with the permit requirements by submitting an NOI to the National Pollutant Discharge Elimination System (NPDES) permitting authority that describes the stormwater management plan, including BMPs and measurable goals. A Phase II permittee has the flexibility to develop an individualized stormwater program that addresses the particular characteristics and needs of its system, provided the basic requirements of the general permit are satisfied.

2. The Phase II permittee has the option of relying on other entities already performing one or more of the minimum control measures, provided that the existing control measure, or component thereof, is at least as stringent as the Phase II rule requirements. For example, a county may already have an illicit discharge detection and elimination program in place and may allow an operator of a regulated small MS4 within the county's jurisdiction to rely on the county program instead of formulating and implementing a new program. In such a case, the permittee would not need to implement the particular measure but would still be ultimately responsible for its effective implementation. For this reason, the EPA recommends that the permittee enter into a legally binding agreement with the other entity. If the permittee chooses to rely on another entity, they must note this in their permit application and subsequent reports. A Phase II permittee may even rely on another governmental entity regulated under the NPDES storm water program to satisfy all of the permittee's permit obligations. Should this option be chosen, the permittee must note this in its NOI, but does not need to file periodic reports.

3. The operator of a regulated small MS4 has the flexibility to determine the BMPs and measurable goals, for each minimum control measure, that are most appropriate for their system. The chosen BMPs and measurable goals, submitted in the permit application, become the required stormwater management program; however, the NPDES permitting authority can require changes in the mix of chosen BMPs and measurable goals if all or some of them are found to be inconsistent with the provisions of the Phase II Final Rule. Likewise, the permittee can change its mix of BMPs if it determines that the program is not as effective as it could be.

4. Reports must be submitted annually during the first permit term. For subsequent permit terms, reports must be submitted in years 2 and 4 only, unless the NPDES permitting authority requests more frequent reports. The reports must include the following:
    - The status of compliance with permit conditions, including an assessment of the appropriateness of the selected BMPs and progress toward achieving the selected measurable goals for each minimum measure.
    - Results of any information collected and analyzed, including monitoring data, if any.
    - A summary of the stormwater activities planned for the next reporting cycle.
    - A change in any identified BMPs or measurable goals for any minimum measure.
    - Notice of relying on another governmental entity to satisfy some of the permit obligations (if applicable).

5. Operators of regulated small MS4s in urbanized areas, whether automatically designated or designated by the permitting authority, should have submitted their permit applications within 90 days of permit issuance. Regulated small MS4 stormwater management programs should be fully developed and implemented by the end of the first permit term, typically a 5-year period.

6. The operator of a regulated small MS4 is required to obtain an NPDES permit that is federally enforceable, thus subjecting the permittee to potential enforcement actions and penalties by the NPDES permitting authority if the MS4 operator does not fully comply with application or permit requirements. This federal enforceability also includes the right for interested parties to sue under the citizen suit provision of the CWA.

Within Weld County, the following communities currently have MS4 permits:

- City of Greeley
- City of Evans
- City of Longmont
- City of Brighton
- Town of LaSalle
- Town of Erie
- Town of Windsor
- Town of Firestone

As Frederick becomes designated for inclusion in the program, it is recommended that the Town seek out advice from the County and adjacent judications to develop their MS4 program. The information provided as part of this study can be utilized to help Frederick identify, monitor, and manage the existing MS4 systems within their jurisdiction. In addition, the design and construction of the capital improvement projects identified as part of this study can further provide opportunity for the Town to achieve its goals with respect to the six community MCM goals.

3 Hydrologic Analysis

3.1 Overview

The goal of the baseline and future condition hydrologic analyses and modeling efforts was to develop peak discharges and hydrograph data at pertinent locations throughout each drainage basin. This information, combined with the capacity estimation of existing drainage facilities, was utilized to identify existing flooding problems, and predict future flooding problems based on ultimate buildout of the communities. The identification of existing and future condition flooding problems facilitated the development of a preferred plan of improvements to address these problems as buildout occurs. The hydrologic analyses associated with this OSP study were conducted in accordance with current community development standards and the Mile High Flood District's Urban Storm Drainage Criteria Manual (USDCM).

The modeling approach chosen to simulate runoff generated within, and routed through, the studied watersheds involved the application of two computers models: the Colorado Urban Hydrograph Procedure (CUHP, Version 2.0.1) and the EPA Storm Water Management Model (SWMM, Version 5.1.015). The CUHP modeling software was utilized to generate subbasin runoff hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms for existing and future land use conditions within each subbasin. The subbasin runoff hydrographs generated from CUHP were written to an input "interface file" that was imported into the SWMM model. The SWMM model combines and routes the individual subbasin hydrographs through the defined storm drainage system, which generally consists of channels, storm sewers, and detention ponds. Results of the SWMM modeling effort define the peak discharges and hydrograph data at pertinent locations for further evaluation.

Headwaters of the Godding Hollow, Idaho Creek, Little Dry Creek, and Boulder Creek Basins are located in the Town of Erie and its associated planning area. Hydrologic and hydraulic results from the recently completed Erie OSP study were utilized to define input hydrographs for drainageways that cross the planning boundary of Erie and enter into the TOF and COD planning boundaries. More specific descriptions of the hydrologic modeling associated with each watershed is provided in chapters documenting the individual basins.

3.2 Design Rainfall

The rainfall design storms used in the hydrologic analysis of this OSP study were based on one-hour rainfall depths for the 2-, 5-, 10-, 50-, and 100-year design storms from the NOAA Atlas 14, Volume 8, Version 2 Precipitation-Frequency website. Use of the Atlas requires a geographical location (latitude and longitude) to be entered to determine rainfall depths. As shown on Figure B.4.1 in Appendix B.4, the centroid of each watershed was determined using GIS software and the latitude/longitude of each basin centroid was input into the NOAA Atlas to obtain the one-hour rainfall depths for each watershed. Since this OSP study did not evaluate the entirety of the Boulder Creek watershed, precipitation values reported in the Erie OSP were utilized for this study to maintain consistency. Design rainfall depths utilized for this study are presented in Table 3.1. As shown in Table 3.1, the rainfall depths do not vary significantly across the OSP study area. The CUHP modeling software was used to develop a two-hour rainfall distribution from the one-hour rainfall depths. Further documentation regarding the one-hour rainfall depth information downloaded from the NOAA Atlas 14 website can be found in Appendix B.4. To provide conservatism and consistency with the Erie OSP study, and since the watershed areas analyzed as part of this OSP are only portions of the larger watershed and less than 15 square miles in size, a Depth Reduction Factor (DRF) was not applied to the values presented in Table 3.1.

Table 3.1 One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Tri-Town (TT)	0.82	1.10	1.39	2.25	2.71
Godding Hollow (GH)	0.818	1.11	1.39	2.25	2.69
Idaho Creek (IC)	0.815	1.10	1.39	2.27	2.73
Sump (SB)	0.823	1.10	1.39	2.25	2.71
Little Dry Creek (LDC)	0.822	1.11	1.38	2.22	2.65
Boulder Creek (BC)*	0.81	1.11	1.39	2.25	2.70

*Rainfall depths obtained from Erie OSP Study

3.3 Subbasin Characteristics

The simulation of subbasin runoff with the CUHP modeling software requires the definition of several hydrologic parameters for each individual subbasin. These parameters include the following:

1. Subbasin area (square miles).
2. Length to Centroid (distance in miles from basin outlet to the subbasin centroid along main drainageway).
3. Length (distance in miles from basin outlet to the furthest point in the basin along the main drainageway).
4. Slope (length-weighted, corrected average slope of basin, in feet/feet).
5. Percent Impervious (portion of basin that is impervious, in percent).
6. Depression Storage (maximum depression storage of basin pervious and impervious areas, in inches).
7. Soil infiltration parameters.
   7.1. Initial Infiltration Rate (initial infiltration rate for pervious surfaces, in inches/hour).
   7.2. Infiltration Decay Rate (exponential decay for Horton's equation, in "per second" units).
   7.3. Final Infiltration Rate (final infiltration rate for pervious surfaces, in inches/hour).

General discussion of the development of these parameters is provided in the subsequent sections. More specific information related to the development of hydrologic parameters for each of the six studied watersheds is provided in chapters documenting the individual basins.

3.3.1 Subbasin Delineation

Within the community planning areas, the larger drainage basin areas presented on Figure 2.1 were subdivided into smaller subbasins ranging in size from approximately 3 acres to nearly 345 acres. The average size of delineated subbasins for this OSP study is approximately 75 acres. The delineation of subbasins was based on several considerations that included the location of existing and planned developments/subdivisions, existing/future drainage

facilities, existing/future road crossings, and known flooding problems. The location of these features and the desire to obtain peak discharge data at several design points resulted in the wide range of subbasin areas noted above.

In general, the major and subdivided subbasins from previous drainage studies were utilized as the starting point for the definition of subbasins associated with this study. Since the subbasin delineations from these previous studies utilized topographic data with less resolution than the 2013 LiDAR data obtained for this study, modifications were first made to the previous delineations to have them correlate to the 2013 LiDAR data. Then a land use comparison was conducted to determine areas that have been developed since the completion of the previous studies. Areas that were determined to have been developed since the previous studies were subdivided into their own basins to reflect the development drainage patterns and their associated detention pond locations, if applicable. Development design plans and drawings that were provided by the communities were utilized to inform the basin delineations for those developments that have occurred after the 2013 LiDAR was collected. Further refinement of subbasin delineations was conducted based on site visits and the location of existing and future crossing and drainage facilities.

In the Idaho Creek Basin, the presence of on-going gravel mining operations and reclaimed water storage reservoirs complicated the delineation of subbasins. Typically, berms are constructed around the perimeter of the gravel mines and reclaimed storage reservoirs to eliminate surface runoff from entering the pit or reservoir from the adjacent watershed area. As a result, the gravel pits and reservoirs become their own subbasin sinks that are cut off from the surrounding watershed. It was recognized that assuming these pits and reservoirs were completely full to the overtopping spillway elevation at the time of a significant rainfall event, such that they would contribute runoff to the adjacent drainageway, would be highly conservative; especially if the water surface area of the pit was assumed to be highly impervious due to rain falling on an existing water body. Based on discussion with staff from the TOF, it was determined that the following assumptions would be made relative to existing gravel pits and reservoirs:

- Due to the freeboard that is usually built into the design of gravel pits and reservoirs, and the fact that berms around them do not allow runoff from the surrounding area to enter them, it was assumed that these areas would be able to accommodate the approximate 2.7 inches of rainfall that would fall upon them during a 100-year event without overtopping. As a result, the area of each gravel pit and reservoir within the study area was delineated and assumed to be non-contributing to the runoff within the larger basin.
- For the routing of hydrographs along drainageways that would potentially overtop into the adjacent gravel pits and reservoirs, the gravel pits and reservoirs were assumed to be completely full to the overtopping elevation such that they would not provide attenuation of the flood peak along the drainageway.

As a result of these assumptions, subbasins were delineated around existing gravel pits and reservoirs and shown on the subbasin maps as a non-contributing subbasin. Hydrology calculations for these areas were not conducted nor included in the hydrologic analysis. Most of these areas were located within the Idaho Creek Basin. However, Milavec Reservoir was also considered to be a non-contributing subbasin in the Tri-Town Basin.

3.3.2 Length, Slope, and Imperviousness

Once the subbasins were delineated, GIS software was utilized to determine the centroid of each basin and ascertain the length along the main drainageway to the centroid. Engineering judgment was utilized to define the length to centroid distance for those basins where the basin centroid was not located near the main drainageway path. After the length to centroid and basin length parameters were defined, the topographic information was utilized to define the slope for each basin using the corrected average slope as defined in the USDCM.

Existing and future condition land use maps for the study area are presented as Figures B.1.1 and B.1.2 in Appendix B, respectively. Percent impervious values for each subbasin were calculated by utilizing GIS to intersect the subbasin areas and land use maps to define the different land use areas within each basin. Values reported in Table 2.2 were then applied to determine the corresponding percent impervious value for each subbasin. For subbasins containing more than one type of land use, a composite percent impervious value was computed based on the area of each land use type within the subbasin. This procedure was conducted for both existing and future land use conditions.

3.3.3 Depression Storage

Maximum depression storage for pervious and impervious areas accounts for rainfall that is collected in small surface depressions and does not become part of the subbasin runoff. These losses include water intercepted by trees, bushes, other vegetation, and localized depression in topography. Table 3.2 provides the depression losses recommended for use with CUHP modeling software. It is noted that depression values for some subbasins were changed between existing and future conditions to reflect the proposed development of currently undeveloped areas.

Table 3.2 Recommended Depression Losses for CUHP

Land Cover	Range In Depression (Retention) Losses in inches	Recommended Values for use with CUHP in inches
Impervious		
Large Paced Areas	0.05-0.15	0.10
Roofs-Flat	0.10-0.30	0.10
Roofs-Sloped	0.05-0.10	0.05
Pervious		
Lawn Grass	0.20-0.50	0.35
Wooded Areas and Open Fields	0.2-0.6	0.40

*Table 6-6 from Volume 1 of USDCM

3.3.4 Soil Infiltration

The ability for water to infiltrate into soil is governed by many factors, but is primarily predicated on soil type. Soils composed primarily of silts and clays will infiltrate less water than soils composed primarily of sands and gravels. Antecedent moisture is also a significant factor in soil infiltration rates. As rainfall begins, infiltration rates are higher as the dry soil is able to take on water. As rainfall continues, the soil becomes saturated, and the infiltration rate decreases. The CUHP modeling software incorporates Horton's infiltration equation to simulate the infiltration process. Table 3.3 provides the infiltration parameters recommended for use with the CUHP modeling software based on NRCS Hydrologic Soil Groups.

Table 3.3 Recommended Horton's Infiltration Parameters for CUHP

NRCS Hydrologic Soil Group	Infiltration (inches per hour)		Decay Coefficient (a)
	Initial (f_i)	Final (f_o)	
A	5.0	1.0	0.0007
B	4.5	0.6	0.0018
C	3.0	0.5	0.0018
D	3.0	0.5	0.0018

*Table 6-7 from Volume 1 of USDCM

The Hydrologic Soil Group (Type A, B, C, and D) coverages for the OSP study area were obtained from the GIS information downloaded from the NRCS website and are shown on Figure B.1.3 in Appendix B. GIS was utilized to intersect the subbasin areas and soil map to define the different soil types within each basin. Values reported in Table 3.3 were then applied to determine the corresponding infiltration parameters for each subbasin. For subbasins containing more than one soil type, composite infiltration parameters were computed based on the area of each soil type within the subbasin.

3.4 Hydrograph Routing

Determination of peak discharges and hydrographs at pertinent locations throughout each studied watershed required the use of SWMM (Version 5.1.015). The SWMM model consisted of defining nodes and links that connect the outlets of each subbasin to the modeled drainage paths and facilities within each of the studied basins. Drainage schematics were developed based on information obtained from previous studies, site visits, and other data collected as part of this study. SWMM modeling components utilized to simulate the physical characteristics of each watershed were categorized as the following: conveyance elements (underground culvert/storm sewers and open channels), storage units (detention ponds), junctions (subbasin outlet nodes or pertinent design points), and flow dividers (required at locations where subsurface conveyance elements overflow to surface conveyance elements to maintain continuity). As part of the SWMM model development, a numbering scheme was developed to facilitate the identification of modeling components and maintain consistency between the models developed for each of the watersheds. The general numbering scheme convention for the SWMM modeling components is presented in Table 3.4.

Table 3.4 SWMM Model Numbering Scheme

Number	Description
1-199	Subbasin Number
200-399	Conveyance Elements
400-599	Junctions for Subbasin Hydrograph Inputs and Design Points
600-699	Existing Detention Ponds/Outlets
700-899	Proposed Detention Ponds /Outlets
900-999	Additional Conveyance Elements/Junctions

For conservatism, simplicity, and consistency with the Erie OSP study, the kinematic wave method was chosen as the routing method for the SWMM models developed as part of this study. Use of the kinematic wave method required the definition of flow diversion nodes for conduits that become pressurized and discharge rating curves for simulating detention ponds.

3.4.1 Conveyance Elements

Both open channel and subsurface (culverts and storm sewer) conveyance elements were incorporated into the SWMM modeling components. Information utilized to define the modeled conveyance elements was obtained from the following sources: previous studies, community database information, development drainage reports, site visits, LiDAR data, and survey data collected as part of this study. Typical input for the conveyance elements included geometry, length, and Manning's "n" roughness values. Irregular cross section data derived from the LiDAR data was typically utilized for the geometry of existing open channels. Trapezoidal geometry was typically defined for proposed open channels. Slopes of the conveyance elements are automatically computed by the SWMM model by using the defined channel lengths and invert elevations of the connecting junction nodes.

Manning's "n" roughness values were assigned to the various conveyance elements using generally accepted values. Pipes were assigned a Manning's "n" roughness value based on material composition. PVC and other plastic pipes were assigned a value of 0.011, concrete pipes and box culverts were assigned values ranging from 0.013 to 0.015, and corrugated metal pipes were assigned a value of 0.024. Defined roughness values for roadways varied between 0.016 to 0.020 and concrete lined channels were typically assigned a value of 0.015. Vegetated channels were assigned roughness values ranging from 0.035 to 0.07 depending on the amount of vegetation present, or assumed to present, for proposed future channels. Finally, a roughness value of 0.020 was defined for existing gravel pits and reservoirs where water is flowing over existing water bodies.

3.4.2 Junctions and Flow Dividers

Junctions were defined in the SWMM model at the location of subbasin outlets, roadway crossings, and other pertinent design locations. The x- and y- coordinates of each junction were based on the Colorado State Plane North

coordinate system to develop a geographically referenced model. Invert elevation data for each junction was obtained from ground survey, LiDAR data, or development drainage reports. Maximum depths for each junction were typically set as the "0" default to allow the model to determine the maximum depth based on the geometry of the connecting conveyance elements.

Flow diversion nodes were incorporated into the SWMM modeling components at locations where subsurface conduit flow is routed one direction and excess overflow is routed another direction. These locations typically occur at road crossings where the road culvert conveys a certain amount of flow across the road and the excess flow will continue longitudinally along the upstream side of the roadway until it reaches another crossing location. Cutoff values for the flow diversion nodes were generally set at the capacity of the culvert, which directs the SWMM model to allow flows up to the culvert capacity to pass through the culvert and flows in excess of the culvert capacity to be directed into a separate conveyance element. Culvert capacities were normally determined from another hydraulic program, such as the Federal Highway Administration's (FHWA) HY-8 culvert analysis software.

3.4.3 Detention Ponds

Typically, the development of a master drainage plan would only account for detention provided by large regional facilities that are publicly owned and maintained. However, both the TOF and COD have been requiring on-site detention to be provided as part of development. In addition, recommendations from the 1999 South Weld County Master Plan have resulted in the requirement for developments within the Tri-Town Basin to over-detain 100-year flows down to a 2-year historic release rate. As a result, it was determined that privately owned, on-site detention ponds will have a significant impact on the hydrology of the studied watersheds. Per the scope of services for this project, the TOF and COD desired to have all on-site detention ponds with volumes larger than 2-acre feet included in the study. It is noted that the drainage plans for some of the larger developments and business parks incorporated more than one detention facility. Only those facilities with a storage volume greater than 2-acre feet were incorporated into this study.

Modeling of the detention facilities required the development of stage-storage-discharge rating curves as inputs into the SWMM model. To the extent possible, stage-storage relationships were developed from ground survey and the 2013 LiDAR data to reflect as-built conditions. For developments constructed after 2013, information provided in the approved drainage reports was utilized to define the rating curves. Ground survey and field measurements of the pond outlet structures was collected to define the pond outlet structure geometry for establishing the discharge rating curves. Due to their minimal impact on flood peak attenuation, water quality capture volumes and releases were typically not incorporated into the detention pond rating curves. Per MHFD guidance, inadvertent detention storage behind roadway and railroad embankments was not considered as part of this study.

For the future condition analyses, conceptual on-site detention ponds were incorporated into the SWMM modeling components to simulate the impact of on-site detention as part of future development. The conceptual future on-site detention ponds were typically simulated with a two-point rating curve. The known release rates for the conceptual ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in SWMM. More specific information related to the development of rating curves for detention ponds modeled as part of this study is provided in chapters documenting the individual basins.

3.4.4 Storm Sewer Systems

Where pertinent, existing storm sewer systems were incorporated into the hydraulic analysis and SWMM modeling components. These systems are generally located within the urbanized, downtown locations of Frederick and Dacono. Modeling of the storm sewers only included the mainline and outfall portions of the systems. It was assumed that adequate inlet capacity has been provided and that pipe capacity will govern the flow in these systems. Information utilized to inform the analysis of the storm sewer systems was obtained from survey data collect as part of this study and from design drawings of the systems provided by the communities. More specific information related to the analysis of existing storm sewer systems as part of this study is provided in chapters documenting the individual basins.

3.5 Previous Studies and Analysis Results

The hydrologic results from this OSP study were compared back to the results from previous master planning efforts as listed in Section 1.4.1. Due to the differences in modeling techniques and assumptions between the previous master planning studies and this OSP study, several differences in the hydrologic results were noted. Due to the varying differences from watershed to watershed, more specific information related to the hydrologic results of this OSP study is provided in chapters documenting the individual basins.

4 Hydraulic Analysis

As previously mentioned, this OSP study did not reevaluate existing regulatory floodplains, nor did it develop any new flood hazard mapping within the study area. Therefore, the hydraulic analysis associated with this study focused on the evaluation of existing drainage infrastructure in comparison to existing drainage criteria for each community. It is recommended that additional studies be conducted to update or identify currently unmapped flood hazards within the study area utilizing the updated hydrologic analysis associated with this report. It is further recommended that future developments be required to evaluate the potential for unmapped flood hazards on undeveloped sites to ensure future developments are constructed such that they are not susceptible to flooding. Further information with respect to these recommendations is provided in Chapter 13.

4.1 Inventory of Existing Facilities

As part of this OSP study, a thorough inventory of existing drainage facilities associated with each watershed was conducted. Inventory lists from previous drainage studies were utilized as the starting point for the compilation of a list of drainage facilities to be inventoried as part of this study. Once the initial list was compiled, review of community GIS information and meetings with community staff were conducted to further populate the list. Several site visits were then conducted to obtain photographic documentation of facilities and finalize the inventory list. Where necessary, site-specific ground survey information was collected to facilitate the hydraulic evaluation. General information related to the evaluation of existing drainage facilities is provided below. More specific information related to the existing drainage facility evaluations for each watershed is provided in chapters documenting the individual basins.

4.2 Evaluation of Existing Facilities

The evaluation of existing drainage facilities was conducted with the use of several hydraulic programs as described in the following sections.

4.2.1 Culvert Crossings and Storm Sewers

Due to the decision to utilize the kinematic wave method for hydrograph routing, the use of the SWMM model to evaluate capacities of these system would be limited to pipe full calculations. Since most of these systems will operate under a pressurized condition during major flood events, it was decided that other hydraulic programs would be utilized to determine the capacities of culvert and storm sewer systems associated with this study. FHWA's HY-8 culvert analysis software was utilized to evaluate road crossing culvert capacities and Bentley's StormCAD software was utilized to analyze storm sewer systems. The U.S. Army Corps of Engineers' HEC-RAS software was utizlied to determine capacities of existing bridge crossings. The existing condition analysis resulted in the evaluation of more than 120 individual culvert crossings, bridge crossings, and storm sewer systems. Capacities of the culvert crossings, bridge crossings, and storm sewer systems were then compared to the peak flow estimates at the corresponding nodes in the SWMM model to determine at what storm event the capacity of the existing facility would be exceeded. Results from this analysis were tabulated and have been presented for each watershed in subsequent chapters.

4.2.2 Detention Ponds

With the exception of a few regional detention facilities, the existing condition detention pond evaluation focused on hydraulically analyzing on-site detention ponds associated with existing developments. A list of potential on-site detention pond locations was compiled based on information gathered from meetings with community staff, coupled with the review of aerial imagery and development plan information. Those developments with on-site detention ponds having a minimum storage capacity of 2 acre-feet were then identified for inclusion as part of this study. This evaluation resulted in the modeling and analysis of approximately 50 existing detention pond facilities across the study area. The stage-storage-discharge curves developed for each pond location were incorporated and hydraulically analyzed as part of the existing condition SWMM model. Results of the SWMM model were then compared to detention pond criteria to determine if the pond was operating as designed. Results from this analysis were tabulated and presented for each watershed in chapters documenting the individual basins.

4.2.3 Open Channels

Since this OSP study did not reevaluate or develop new flood hazard mapping along drainageways within the study area, the evaluation of existing open channels was limited to the hydraulic analysis of these channels within the SWMM model network. This was typically conducted by identifying a representative cross section along each conveyance element reach incorporated into the SWMM model. The 2013 LiDAR data was utilized to obtain the geometry for each cross section. Results from the SWMM model were then utilized to develop general conclusions with respect to the capacities of existing open channels. Within currently developed areas, these capacities were used to inform the potential of flooding along open channel sections. In locations where the land adjacent to the channel is currently undeveloped, it is assumed that future developments will be required to evaluate current and proposed floodplain conditions to ensure future developments are constructed such that they are not susceptible to flooding. Results from the open channel capacity analysis are presented in more detail for each watershed in chapters documenting the individual basins.

4.3 Existing Community Drainage Criteria

In order to determine if the existing drainage facilities meet current drainage criteria, a review of the TOF's and COD's drainage criteria was conducted. A summary of the current TOF and COD drainage standards is provided in Tables 4.1 and 4.2, respectively. The current on-site detention requirement was developed based on recommendations provided in 1999 South Weld County Master Plan. Detention recommendations from the 1999 study included the following:

- Future developments in the Tri-Town Basin, south of WCR 18, are required to limit proposed 100-year condition detention pond releases to match the 2-year existing condition peak runoff from the subbasin.
- Future developments in other areas of the communities are required to limit proposed 10-year condition detention pond releases to match the 10-year existing condition peak runoff, and to limit proposed 100-year condition pond releases to match the 100-year existing condition peak runoff from the subbasin.

Table 4.1 Current Drainage Criteria for the Town of Frederick

General Criteria		
Design Storm Definition	**Return Interval**	**Storm Sewer and Inlets**
Minor Storm (excluding detention requirements)	5-year	Storm sewer and inlets shall have a minimum design capacity equal to the minor storm peak flows. Storm sewer pipe material shall be RCP and have a minimum diameter of 15-inches.
Minor Storm (including detention requirements)	10-year	
Major Storm	100-year	
On-site Detention Pond Criteria		
Location		**Criteria**
Tri-Town Basin Properties Located South of Weld County 18		Proposed 100-year release shall be limited to 2-year existing peak subbasin runoff.
All other locations excluding the area noted above		Proposed 10-year release shall be limited to 10-year existing subbasin peak runoff, and proposed 100-year release shall be limited to 100-year existing peak subbasin runoff.
All On-site Detention Ponds		Water quality detention shall be provided per MHFDC guidelines and have minimum holding time of 24-hours and a maximum holding time of 40-hours.
Street Capacity Criteria		
Road Type	**Design Storm**	**Criteria**
Gravel	Major	100-year runoff tributary to borrow/roadside ditches shall be contained entirely within the ditches.
Local Road	Minor	No curb overtopping.
	Major	Overtopping allowed. The maximum depth at the centerline of the roadway may not exceed 0.10 feet.
Collector Road	Minor	No curb overtopping.
	Major	Overtopping not allowed. Flow spread must be contained within ROW. Depth at the flowline must not exceed 18-inches and maintain one 12-foot travel lane open for emergency vehicles.
Arterial Road	Minor	Flow spread must be contained in the ROW and maintain at least one 12-foot travel lane free of water in each direction for emergency vehicles.
	Major	Flow spread must be contained in the ROW and maintain at least one 12-foot travel lane free of water in each direction for emergency vehicles.

Information obtained from Section 900 of Town of Frederick Design Standards and Specifications (2019)

Table 4.2 Current Drainage Criteria for the City of Dacono

General Criteria		
Design Storm Definition	**Return Interval**	**Storm Sewer and Inlets**
Minor Storm	5-year	Storm sewer and inlets shall have a minimum design capacity equal to the minor storm peak flows with no surcharging. Storm sewer pipe material shall be RCP within the ROW and have a minimum diameter of 18-inches for trunk lines, 15-inches for laterals, and 12-inches for detention pond outlets.
Major Storm	100-year	
On-site Detention Pond Criteria		
All detention facilities are to be designed for two storm frequencies: the 10-year and the 100-year recurrence interval floods. Proposed 10-year release shall be limited to 10-year existing subbasin peak runoff, and proposed 100-year release shall be limited to 100-year existing peak subbasin runoff		
Street Capacity Criteria		
Road Type	**Design Storm**	**Criteria**
Type A - Local Road	Minor	No curb overtopping. Flow may spread to crown of street, but not overtop.
	Major	Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the ground line. The depth of water at the gutter flowline shall not exceed twelve inches.
Type B - Collector Road	Minor	No curb overtopping. Flow spread must leave at least one 10-foot lane free of water (five feet either side of street crown).
	Major	Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the ground line. The depth of water at the gutter flowline shall not exceed twelve inches.
Type C - Arterial Road	Minor	No curb overtopping. Flow spread must leave at least two 10-foot lanes free of water (ten feet either side of street crown or median).
	Major	Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the ground line. To allow for emergency vehicles, the depth of water shall not exceed six inches at the street crown and twelve inches at the gutter flowline, whichever is more restrictive.

Information obtained from Section 6 of City of Dacono Standards and Specifications for the Design and Construction of Public Improvements (2010, revised 2019)

The criteria provided in Tables 4.1 and 4.2 were reviewed with community staff and compared to current recommendations provided in the USDCM to determine if adjustments to the current criteria may be warranted. Based on meetings with staff from both communities, it was determined that the current drainage criteria are adequate from a community perspective. However, some slight modifications to the City of Dacono's criteria were identified for the development and evaluation of proposed improvements associated with this OSP study as subsequently noted in Section 5.2.

4.4 Flood Hazards and Hydraulic Modeling Results

Existing flood hazards within the study area were generally determined to occur due to undersized storm sewer systems and culvert crossings. Known flooding problem areas in downtown Dacono and along roadways with inadequate culvert crossings were confirmed as part of this study. Specific flooding problems for each watershed have been discussed in more detail in subsequent chapters. Discussion of current FEMA flood hazard mapping within the study area is presented in Section 2.4 of this report.

5 Formulation of Drainage Improvements

The main goals identified in the development of feasible drainage improvements as part of this OSP study were to increase public safety, reduce flood risk, reduce or eliminate road overtopping, and improve water quality. Based on the results of the existing and future condition hydrologic analyses, as well as hydraulic evaluation of existing drainage facilities, areas with known flooding problems were identified and potential solutions for these locations were developed. Initial screening of alternatives was based on input from community staff, site constraints, and the community criteria presented in Tables 4.1 and 4.2. The selected plan for each basin was reviewed and approved by community staff prior to the development of cost estimates and formulation of the prioritization plan.

5.1 Alternative Analysis

Due to the unique characteristics of each of the six watersheds studied as part of this OSP, the development of proposed drainage improvements was based on a holistic approach for each individual watershed. An initial list of flooding problems within each watershed was identified from the existing and future condition analyses and reviewed with community staff. A list of alternative improvements was then identified based on the design criteria and hydraulically evaluated to develop conceptual designs for each improvement location. In general, the proposed conceptual improvements focused on the following:

- Installation of new, or replacement of, existing undersized road crossings.
- Enlargement of existing undersized storm sewers.
- Construction of regional detention facilities in locations that optimize the reduction in peak discharges along the main drainageway and do not significantly impact the potential for future development.
- Construction of new stormwater channels, where existing channels do not currently exist (enlargement or improvements to existing drainageways is assumed to be conducted as development occurs along the properties adjacent to these channels).

5.2 Design Criteria

The design and evaluation of proposed improvements was primarily based on the TOF and COD development criteria provided in Tables 4.1 and 4.2. However, some modifications to the City of Dacono's current criteria were made for this OSP study to provide consistency for the detention requirements in the Tri-Town Basin and the overtopping requirement along shared roadway crossings. The following provides a summary of the criteria utilized for the development and analysis of proposed improvements associated with this OSP Study:

- Proposed condition 100-year peak flows, as determined from the proposed improvement SWMM models, were utilized to conceptually design all proposed improvements.
- Conceptual on-site detention is assumed for all future development as part of the future condition/proposed improvement analyses.
    - In the Tri-Town Basin, future developments located south of WCR 18 are required to provide on-site detention to limit the 100-year proposed to the 2-year existing peak subbasin runoff rate. This requirement was also applied to subbasins located within the City of Dacono to provide consistent detention requirements throughout the basin, and to reduce future flood peaks within the downtown area of Dacono for proposed improvements.
    - Detention requirements for future developments elsewhere in the study area are required to provide on-site detention to meet the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing criteria.
    - Water quality capture volumes and excess urban runoff volumes were not incorporated into the conceptual on-site detention ponds curves developed for this study. However, it is recommended that future development be required to include water quality capture volumes within storm water detention facilities.
- Within the TOF, improvements to arterial roadways will be designed to convey the 100-year flow without overtopping.
- Shared crossing improvements along State Highway 52 will be designed to convey the proposed improvement 100-year peak flow without overtopping the roadway. It is recognized by both communities that this roadway is a critical connection to Interstate 25 and should not be overtopped during the 100-year flood event to provide emergency access.
- As part of this OSP study, the City of Dacono requested that a sensitivity analysis be performed to determine if their current overtopping criteria for arterial roadways (other than Hwy 52) should be adjusted for the development of conceptual capital improvement projects associated with this study. Results of the sensitivity analysis resulted in the following decisions for the design of conceptual crossing improvements for arterial roadways within the City of Dacono planning area:
    - Culvert improvements will be designed, at a minimum, to pass the 10-year event without overtopping the road.
    - Overtopping of the roadway during the 100-year event will be limited to no more than 12 inches. During the final design of these crossing improvements, efforts should be made to reduce the 100-year road overtopping to 6 inches or less to adhere to Dacono's current criteria reported in Table 4.2.

5.3 Recommended Plans

Results of the alternative analyses were reviewed with community staff and a recommended plan of improvements were identified for each individual watershed. For a few of the proposed improvements, alternative solutions were presented for further analysis as part of the preliminary and final design of these projects. The recommended plan of improvements for each watershed are discussed in more detail in chapters documenting the individual basins.

5.4 Cost Estimation

Estimates of cost for the recommend plan of improvements were developed through the use of the MHFD's UD-MP Cost Spreadsheet (Version 2.2) and CDOT Cost Data Books with adjustments per the CDOT 2021 Quarter 2 Construction Cost Index. Base capital improvement costs for each proposed project were developed by estimating the capital improvement quantities from the conceptual design and multiplying these quantities by the associated unit costs from the MHFD cost spreadsheet. A table of these unit costs has been provided in Appendix B.5. Asphalt removal and replacement costs were not included in the general unit costs of the MHFD cost spreadsheet. Therefore, bid quotes from recent projects were utilized to generate these unit costs.

The MHFD cost spreadsheet also includes the ability to incorporate additional capital improvement costs typically associated with construction projects. These cost categories, and how they were estimated, are as follows:

- Dewatering – user defined (typically based on a percentage of the subtotal of capital costs at the judgement of the engineer developing the estimate and is based on the assumed need for dewatering to construct the project).
- Mobilization – 5% of the subtotal of capital improvement costs (set by MHFD spreadsheet).
- Traffic Control - user defined (typically based on a percentage of the subtotal of capital costs at the judgement of the engineer developing the estimate and is based on the assumed need for traffic control to construct the project).
- Utility Coordination/Relocation - user defined (typically based on a percentage of the subtotal of capital costs at the judgement of the engineer developing the estimate and is based on assumed need for utility coordination and relocation to construct the project).
- Stormwater Management/Erosion Control - 5% of the subtotal of capital improvement costs (set by MHFD spreadsheet).
- Land/ROW Acquisition – user defined (estimated based on the Weld County appraised property value data and generally associated with assumed land acquisition needs for the construction of new drainage channels or regional detention ponds).

The above costs were summed to develop a total cost of capital improvements for each project. These total capital improvement costs were then utilized to estimate costs associated with design, permitting and administration of the project as follows:

- Engineering – 15% of total capital improvement costs (set by MHFD spreadsheet).
- Legal/Administration – 5% of total capital improvement costs (set by MHFD spreadsheet).
- Contract Administration/Construction Management – 10% of total capital improvement costs (set by MHFD spreadsheet).
- Contingency – 25% of total capital improvement costs (set by MHFD spreadsheet).

These general cost assumptions were reviewed with community staff. It was discussed that some of the cost percentage assumptions set by the MHFD in the cost spreadsheet appear to be developed for construction projects in highly urbanized areas and are likely conservative for most projects associated with this OSP study. However, it was also recognized that construction costs have risen considerably in the past few years due to inflation and construction material shortages and that these recent construction cost increases are not reflected in the MHFD cost spreadsheet. Therefore, it was agreed that the conservative cost percentage assumptions set by the MHFD in the cost spreadsheet should help offset the recent increase in construction costs, and the default cost percentage assumptions will be utilized for this OSP study.

Several crossing improvements were identified that cross between two community jurisdictions. These crossing are generally located along Hwy 52 and Colorado Boulevard. For these crossing improvements, cost estimates were split between each community based on the length of the proposed improvement within each community. The centerline of the roadway was typically considered to the dividing line between community boundaries. Cost estimates allocated to the Town of Erie and Town of Firestone for portions of the proposed improvements within their jurisdictions has been presented for informational purposes. It is recognized that proposed improvements that span multiple jurisdictions will require coordination and approval from these adjacent jurisdictions as part of the design and construction process. The cost estimates developed for the recommended plan of improvements for each watershed are discussed in more detail in chapters documenting the individual basins.

5.5 Implementation Planning

To promote the construction of drainage improvements as funding becomes available, priorities were established to develop a sequencing plan for the implementation of projects both within a single watershed and across the entire OSP study area. Since the TOF and COD will be responsible for the construction of improvements within their jurisdictions, separate sequencing plans were developed for each community. Based on input from community staff, the following four categories and associated scoring methods were utilized to develop a total prioritization score for each project. Higher scores indicate a higher priority for the implementation of a project.

- Category 1 (Scores 1 to 5): **Risk** – the potential impact to the community or private property if the improvement is not made:
  - 1 = Low risk impact.
  - 2 = Minor risk impact.
  - 3 = Moderate risk impact.
  - 4 = High risk impact.
  - 5 = Very high risk impact.
- Category 2 (Scores 1 to 3): **Cost** – estimate of total cost to construct the project:
  - 1 = Total project cost is greater than $1,000,000.
  - 2 = Total project cost is between $500,000 and $1,000,000.
  - 3 = Total project cost is less than $500,000.

- Category 3 (Scores 1 to 3): **Alternative Funding Availability** – the ability for project funding to be shared between communities or other funding sources (state/federal grants, low interest rate loans, etc.):
  - 1 = Unlikely cost sharing ability (community funding only).
  - 2 = Potential cost sharing between communities or other funding sources.
  - 3 = High likelihood of cost sharing between communities or other funding sources.
- Category 4 (Scores 1 to 3): **Community Implementation Time frame** – time frame in which community anticipates the project to be implemented:
  - 1 = Long-term time horizon (20 years or more).
  - 2 = Mid-Term time horizon (between 10-20 years).
  - 3 = Short-Term time horizon (less than 10 years).

In cooperation with community staff, scores for each of these four categories were assigned to the recommend plan of improvements for each watershed. Projects were then ranked according to their total scores to develop a sequencing plan for each basin, as well as across the entire OSP study area. Project sequencing plans for each individual watershed are discussed in more detail in chapters documenting the individual basins. A total project sequencing plan for the entire OSP study area is provided and discussed for both communities in Chapter 12.

6 Tri-Town Basin (TT)

6.1 Project Area

Figure 6.1 shows the extents of the Tri-Town Basin and its geographical relation to the TOF and COD planning boundaries. The headwaters of the Tri-Town Basin are located south of State Highway 52 (Hwy 52), and entirely within the COD planning area. Therefore, incorporating inflows from the Erie OSP study was not necessary for the modeling of the Tri-Town Basin. The Tri-Town Basin encompasses approximately 7,720 acres and is the most populated basin of all those included as part of this OSP study with the downtown areas of Dacono, Frederick, and Firestone located within the basin boundaries. Runoff from the basin predominately flows south to north. Numerous county roads, Hwy 52, and irrigation ditches/canals cross the major drainageway and its tributaries. These crossings tend to constrict the channel and create overtopping and flooding issues during major storm events. Two irrigation ditches, the Stanley Ditch and the Lower Boulder Ditch (which becomes the New Coal Ridge Ditch just west of Colorado Boulevard) traverse the Tri-Town Basin within the study area. These ditches convey irrigation flows within and through the basin, but offer limited value as drainage features that will convey stormwater runoff during major flood events. Due to the limited capacity of the ditch systems, coupled with the magnitude of stormwater flows, these irrigation ditches were assumed to not significantly influence drainage patterns within the basin and flows were routed over them.

The major drainageway for the Tri-Town Basin originates just south of Hwy 52 where runoff generated from south of Dacono combines with runoff generated from the urbanized area of downtown Dacono and is conveyed to a sump location at 8th Street, between Birch Avenue and Cherry Street. A series of culverts is used to convey flow across Hwy 52, where it flows through an improved stormwater channel to Centennial Park, just south of downtown Frederick. An eastern tributary of the basin confluences with the main drainageway at Centennial Park, where a regional stormwater detention pond was constructed in 2003 to attenuate flood peaks. Outflow from the regional pond is directed into the Tri-Town Channel which parallels the east side of Colorado Boulevard from Eighth Street north to Godding Hollow Parkway (WCR 18). The Tri-Town Channel crosses several major roadways including Fifth Street, Tipple Parkway (WCR 16) and McClure Avenue. The channel intercepts drainage outfalls from basins located to the east and west of Colorado Boulevard, including four major storm sewer outfalls servicing the downtown areas of Frederick and Firestone.

Approximately 300 feet south of Godding Hollow Parkway (WCR 18), the Tri-Town Channel discharges into a large culvert crossing of Colorado Boulevard and Godding Hollow Parkway that was built in 2004. North of Godding Hollow Parkway, the main channel flows around the eastern side of Milavec Reservoir and confluences with No Name Creek near the Bella Rosa Golf Course. North of the golf course, the drainageway crosses Bella Rosa Parkway (WCR 20) and flows through the No Name Creek Subdivision prior to exiting the Frederick planning area.

6.2 Previous Studies

In 1999, Anderson Consulting Engineers, Inc. completed the most recent stormwater master drainage plan for the Tri-Town Basin. The study, "I-25 Corridor Master Drainage Plan, Godding Hollow and Tri-Town Basins", was conducted for Weld County with the goal of providing a regionalized plan for stormwater improvements within the Godding Hollow and Tri-Town Basins. The 1999 study formed the basis of the Tri-Town Basin analysis conducted as part of this OSP study.

The recommended plan from the 1999 study identified several flood improvement projects within the TOF and COD portion of Tri-Town basin. Three of these improvements, which have been implemented, included: 1) construction of channel improvements between Hwy 52 and Centennial Park; 2) construction of a regional detention pond at Centennial Park; and 3) construction of a 100-year crossing structure at the Colorado Boulevard/Godding Hollow Parkway crossing. These improvements have greatly contributed to the reduction of flood risk within the basin, north of Hwy 52.

As noted in Table 4.1, the 1999 plan also recommended that future development within the Tri-Town Basin, south of Godding Hollow Parkway (WCR 18), be required to provide on-site detention to limit proposed/developed 100-year flows to existing/pre-development 2-year peak subbasin runoff rates. With the adoption of this policy, current 100-year peak discharge rates are significantly lower than they otherwise would have been with the development that has occurred since 1999; 100-year peak discharges will continue to decrease within the basin as development progresses. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

6.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Tri-Town Basin is presented in the following sections.

6.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Tri-Town Basin are presented in Table 6.1.

Table 6.1 Tri-Town Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Tri-Town (TT)	0.82	1.10	1.39	2.25	2.71

6.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 6.1, the larger Tri-Town Basin was subdivided into smaller subbasins for the hydrologic analyses. The definition of smaller subbasins was conducted for the approximate 3,800 acres of the basin located within the TOF and COD planning areas. At the northeastern end of the study area, modeling of subbasins within an approximate 1,200-acre area of the Town of Firestone, and its associated planning area, was necessary to define the contribution of runoff from this area to the main channel located within the TOF planning area. In total, 97 subbasins were

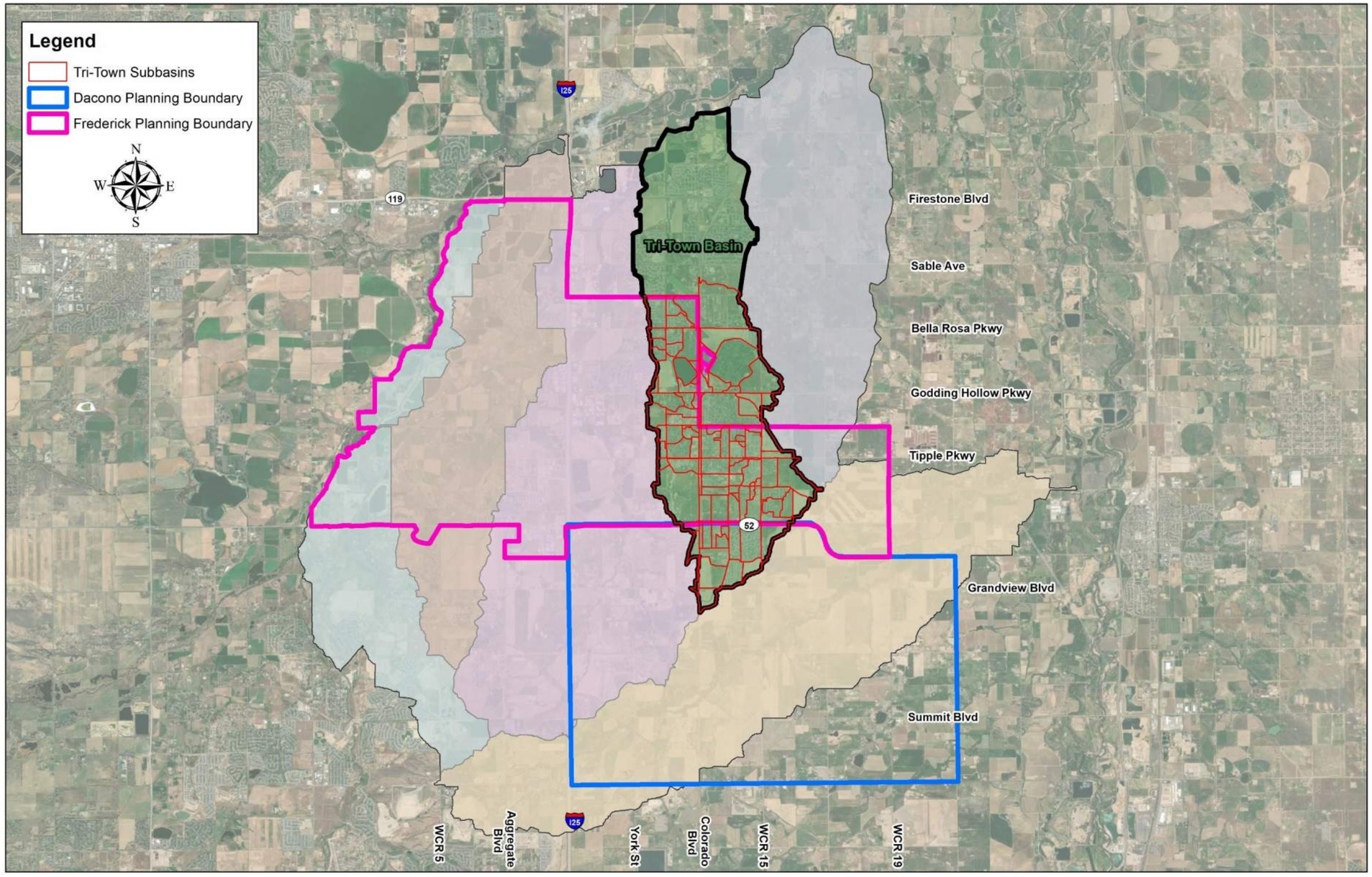

Figure 6.1 Tri-Town Basin Study Area

delineated for the Tri-Town Basin, with an average basin size of approximately 50 acres. As discussed in Section 3.1.1, the subbasin surrounding the Milavec Reservoir was considered to be non-contributing and not included in the hydrologic analysis. Detailed subbasin maps are provided in Appendix C.1.

Hydrologic modeling parameters, existing land use, and soil parameters were developed for each subbasin based on the procedures outlined in Section 3.3 of this report. These hydrologic parameters, and the rainfall depths reported in Table 6.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Results from the initial CUHP analysis were checked for reasonableness and adjustments to the parameters were made, as necessary. Table C.1.1 in Appendix C.1 presents the final Tri-Town hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table C.1.1, the average existing condition percent impervious value for the basin is 24%, with an average unit runoff rate for the 100-year storm of 1.53 cfs/acre.

6.3.3 Inventory of Existing Drainage Facilities

A thorough inventory of existing drainage facilities within the Tri-Town Basin was conducted as part of this study and utilized to develop the drainage network incorporated into the SWMM models. Inventory of existing crossing structures and detention ponds followed procedures outlined in Section 4.1 of this report and typically included site survey and photographic documentation, which have been digitally provided as part of Appendix J. FHWA's HY-8 culvert analysis software was utilized to evaluate road crossing culvert capacities and Bentley's StormCAD software was utilized to analyze storm sewer systems. Detention pond stage-storage relationships were developed from ground survey and the 2013 LiDAR data to reflect as-built conditions. For developments constructed after 2013, information provided in the approved drainage reports was utilized to define detention pond rating curves. Ground survey and field measurements of pond outlet structures was collected to define the outlet geometry for establishing the discharge rating curves for the detention ponds. It is noted that the drainage plans for some of the larger developments and business parks included more than one detention facility. Only those facilities with a storage volume greater than 2-acre feet were incorporated into this study.

Inventory of the existing drainage facilities within the Tri-Town Basin resulted in the evaluation of 38 individual crossing structures and 27 detention ponds. Maps depicting the locations of the existing crossings and detention basin facilities are provided in Appendix C.1. Table C.1.2 in Appendix C.1 provides detailed information on the existing condition crossing structure characteristics and capacity analysis. Additional documentation for the development of the stage-storage-discharge curves for each individual pond is also provided in Appendix C.1. HY-8 and StormCAD models utilized to evaluate the existing culvert improvements are provided digitally in Appendix J.

6.3.4 SWMM Model Development

Determination of peak discharges and hydrographs at pertinent locations required the use of SWMM (Version 5.1.015). Development of the Tri-Town Basin existing condition SWMM model, based on information obtained from previous studies, site visits, and other data collected as part of this study, followed the general procedures described in Section 3.4 of this report. Since the headwaters of the Tri-Town Basin are located entirely within the COD planning area, it was not necessary to incorporate inflows from the Erie OSP study into the Tri-Town SWMM model. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table C.1.1 in Appendix C.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. A detailed conveyance element map illustrating the existing condition SWMM model schematic for the Tri-Town Basin is provided in Appendix C.1. Existing condition SWMM models for the Tri-Town Basin are digitally provided as part of Appendix J.

6.3.5 Results of Analysis

Table 6.2 provides a summary of the existing condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the 1999 study have also been included in Table 6.2. Table C.1.3 in Appendix C.1 provides a complete discharge comparison for all modeled flow events.

Table 6.2 Tri-Town Basin Existing Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	1999 Study 100-Year Peak Discharge (cfs)	2022 OSP Study 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Frederick Planning Boundary	401	5,030	N/A	2,889	N/A
Bella Rosa Parkway	404	4,366	3,842	2,583	-1,259
No Name Creek Tributary	904	4,281	3,659	2,508	-1,151
Godding Hollow Parkway	407	3,183	3,445	1,464	-1,981
Colorado Boulevard	408	3,085	2,593	1,407	-1,186
McClure Avenue	409	2,808	2,492	987	-1,505
Tipple Parkway	410	2,203	1,937	783	-1,154
Eighth Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1,652	2,108	388	-1,720
State Highway 52 Frederick/Dacono Boundary	999	792	1,519	1,088	-431
Second Street, East of Colorado Boulevard	415	287	372	308	-64

*Milavec Reservoir (~67 acres) considered to be a non-contributing area and is not included in the drainage area calculations.

As presented in Table 6.2, peak discharges from the current OSP study are generally lower than the peak discharges reported in the 1999 study. Several factors can be attributed to these differences. However, the two largest factors are the construction of the regional detention facility at Centennial Park and the requirement for development located south of Godding Hollow Parkway to provide on-site detention that requires developed 100-year flows to be detained and released at pre-development 2-year peak subbasin rates. These results provide a good example of how detention can be implemented to reduce peak flow rates.

Results of the existing condition SWMM model were also utilized to evaluate the performance of the existing crossing structures and detention basins located within the basin. Adequate and under-performing drainage facilities are identified in Table C.1.2 and the inventory maps presented in Appendix C.1. With respect to the identified under-performing detention facilities (ponds identified to overtop during the 100-year event), it is recognized that the design of existing on-site detention ponds associated with developments utilized different modeling software programs, assumptions, and was conducted at a more detailed level than those associated with this OSP study. Therefore, the identification of underperforming detention ponds as part of this study is intended as an informational tool for the communities and is not intended to be used as a regulatory tool for on-site detention pond compliance.

6.3.6 Identification of Existing Drainage Problems

As shown on the existing condition crossing inventory maps and tables provided in Appendix C.1, major drainage problems were identified along the Hwy 52 corridor and within downtown Dacono. Existing storm sewer systems along Glen Creighton Drive and Carbondale Drive provide drainage for small storms, but are not adequate for conveying the 2-year flow event. Once this storm sewer system reaches capacity, excess flow is conveyed westward within the drainage swales and streets towards the sump area and main culvert crossing of HWY 52 between Birch Avenue and Cherry Street. Detailed floodplain analyses were not conducted for this study, but it is anticipated that several existing structures along Glen Ayre Street, Carbondale Drive, and 7th Street would be inundated and potentially damaged during a 100-year flood event. In addition, it is anticipated that overtopping of Hwy 52 will occur during flood events exceeding the 10-year event. Some of the existing structures south of 8th Street appear to have finished floors lower than the overtopping elevation of Hwy 52 and would likely be damaged during overtopping events.

Within the Town of Frederick, Ridgeway Boulevard at the intersection of Leyden Creek Boulevard is anticipated to overtop for flow events in excess of the 10-year due to an undersized storm sewer system and predicted overtopping of the Savannah subdivision pond. Overtopping of Frederick Way is also anticipated to occur during flow events exceeding the 10-year event due to undersized storage capacity within the Prairie Green Ponds. Recent improvements to the Fifth Street storm sewer system in downtown Frederick are predicted to be capable of conveying flows in excess of the 10-year event, but less than the 50-year event. Excess flows not captured by this storm sewer system will be conveyed north, primarily along Oak Street and then along 2nd Street, to the sump location at Elm Street, just south of Tipple Parkway. A limited hydraulic evaluation indicated that the street capacities of Oak and 2nd Streets are adequate to convey this excess flow without inundating existing structures. The existing storm sewer system along McClure Avenue was also identified to have a capacity in excess of the 10-year event, but less than the 50-year event. Flows exceeding the capacity of this storm sewer system will travel within the street section westward down McClure Avenue to its outfall into the Tri-Town channel. A limited hydraulic evaluation indicated that the street capacity of McClure Avenue is sufficient to convey the excess flow without inundating existing structures. Existing culvert crossings near the McClure Avenue and Colorado Boulevard intersection, and along Godding Hollow Parkway, west of Colorado Boulevard, were also identified to have capacities less than the 100-year event. It is noted that the culvert improvements for the Tri-Town channel crossing of Colorado Boulevard and Godding Hollow Parkway were determined to have adequate capacity to convey the 100-year event.

Major drainage problems were also identified at the No Name Creek crossing of Colorado Boulevard and the main channel crossing of Bella Rosa Parkway. The existing No Name Creek crossing of Colorado Boulevard is located near the old sewage treatment ponds and is predicted to have a capacity less than the 10-year event. The low point of Colorado Boulevard is located approximately 2,700 feet north of this crossing. Therefore, excess flows from this crossing are conveyed north along the east side of Colorado Boulevard and overtop the roadway at this low point. Based on information provided by the Town of Firestone, a culvert crossing was installed at this low point as part of a road widening project of Colorado Boulevard in 2004. However, the project was unable to obtain a drainage easement through the Bella Rosa Golf Course, which was under construction at that time, to outfall the culvert crossing to the main drainageway. As a result, the ends of the culvert were backfilled and the culvert has not been utilized. The main drainageway crossing of Bella Rosa Parkway is also a known drainage problem as this crossing was washed out during the 2013 flood. The culvert installed to repair the washed out crossing is still significantly undersized, with an estimated capacity of less than 2-year event.

6.4 Future Condition Analyses

The future condition analyses were based on the comprehensive land use and zoning maps of the communities to estimate hydrologic conditions representing a full buildout of the basin. Hydrologic results from the future condition analyses were evaluated with existing drainage infrastructure to provide an assessment of future buildout conditions without the implementation of drainage improvements. Design rainfall and subbasin delineations were not modified from the existing condition analysis.

6.4.1 Hydrograph Development

The hydrologic parameters defined as part of the existing condition analysis were maintained for the future condition analysis, except for the percent impervious and depression storage values of those subbasins that were assumed to be developed based on the comprehensive land use and zoning maps for each community. Of the 97 subbasins delineated for the Tri-Town Basin, 34 of them were assumed to have future development. The future condition hydrologic parameters, and the rainfall depths reported in Table 6.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table C.2.1 in Appendix C.2 presents the final Tri-Town hydrologic parameters and peak flow runoff rates for the future condition analysis. As shown in Table C.2.1, the average future condition percent impervious value for the basin is 38%, an increase of approximately 60% when compared to existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 1.99 cfs/acre.

6.4.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the future conditions analysis to simulate the impact of on-site detention as part of future development. For the Tri-Town Basin, the requirement for properties located south of Godding Hollow Parkway (WCR 18) to provide on-site detention to limit proposed/developed 100-year flows to existing/pre-development 2-year peak subbasin runoff rates was maintained. In addition, the Town of Firestone has adopted this same requirement for properties located south of Pine Cone Avenue (WCR 20) and east of Colorado

Boulevard. Proposed development outside of these specified areas was assumed to provide conceptual on-site detention to meet the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. The known release rates for the conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Documentation for the stage-storage-discharge curves developed for the conceptual Tri-Town Basin on-site detention ponds is provided in Appendix C.2.

6.4.3 SWMM Model Development

Development of the Tri-Town Basin future condition SWMM model was based on the existing condition model, with the only change being the implementation of the conceptual on-site design ponds in subbasins that were assumed to be developed as part of future conditions. Subbasin hydrographs developed from the future condition CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table C.2.1 in Appendix C.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Runoff for basins assumed to be developed as part of the future conditions were imported into a conceptual on-site detention pond node. A detailed conveyance element map illustrating the future condition SWMM model schematic for the Tri-Town Basin is provided in Appendix C.2. Future condition SWMM models for the Tri-Town Basin are digitally provided as part of Appendix J.

6.4.4 Results of Analysis

Table 6.3 provides a summary of future condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 6.3. Table C.2.2 in Appendix C.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 6.3, results of the future condition analysis indicate reduced discharges compared to existing conditions. This reduction in discharges is a direct result of the simulated conceptual on-site detention ponds requiring proposed/developed 100-year flows to be detained and released at existing/pre-development 2-year peak runoff rates throughout the majority of the basin. The future condition flow rates were compared back to existing crossing capacities to reevaluate the performance of existing crossing structures under future conditions. Results of this comparison is provided in Table C.1.2 in Appendix C.1 and depicted on the future condition crossing map provided in Appendix C.2. As illustrated in Table C.1.2, the decreased discharges associated with future conditions will improve the functionality of numerous crossings during the 100-year storm event. However, significant capacity limitations will still exist with respect to the 100-year storm at several locations including Hwy 52, the No-Name Creek crossing of Colorado Boulevard, and Bella Rosa Parkway.

Table 6.3 Tri-Town Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Frederick Planning Boundary	401	5,030	2,889	2,061	-829
Bella Rosa Parkway	404	4,366	2,583	1,647	-936
No Name Creek Tributary	904	4,281	2,508	1,580	-928
Godding Hollow Parkway	407	3,183	1,464	1,016	-449
Colorado Boulevard	408	3,085	1,407	976	-431
McClure Avenue	409	2,808	987	569	-418
Tipple Parkway	410	2,203	783	394	-389
Eighth Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1,652	388	192	-196
State Highway 52 Frederick/Dacono Boundary	999	792	1,088	736	-353
Second Street, East of Colorado Boulevard	415	287	308	16	-292

*Milavec Reservoir (~67 acres) considered to be a non-contributing area and is not included in the drainage area calculations.

6.5 Alternative Analysis

Results of the future condition analysis and crossing map were reviewed with community staff to identify the projects that would be evaluated as part of the alternative analysis. Conclusions from these discussions resulted in the following list of improvements for alternative evaluation in the Tri-Town Basin.

- Within the City of Dacono, improvements will be evaluated to reduce, and potentially eliminate, flooding problems within the downtown area of Dacono. Enlargement of the existing storm sewer system along Glen Creighton Drive and Carbondale Drive will be evaluated. A larger crossing of Hwy 52 near Forest Avenue, as proposed in the 1999 plan, will be evaluated as an outfall for Carbondale Drive storm sewer. In addition, the Economic Development Authority of Dacono owns property along the west side of Glen Creighton Drive, which is scheduled to be developed in the near future. The City would like to investigate if a small regional detention pond could be incorporated into this development to further reduce flood peaks for the proposed storm sewer improvements along Glen Creighton Drive and Carbondale Drive.
- Improvements will be evaluated to eliminate the overtopping of Hwy 52 at the main drainageway crossing between Birch Avenue and Cherry Street. Due to the low lying properties south of 8th Street, the design of the enlarged crossing will need to accommodate lower headwater conditions to ensure these properties are removed from the floodplain.

- Within the Town of Frederick, improvements will be evaluated for all arterial roadway crossings that currently do not have 100-year capacity per Town Criteria. This includes the undersized crossings along Colorado Boulevard, Bella Rosa Parkway, Ridgeway Boulevard, and Frederick Parkway.
- Since the Town of Frederick owns and maintains the three Prairie Green detention ponds, improvements will be evaluated to optimize the ponds such that they do not overtop during a 100-year event.
- With recent improvements being completed on the Fifth Street storm sewer system, and a preliminary analysis indicating that existing street capacity along Oak and 2nd Streets is sufficient to convey excess flow from this system north to the sump at Elm Street, further improvements to the Fifth Street storm sewer system will not be investigated. The Town of Frederick will continue to monitor flooding problems within the downtown area and determine if future improvements are warranted.
- The McClure Avenue storm sewer system is a shared outfall for Frederick and Firestone. With the existing storm sewer system identified to have capacity between the 10-year and 50-year event, it was questioned if the excess street flow would meet street drainage criteria during a 100-year event. It was decided that Frederick would like an improvement identified to upsize this storm sewer system such that it will have 100-year capacity.
- A localized flooding issue has also been identified by residents of Frederick along Hurt Street, just west of Colorado Boulevard. This localized flooding issue results in the ponding of water along Hurt Street after most rainfall events. Frederick would like an improvement identified in this location to alleviate the local flooding issue.

Utilizing this list of improvements, an alternative analysis was conducted to determine potential drainage facility solutions at the identified locations. These alternatives were presented and discussed with community staff and a recommended plan of improvements was identified.

6.6 Recommended Plan

The following recommended plan of improvements for the Tri-Town Basin was identified and agreed to by community staff. It is noted that the following improvements were analyzed for the full buildout condition of the basin. Due to the on-site detention requirements in this basin, the peak flows rates associated with full buildout are lower than existing conditions. As a result, it should be recognized that the implementation of the following improvements while development within the basin is ongoing, will result in an interim condition in which the proposed improvements will underperform until full buildout is reached. Maps depicting the proposed drainage improvements are provided in Appendix C.3. HY-8 models utilized to evaluate the proposed culvert improvements are provided digitally in Appendix J.

- Bella Rosa Parkway (WCR 20) Crossing (TT-C2): Improvements identified for the Bella Rosa crossing included the significant enlargement of the crossing from a 48" RCP to three 5' H x 9' W RCBCs. To provide sufficient room for the box culverts and other utility crossings, it is also proposed that the existing roadway be raised approximately 3 feet from its low point, requiring improvements to approximately 760 feet of roadway.
- No Name Creek Crossing of Colorado Boulevard (TT-C14 and TT-C15): The implementation of two crossing improvements will be required to eliminate the overtopping of Colorado Boulevard at the No Name Creek crossing between Bella Rosa Parkway and Godding Hollow Parkway. At the main crossing of No Name Creek (TT-C15), it is proposed that a 3' H x 11' W RCBC culvert be added to the existing four 36" RCP crossings to increase the capacity of this crossing to convey the future condition 100-year flows along No Name Creek. A small berm will need to be constructed on the north side of the crossing to fully utilize the culvert crossing capacity and prevent flows from being conveyed north along the roadway to the low point. As previously mentioned, the Town of Firestone has indicated that an existing 29" H x 45" W HERCP culvert crossing was installed at the low point of Colorado Boulevard (TT-C14) during a roadway improvement project in 2004. However, the project could not obtain a drainage easement to outfall this culvert across the Bella Rosa Golf Course to the main drainageway. In 2014-2015, the Town of Firestone commissioned Colorado Civil Group to design a culvert connection across the golf course to outfall the existing culvert. This design was reviewed as part of this OSP study and found to be adequate for the basis of a conceptual improvement for this crossing. However, it is recommended that the designed 24" HDPE pipe crossing of the golf course be upsized to a 36" HDPE to accommodate the future conditions flows associated with this study. A copy of this design has been included in Appendix C.3.
- Colorado Boulevard Crossing North of McClure Ave (TT-C16): Evaluation of the existing 19" H x 30" W HERCP crossing at the sump location on Colorado Boulevard, north of McClure Avenue, indicates that it has less than 100-year capacity. It is proposed that an additional 24" H x 38" W HERCP crossing be added to eliminate the overtopping of Colorado Boulevard during a 100-year event.
- McClure Avenue Crossing West Colorado Boulevard (TT-C25): Evaluation of the existing 24" H x 38" W HERCP crossing of McClure Avenue, west of Colorado Boulevard, indicates that it has less than 100-year capacity. It is proposed that a 14" H x 23" W HERCP crossing be added to eliminate the overtopping of McClure Avenue during a 100-year event.
- McClure Avenue Storm Sewer (TT-C24): The eastern portion of the existing McClure Avenue storm sewer is comprised of a 24" RCP that has less than 100-year capacity. It is proposed that this portion of the existing storm sewer system be enlarged to a 36" RCP to provide 100-year capacity.
- Hurt Street Crossing West of Colorado Boulevard (TT-C17): This local flooding problem was identified for a proposed improvement by the Town of Frederick. Currently, runoff from the commercialized areas on the south side of the street are conveyed across Hurt Street in a drain pan and directed into drainage channel on the north side of the road. Sediment has built up at the transition from the concrete drain pan to the channel rundown, which is constricting flow and creating ponding issues at the low point of the road. It is proposed that this existing transition be removed and that the concrete drain pan be extended into the bottom of channel to reduce the potential for sediment build up. A riprap apron is proposed to be installed at the bottom of the channel rundown to dissipate energy and provide erosion protection. At direction of Town staff, an alternative was also identified for this location that is noted on the proposed improvement map. This alternative proposes the installation of a 10-year storm sewer system and inlets to be installed along the south side of the road to eliminate conveyance of flow across the road for events up to the 10-year. This storm sewer system could be tied into the existing storm sewer system that crosses Hurt Street just west of Colorado Boulevard.
- Ridgeway Boulevard Crossing South of Leydan Creek Boulevard (TT-C28): An existing 24" storm sewer system in Leydan Creek Boulevard conveys outflow from the Savanah and Angel View detention ponds across Ridgeway Boulevard and into Pond 1 of the Prairie Green regional detention ponds. Evaluation of the existing

24" storm sewer indicates that it has less than 100-year capacity, resulting in the overtopping of Ridgeway Boulevard. It is proposed that a new 36" culvert crossing of Ridgeway Boulevard be installed to capture street flow reaching the eastern side of the intersection and convey it across Ridgeway Boulevard. Ideally, the new crossing location would be located on the south side of Leydan Creek Boulevard to also capture the predicted 100-year overtopping of the Savanah detention pond, as the pond's spillway is located at the southeastern corner of the intersection.

- Prairie Green Ponds (TT Ponds 668, 669, 670): Evaluation of the three Prairie Green regional detention ponds indicates that future improvements are necessary to optimize the functionality of the ponds and eliminate pond overtopping during a 100-year event. It is noted that these ponds were overtopped and damaged during the 2013 flood event and that improvements were constructed in 2014 to repair the washed out portions of the embankments and construct emergency spillways. Improvements identified for the eastern most pond (referred to as Pond 1 or TT Pond 670) include raising the pond embankment and emergency spillway by 1-foot and increasing the outlet orifice area to 3.32 square feet. During the development of this OSP study, Phase 4 of the Prairie Green development was submitted to the Town of Frederick for approval. Since this phase of the development will include the extension of Indian Paint Brush Street along the embankment separating Ponds 1 and 2, the developer of Phase 4 agreed to raise the elevation of Indian Paint Brush Street and the emergency spillway of Pond 1 to provide the needed improvements to eliminate the overtopping of Pond 1. The Phase 4 developer also agreed to increase the outlet orifice size of Pond 1 as part of their development. Improvements identified for the middle pond (referred to as Pond 2 or TT Pond 669) include raising the pond embankment and emergency spillway by 1.5-feet and removing the orifice plate on the outlet. Improvements identified for the western pond (referred to as Pond 3 or TT Pond 668) include increasing the outlet orifice area to 5.0 square feet. The Town of Frederick will be responsible for the improvements to Ponds 2 and 3. Stage-storage-discharge curve documentation for the proposed pond improvements is provided in Appendix C.3.
- Storm Sewer South of Thunder Valley K-8 School (TT-C29): The outlet of Prairie Green Pond 3 consists of a 36" RCP and initiates the storm sewer system that conveys storm flows underneath the open field south of the Thunder Valley K-8 School. Several area inlets are located along the storm sewer alignment that capture flow along the drainage easement where the storm sewer is located. At the eastern-most area inlet, the 36" RCP pipe from Prairie Green Pond 3 is reduced to a 24" RCP. This reduction in size restricts the capacity of the existing system and creates an overflow situation during large storm events which travels overland through the existing ball fields to the south. In order to provide adequate capacity for the proposed increase in outlet orifice area of the Prairie Green 3 pond, and to eliminate excess flow from being conveyed across the ball fields during a 100-year event, it is proposed that the existing storm sewer system be upsized to a 36" RCP.
- Dacono Economic Development Authority Property Proposed Regional Pond (TT Pond 784): At the request of the City of Dacono, a small regional detention pond was investigated at the future development site of property owned by the Economic Development Authority, east of Glen Creighton Drive. Results of this investigation concluded that a pond could be located within the site that could provide adequate on-site detention for the development and reduce peak flows from the existing developed area to the east. Stage-storage-discharge curve documentation for the proposed regional pond is provide in Appendix C.3.
- Glen Creighton Drive and Carbondale Drive Storm Sewer (TT-C37): The existing Glen Creighton Drive/Carbondale Drive storm sewer initiates at the intersection of Glen Creighton Drive and Glen Dale Street/Circle. The storm sewer conveys flow north where additional flow is picked up at the sump area on Glen Creighton Drive between Glen Ayre Steet and Carbondale Drive. The storm sewer then heads west down Carbondale Drive to Forest Avenue. An overflow pipe directs excess flow from the storm sewer to an above-ground drainage channel between Glen Ayre Street and Carbondale Drive. Evaluation of the existing 30" RCP storm sewer system indicates that the storm sewer has less than a 2-year capacity. When the storm sewer system becomes overwhelmed, flow is conveyed west, both along the existing drainage channel and within the adjacent streets; it is anticipated these overflows will cause flooding problems for adjacent structures. It is proposed that the existing storm sewer system be replaced with a larger 78" RCP storm sewer system (or equivalent size if utility conflicts require a different geometry). This system would be capable of conveying the future condition 100-year flow and alleviate current flooding problems in this area. It is noted that these improvements will require the installation of additional inlets at the Glen Creighton Drive sump to improve the capture of street flows.
- Forest Avenue Storm Sewer and Hwy 52 Crossing (TT-C23 and TT-C38): At the intersection of Carbondale Drive and Forest Avenue, additional flow is contributed to the system from the existing development to the south. The existing dual 18" CMP culvert crossing (TT-C38) of Carbondale Drive is significantly undersized. Flow passing through the culverts is conveyed north in a roadside swale, where it combines with the outfall of the existing Carbondale Drive storm sewer near 8th Street. Excess flow that is not conveyed through the existing culvert crossing of Carbondale Drive, overtops Forest Avenue and travels west down 7th Street where it is anticipated to cause flooding problems for adjacent structures during large flow events. The outfall of the Carbondale Drive storm sewer crosses Forest Avenue just south of 8th street, where it combines with flow from the roadside swale in a junction box and is conveyed across Hwy 52 through existing 24" and 36" CMPs (TT-C23). This existing crossing of Hwy 52 was deemed to have adequate capacity to convey the 100-year flow reaching this location, but only as a result of capacity restrictions of the existing Carbondale Drive storm sewer that limit the amount flow that is able to reach this crossing. To provide an adequate outfall for the proposed Carbondale Drive storm sewer improvements, and to capture the additional 100-year flow being conveyed to the southeastern corner of the Forest Avenue and Carbondale Drive intersection, it is proposed that a dual 3' H X 12' W RCBC storm sewer system be installed along Forest Avenue and across Hwy 52. The Carbondale Drive storm sewer improvements are proposed to be tied into these box culverts with a large junction box structure. These improvements would be capable of capturing the 100-year flow generated east of Forest Avenue and conveying it across Hwy 52, which will significantly reduce the amount of flow reaching the main channel crossing of Hwy 52 between Birch Avenue and Cherry Street. These improvements will also require the existing drainage channel along the northern side of the Hwy 52 to be enlarged.
- Main Channel Crossing of Hwy 52 (TT-C8, TT-C9 and TT-C10): The existing main channel crossing of Hwy 52 (TT-C9) consists of a 48" CMP and two 30" H x 48" Arch CMPs. Due to the existing undersized drainage facilities in the eastern portion of downtown Dacono, as noted above, a significant amount of flow reaches this location as it is the low point crossing of Hwy 52. Evaluation of this crossing indicates that Hwy 52 will overtop during flows between the 10-year event and 25-year event. The capacity of the existing Hwy 52 crossing is also restricted by high tailwater conditions caused by an existing 4' H x 5' W RCBC crossing (TT-C8) on the north side of Hwy 52. It is assumed that this crossing is intended to provide access to the Hwy 52 right-of-way on the eastern side of the channel. The existing crossing of 8th Street (TT-C10) is comprised of a 48" CMP and 42" CMP. When implemented, the Carbondale Drive and Forest Avenue storm sewer improvements will significantly reduce the amount of flow reaching the main channel crossing. As a result, it is proposed the

main channel crossing be enlarged with a 3' H x 10' W RCBC that starts south of 8th Street and extends to the north side of Hwy 52. Flow that is captured and conveyed along the roadside swale between 8th Street and the south side of Hwy 52 would be tied into the box culvert system. To improve tailwater conditions on the Hwy 52 crossing, it is also proposed that the existing 4' H x 5' W RCBC access road crossing on the north side of Hwy 52 be removed and replaced with a concrete low flow crossing. These improvements will convey the proposed 100-year flow at this crossing, without overtopping Hwy 52 or inundating the low-lying properties to the south.

6.6.1 SWMM Model Development

Development of the Tri-Town Basin proposed improvement SWMM model was based on the future condition model, with incorporated changes to reflect the recommend plan of improvements. Results of the future condition CUHP analysis were utilized for the proposed improvement SWMM model. To accurately model the proposed detention pond on the Dacono Economic Development Authority property, Subbasin 84 was further subdivided as part of the proposed improvement SWMM model to reflect the portion of the original basin that will drain to the proposed pond location and the portion of the basin that will not direct runoff into the proposed pond. Hydrographs for these subdivided basins were developed by area weighting the hydrograph associated with the original basin. Documentation for the development of these hydrographs has been digitally provided in a spreadsheet with the SWMM model documentation. A detailed conveyance element map illustrating the proposed improvement SWMM model schematic for the Tri-Town Basin is provided in Appendix C.3. Proposed improvement SWMM models for the Tri-Town Basin are digitally provided as part of Appendix J.

6.6.2 Results of Analysis

Table 6.4 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the future condition analysis have also been included in Table 6.4. Table C.3.1 in Appendix C.3 provides a complete discharge comparison for all modeled flow events.

As presented in Table 6.4, results of proposed improvement analysis highlight the significant decrease in the proposed 100-year discharge for the main channel crossing of Hwy 52 when compared to future conditions. This reduction in discharge is a result of the proposed Carbondale Drive and Forest Avenue storm sewer improvements that will direct water away from this crossing. Proposed improvement changes to the 100-year discharge at other locations within the basin are negligible as the recommended plan relies largely on conveyance system enhancements. Table C.3.2 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. HY-8 models utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table C.3.2 has been depicted on the proposed improvement crossing map provided in Appendix C.3.

Table 6.4 Tri-Town Basin Proposed Improvement Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Improvements 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Frederick Planning Boundary	401	5,030	2,061	2,044	-17
Bella Rosa Parkway	404	4,366	1,647	1,627	-20
No Name Creek Tributary	904	4,281	1,580	1,551	-29
Godding Hollow Parkway	407	3,183	1,016	1,012	-4
Colorado Boulevard	408	3,085	976	972	-3
McClure Avenue	409	2,808	569	566	-3
Tipple Parkway	410	2,203	394	393	-1
Eighth Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1,652	192	191	-1
State Highway 52 Frederick/Dacono Boundary	999	792	736	223	-513
Second Street, East of Colorado Boulevard	415	287	16	16	0

*Milavec Reservoir (~67 acres) considered to be a non-contributing area and is not included in the drainage area calculations.

6.6.3 Cost Estimates

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed. For the more complicated improvements that included road modifications, proposed channels, and regional detention ponds, conceptual designs and gradings plans were digitally developed in an ACAD file for the estimation of earthwork quantities. A digital copy of this ACAD file has been provided in Appendix J.

The estimated quantities for each project were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. A summary of the project cost estimates for the Tri-Town Basin have been provided as Table C.4.1 in Appendix C.4. The estimated quantities and cost breakdown assumptions for each individual project have also been provided in Appendix C.4. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project

cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP.

6.6.4 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities for each community was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from each community, a final scoring and ranking for each project were developed as presented in Tables 6.5 and 6.6. Total project costs have also been summarized in Tables 6.5 and 6.6. It is noted that the rankings presented in Tables 6.5 and 6.6 are meant to provide a general sequencing plan for each community as funding becomes available. However, these rankings should be considered flexible, with each community having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 6.5 Town of Frederick Selected Plan Costs and Implementation Plan for Tri-Town Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick	TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway (Low Point Crossing)	29" H x 45" W HERCP/ 36" HDPE	-	$ 221,000	5	3	2	3	**13**	1
Frederick/ Firestone	TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway (No Name Creek Crossing)	(4) 36" RCP 3' H x 11' W RCBC	Frederick Portion (Half of Crossing[1])	$ 155,000	5	3	2	3	**13**	2
Frederick/ Dacono	TT-C9	Highway 52 - Main Channel	3' H x 10' W RCBC	Frederick Portion (Half of Crossing[2])	$ 248,000	5	2	3	2	**12**	3
Frederick/ Dacono	TT-C23	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvements[3])	$ 411,000	5	2	3	2	**12**	4
Frederick	TT-C8	Access Road Crossing North of Highway 52	Existing Crossing to be Removed and Replaced with Low Flow Crossing	-	$ 59,000	5	3	1	2	**11**	5
Frederick	TT-C2	County Road 20/Bella Rosa Parkway	(3) 5' H x 9' W RCBC	-	$ 1,057,000	5	1	2	3	**11**	6
Frederick	TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP 36" RCP	-	$ 137,000	4	3	1	3	**11**	7
Frederick/ Firestone	TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	(2) 19" H x 30" W HERCP	Frederick Portion (Half of Crossing[4])	$ 59,000	3	3	2	2	**10**	8
Frederick	TT Ponds 667 & 668	Prairie Green Ponds 2 & 3	Raise Spillway and Embankment of Pond 2 Remove Orifice Plate on Pond 2 and Enlarge Orifice Opening Area on Pond 3	-	$ 108,000	3	3	1	2	**9**	9
Frederick	TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate to tie into upsized 36" RCP outfall	-	$ 417,000	3	3	1	2	**9**	10
Frederick	TT-C17	Colorado Blvd, North of Hurt Street	Channel Improvement		$ 33,000	2	3	1	1	**7**	11
Frederick	TT-C25	Majestic Street, West of Colorado Blvd	14" H x 23" W HERCP 24" H x 38" W HERCP	-	$ 137,000	2	3	1	1	**7**	12
Frederick/ Firestone	TT-C24	McClure Avenue Storm Sewer	36" RCP	Frederick Portion (Half of Storm Sewer Improvements[5])	$ 452,000	2	2	2	1	**7**	13
				Total <u>Frederick</u> Costs for Tri-Town	**$ 3,494,000**				**Average Score**	**10.2**	

[1]Total Project Cost = $310,000. Other half of crossing costs ($155,000) allocated to Town of Firestone.

[2]Total Project Cost = $549,000. Other half of crossing costs ($301,000) allocated to City of Dacono.

[3]Total Project Cost = $721,000. Other half of crossing costs ($310,000) allocated to City of Dacono.

[4]Total Project Cost = $143,000. Other half of crossing costs ($84,000) allocated to Town of Firestone.

[5]Total Project Cost = $904,000. Other half of storm sewer costs ($452,000) allocated to Town of Firestone.

Table 6.6 City of Dacono Selected Plan Costs and Implementation Plan for Tri-Town Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Dacono/ Frederick	TT-C9	Highway 52 - Main Channel	3' H x 10' W RCBC	Dacono Portion (Half of Crossing[1])	$ 301,000	5	2	3	2	**12**	1
Dacono	TT-C10	Eighth Street	3' H x 10' W RCBC	-	Combined with TT-C9	5	2	3	2	**12**	2
Dacono/ Frederick	TT-C23	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Dacono Portion (Half of Crossing[2])	$ 310,000	5	2	3	2	**12**	3
Dacono	TT-C38	Forest Avenue Storm Sewer	(2) 3' H x 12' W RCBC	-	$ 1,420,000	5	1	3	3	**12**	4
Dacono	TT-C37	Carbondale Drive Storm Sewer	78" RCP	-	$ 1,793,000	5	1	3	3	**12**	5
Dacono	TT Pond 784	East of Glenn Creighton Drive, South of Highway 52	3.7 AC-FT Detention Pond	Pond	$ 296,000	2	3	1	3	**9**	6
				Total Dacono Costs for Tri-Town	**$ 4,120,000**				**Average Score**	**11.5**	

[1]Total Project Cost = $549,000. Other half of crossing costs ($248,000) allocated to Town of Frederick.

[2]Total Project Cost = $721,000. Other half of crossing costs ($4110,000) allocated to Town of Frederick.

7 Godding Hollow Basin (GH)

7.1 Project Area

Figure 7.1 shows the extents of the Godding Hollow Basin and its geographical relation to the TOF and COD planning boundaries. As illustrated on Figure 7.1, the headwaters of the Godding Hollow Basin are located south of State Highway 52 (Hwy 52) and west of Interstate 25 (I-25). This area is located outside of the current study area, but was evaluated as part of the Town of Erie OSP. Therefore, inflows from the Erie OSP were incorporated into the modeling of the Godding Hollow Basin as part of this study. The Godding Hollow basin encompasses approximately 12,110 acres and is still predominately a rural watershed, but development has started to occur in several areas throughout the basin. Runoff from the basin generally flows south to north. Numerous county roads, I-25, Hwy 52, and irrigation ditches/canals cross the major drainageway and its tributaries. These crossings tend to constrict the channel and create overtopping and flooding issues during major storm events. Two irrigation ditches, the Stanley Ditch and the Lower Boulder Ditch, traverse the Godding Hollow Basin within the study area. These ditches convey irrigation flows within and through the basin, but offer limited value as drainage features that will convey stormwater runoff during major flood events. Due to the limited capacity of the ditch systems, coupled with the magnitude of stormwater flows, these irrigation ditches were assumed to not significantly influence drainage patterns within the basin and flows were routed over them.

The major drainageway for the Godding Hollow Basin originates near the intersection of Erie Parkway (WCR 8) and WCR 7, west of I-25 within the Town of Erie Planning Area. From this location, the drainageway conveys runoff northeast through a timber bridge at the Union Pacific Railroad and through two large box culverts at I-25 where it enters the Dacono planning area. East of I-25, the main drainageway continues northeast where it crosses Speedway Boulevard (WCR 10) and confluences with another tributary (referred to as the I-25 Tributary in this study) near the Colorado National Speedway. Another tributary (referred to as the Southeastern Tributary) then confluences with the main channel prior to the Grandview Boulevard (WCR 12) crossing. North of the Grandview Boulevard crossing, a larger eastern tributary (referred to as the York Tributary) confluences with the main drainageway. From this location, the main drainageway continues north and crosses under the Lower Boulder Ditch in a large box culvert. South of Hwy 52, another eastern tributary crosses York Street (WCR 11) and the Lower Boulder Ditch prior to confluencing with the main drainageway south of Hwy 52.

North of Hwy 52, a large western tributary (referred to as the Erie Tributary) crosses I-25 and converges with the main drainageway channel. From this location, the main channel continues north to the Tipple Parkway (WCR 16) and Godding Hollow Parkway (WCR 18) crossings. Small tributaries that originate west of I-25 converge with the main drainageway between these crossings. It is noted that both the Tipple Parkway and Godding Hollow Parkway crossings were washed out during the 2013 flood and have been replaced with multiple box culvert crossings. North of Godding Hollow Parkway, the main channel flows between the Raspberry Hill and Eagle Valley developments and continues north to the Bella Rosa Parkway (WCR 20) crossing. The main drainageway continues north from Bella Rosa Parkway, prior to exiting the Frederick planning area near the Cottonwood Hollow development. It is noted that a small tributary (referred to as the Western Tributary) originates west of I-25 and north of Bella Rosa Parkway. This tributary crosses I-25 at the edge of the Frederick planning boundary and confluences with the main channel on the east side of I-25 outside of the Frederick planning area. It was decided that the only the portion of this tributary located west of I-25 would be evaluated as part of this study. This will provide the data needed for future modeling of the Godding Hollow Basin and drainageway north of the Frederick planning area.

7.2 Previous Studies

In 1999, Anderson Consulting Engineers, Inc. completed the most recent stormwater master drainage plan for the portion of the Godding Hollow Basin located within the TOF and COD planning areas. The study, "I-25 Corridor Master Drainage Plan, Godding Hollow and Tri-Town Basins", was conducted for Weld County with the goal of providing a regionalized plan for stormwater improvements within the Godding Hollow and Tri-Town Basins. The 1999 study formed the basis of the Godding Hollow Basin analysis conducted as part of this OSP study. It is noted that the 1999 baseline hydrologic evaluation incorporated inadvertent detention areas upstream of roadway embankments where significant ponding would occur. Two of these inadvertent detention areas are located within the portion of the Godding Hollow Basin evaluated as part of this study. Further discussion with respect to the implications of this assumption are provided in Section 7.3.5.

In 2020, Merrick completed the most recent stormwater master drainage plan update for the portion of the Godding Hollow Basin located within the Town of Erie planning area. The study, "Town of Erie Outfall Systems Plan (East of Coal Creek)," developed updated baseline condition and recommended plan condition hydrology for the Godding Hollow Basin located in the Town of Erie planning area. This study identified seven separate locations where Erie's portion of the Godding Hollow Basin outfalls into the portion of the basin located within the TOF and COD planning areas. To provide consistency between the Erie OSP and this study, hydrographs at each outfall location were obtained from the Erie OSP SWMM models and utilized as inflow hydrographs for the SWMM models developed as part of this study. In addition, the 2020 Erie study identified proposed improvements along the Hwy 52 corridor, west of I-25, that share a jurisdictional boundary with the Town of Frederick. To provide consistency, these improvements were reviewed and incorporated into the recommended plan for this study. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

7.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Godding Hollow Basin is presented in the following sections.

7.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Godding Hollow Basin are presented in Table 7.1.

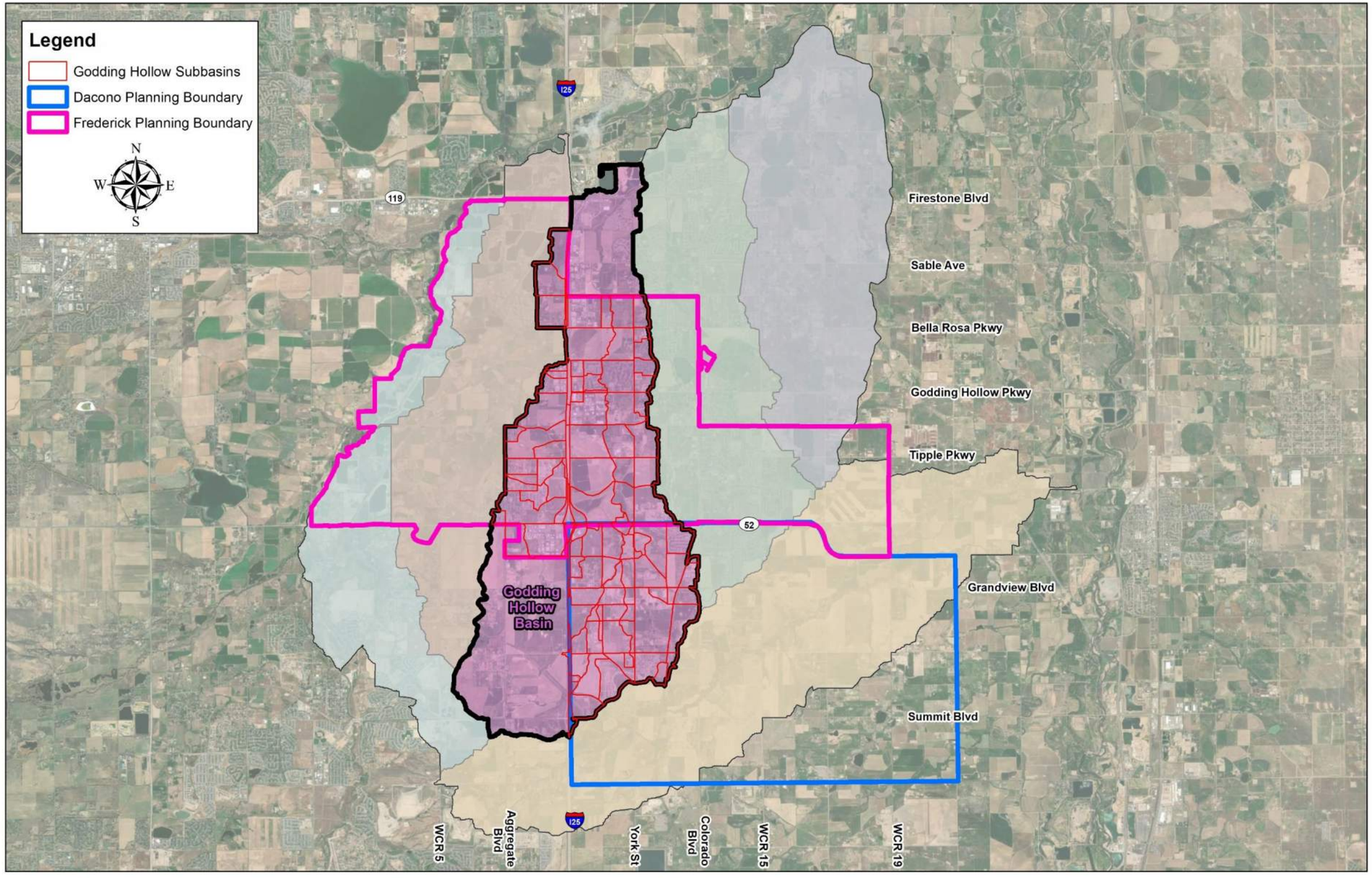

Figure 7.1 Godding Hollow Basin Study Area

Table 7.1 Godding Hollow Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Godding Hollow (GH)	0.818	1.11	1.39	2.25	2.69

7.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 7.1, the larger Godding Hollow Basin was subdivided into smaller subbasins for the hydrologic analyses. The definition of smaller subbasins was conducted for the approximate 8,200 acres of the basin located within the TOF and COD planning areas. In total, 115 subbasins were delineated for the Godding Hollow Basin with an average basin size of approximately 70 acres. Detailed subbasin maps are provided in Appendix D.1.

Hydrologic modeling parameters, existing land use, and soil parameters were developed for each subbasin based on the procedures outlined in Section 3.3 of this report. These hydrologic parameters, and the rainfall depths reported in Table 7.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Results from the initial CUHP analysis were checked for reasonableness and adjustments to the parameters were made, as necessary. Table D.1.1 in Appendix D.1 presents the final Godding Hollow hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table D.1.1, the average existing condition percent impervious value for the basin is 27%, with an average unit runoff rate for the 100-year storm of 1.71 cfs/acre. The subbasin delineations and hydrologic modeling of the Godding Hollow Basin associated with the Erie OSP study were reviewed for general conformance to the assumptions associated with this study. No major inconsistences were identified as part of this review and the Erie OSP information was utilized for this study.

7.3.3 Inventory of Existing Drainage Facilities

A thorough inventory of existing drainage facilities within the Godding Hollow Basin was conducted as part of this study and utilized to develop the drainage network incorporated into the SWMM models. Inventory of existing crossing structures and detention ponds followed procedures outlined in Section 4.1 of this report and typically included site survey and photographic documentation, which have been digitally provided as part of Appendix J. FHWA's HY-8 culvert analysis software was utilized to evaluate road crossing culvert capacities. Detention pond stage-storage relationships were developed from ground survey and the 2013 LiDAR data to reflect as-built conditions. For developments constructed after 2013, information provided in the approved drainage reports was utilized to define detention pond rating curves. Ground survey and field measurements of pond outlet structures was collected to define the outlet geometry for establishing the discharge rating curves for the detention ponds. It is noted that the drainage plans for some of the larger developments and business parks included more than one detention facility. Only those facilities with a storage volume greater than 2-acre feet were incorporated into this study.

Inventory of the existing drainage facilities within the Godding Hollow Basin resulted in the evaluation of 33 individual crossing structures and 17 detention ponds. Maps depicting the locations of the existing crossings and detention basin facilities are provided in Appendix D.1. Table D.1.2 in Appendix D.1 provides detailed information on the existing condition crossing structure characteristics and capacity analysis. Additional documentation for the development of the stage-storage-discharge curves for each individual pond is also provided in Appendix D.1. HY-8 models utilized to evaluate the existing culvert improvements are provided digitally in Appendix J.

7.3.4 SWMM Model Development

Determination of peak discharges and hydrographs at pertinent locations required the use of SWMM (Version 5.1.015). Development of the Godding Hollow Basin existing condition SWMM model, based on information obtained from previous studies, site visits, and other data collected as part of this study, followed the general procedures described in Section 3.4 of this report. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table D.1.1 in Appendix D.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Hydrographs from the Erie OSP were also incorporated into the SWMM models developed as part of this study to appropriately account for inflow from the upstream portion of the watershed. These hydrographs were obtained from the results of the Erie OSP existing condition SWMM model at the outfall locations where flow crosses the Erie planning boundary into the Frederick and Dacono planning boundaries. For consistency, the outfall node names and locations from the Erie OSP model were maintained and incorporated into the SWMM models developed as part of this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the existing condition SWMM model schematic for the Godding Hollow Basin is provided in Appendix D.1. Existing condition SWMM models for the Godding Hollow Basin are digitally provided as part of Appendix J.

7.3.5 Results of Analysis

Table 7.2 provides a summary of the existing condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the 1999 study have also been included in Table 7.2. Table D.1.3 in Appendix C.1 provides a complete discharge comparison for all modeled flow events.

As presented in Table 7.2, peak discharges from the current OSP study showed both increases and decreases when compared to the 1999 study. Several factors can be attributed to these differences. The increase in flows north of Hwy 52 can primarily be attributed to the incorporation of inadvertent detention areas as part of the 1999 study. The 1999 study modeled significant areas of inadvertent detention south of the Hwy 52 embankment along the main drainageway and west of I-25 along the Erie Tributary. It is noted that the ponding area south of the Hwy 52 embankment is anticipated to remain under present day conditions. However, since this area is not currently owned, designated, and operated by a public entity as a regional detention facility, current MHFD criteria states that inadvertent detention areas such as this cannot be modeled to provide flood peak attenuation as part of existing condition analyses. The reasoning for this criterion is that without these areas being designated and maintained as regional detention facilities by public entities, future development could incorporate crossing improvements that will remove the inadvertent ponding area. A good example of this occurred when CDOT enlarged the I-25 crossing of the Erie Tributary to convey the 100-year flow. The inadvertent detention that was modeled as part of the 1999 study west of I-25 was lost due to the improved road crossing. Table 7.2 also indicates a general decrease in main

drainageway discharges south of the Grandview Boulevard crossing. These decreases are generally attributed to the revised modeling assumptions and parameters associated with this study and the Erie OSP.

Table 7.2 Godding Hollow Basin Existing Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	1999 Study 100-Year Peak Discharge (cfs)	2022 OSP Study 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path					
Frederick Planning Boundary	402	10,511	N/A	6,550	N/A
Bella Rosa Parkway	404	10,111	4,583	6,529	1,946
Godding Hollow Parkway	410	9,140	4,727	6,400	1,673
Tipple Parkway	414	7,583	4,735	5,885	1,150
Confluence with Erie Tributary	415	7,181	4,439	5,753	1,314
State Highway 52 Frederick/Dacono Boundary	418	4,226	4,007	4,450	443
Lower Boulder Ditch	419	3,732	3,698	3,904	206
Confluence with York Tributary	983	3,501	3,612	3,723	111
Grandview Boulevard	423	2,107	2,618	2,293	-325
Confluence With Southeastern Tributary	925	1,969	2,531	2,150	-381
Confluence With I-25 Tributary	428	1,527	2,247	1,665	-582
I-25 Tributary East of I-25/ Dacono Planning Boundary	929	558	920	644	-276
Speedway Boulevard	503	919	1,191	988	-203
West of I-25 Crossing/ Dacono Planning Boundary	P-970	466	871	585	-286
Erie Tributary					
Eastern I-25 Frontage Road	467	2,475	1,269	1,715	446
West of I-25 Crossing	462	2,172	1,228	1,515	287
State Highway 52/ Frederick Planning Boundary	P-675	1,270	1,020	1,158	138
Western Tributary					
West of I-25 Crossing/ Frederick Planning Boundary	431	388	106	279	173

Results of the existing condition SWMM models were also utilized to evaluate the performance of the existing crossing structures and detention basins located within the basin. Both adequate and under-performing drainage facilities are identified in Table D.1.2 and shown on the inventory maps presented in Appendix D.1. With respect to the identified under-performing detention facilities (ponds identified to overtop during the 100-year event), it is recognized that the design of existing on-site detention ponds associated with developments utilized different modeling software programs, assumptions, and was conducted at a more detailed level than those associated with this OSP study. Therefore, the identification of under-performing detention ponds as part of this study is intended as an informational tool for the communities and is not intended to be used as a regulatory tool for on-site detention pond compliance.

7.3.6 Identification of Existing Drainage Problems

Due to the well-defined drainageways and predominately rural nature of the Godding Hollow Basin, existing drainage problems within the basin are mostly attributed to inadequate culvert capacity at the major roadway crossings. As shown on the existing condition crossing inventory maps and tables provided in Appendix D.1, major crossing deficiencies were noted along Speedway Boulevard, Grandview Boulevard, and along Hwy 52, west of I-25. The existing capacities of the main channel crossings of the Lower Boulder Ditch and Hwy 52 were estimated to be slightly greater than the 10-year event. It is noted that both of these crossings were overtopped during the 2013 flood. As previously noted, the crossings of Tipple Parkway and Godding Hollow Parkway were washed out during the 2013 flood. Significant enlargements to both crossings were installed as part of the flood repairs to the roadways in 2018 and 2015, respectively. The design discharges utilized to size these crossing improvements are unknown as drainage reports for these projects could not be located in the Town of Frederick's archives. Evaluation of the current crossings using the existing condition hydrology developed as part of this study indicate that these crossing will convey the 10-year event, but are anticipated to overtop during a 50-year event. The Bella Rosa Parkway crossing was also found to have significant capacity deficiencies for major storm events. It is presumed that the Bella Rosa Parkway crossing also overtopped during the 2013 flood, but due to the widespread overtopping flows along the roadway, the existing crossing was not washed out, and repairs were not necessary. The multiple crossings of I-25 were found to generally have 100-year capacity for the main drainageways and tributaries, and at least 10-year capacity for the smaller tributaries. These crossings and their capacities largely adhere to CDOT criteria. Per direction received from community staff, improvements to the I-25 crossings were not evaluated as part of this study.

7.4 Future Condition Analyses

The future condition analyses were based on the comprehensive land use and zoning maps of the communities to estimate hydrologic conditions representing a full buildout of the basin. Hydrologic results from the future condition analyses were evaluated with existing drainage infrastructure to provide an assessment of future buildout conditions without the implementation of drainage improvements. Design rainfall and subbasin delineations were not modified from the existing condition analysis.

7.4.1 Hydrograph Development

The hydrologic parameters defined as part of the existing condition analysis were maintained for the future condition analysis, except for the percent impervious and depression storage values of those subbasins that were assumed to be developed based on the comprehensive land use and zoning maps for each community. Of the 115 subbasins delineated for the Godding Hollow Basin, 68 of them were assumed to have future development. The future condition hydrologic parameters, and the rainfall depths reported in Table 7.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table D.2.1 in Appendix D.2 presents the final Godding Hollow hydrologic parameters and peak flow runoff rates for the future condition analysis. As shown in Table D.2.1, the average future condition percent impervious value for the basin is 54%, approximately doubling the average percent impervious value of existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 2.61 cfs/acre.

7.4.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the future conditions analysis to simulate the impact of on-site detention as part of future development. All conceptual on-site detention ponds within the Godding Hollow Basin were assumed to adhere to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. The one exception to this assumption was for the conceptual on-site detention ponds associated with the Wildflower Subdivision located north of Tipple Parkway, just west of I-25. The drainage plans for this development have already been approved and the release rates for the two on-site detention ponds associated with this development were designed to accommodate the existing I-25 culvert capacities to which the ponds outlet. The noted release rates on the development plans, which have been provided in Appendix D.2, were incorporated into the rating curves for the on-site detention ponds modeled as part of this study. Release rates for the other conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Documentation for the stage-storage-discharge curves developed for the conceptual Godding Hollow Basin detention ponds is provided in Appendix D.2.

7.4.3 SWMM Model Development

Development of the Godding Hollow Basin future condition SWMM model was based on the existing condition model. The only changes to the SWMM model were the implementation of the conceptual on-site design ponds in subbasins that were assumed to be developed as part of future conditions, as well as the rerouting of conveyance element 250 into one of the on-site detention ponds associated with the Wildflower Subdivision, as depicted on the associated development plans. Subbasin hydrographs developed from the future condition CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table D.2.1 in Appendix D.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Runoff for basins assumed to be developed as part of future conditions were imported into a conceptual on-site detention pond node. It is noted that the Erie OSP study did not evaluate a future condition with conceptual on-site detention pond scenario for incorporation with the future condition analysis conducted as part of this study. Coordination with staff from the Town of Erie confirmed that Erie also regulates the 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirement for future development. As a result, the future condition with on-site detention hydrology from Erie's portion of the Godding Hollow Basin should not be significantly different than the existing condition hydrology. Therefore, it was decided to utilize the existing condition hydrographs from the Erie OSP SWMM models at the outfall locations as inflow hydrographs for the future condition modeling associated with this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP study has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the future condition SWMM model schematic for the Godding Hollow Basin is provided in Appendix D.2. Future condition SWMM models for the Godding Hollow Basin are digitally provided as part of Appendix J.

7.4.4 Results of Analysis

Table 7.3 provides a summary of future condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 7.3. Table D.2.2 in Appendix D.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 7.3, results of future condition analysis indicate increased discharges compared to existing conditions. The predicted increase in peak flow rates along the main drainageways can be attributed to the additional volume of future condition runoff caused by development, as well as the attenuated and prolonged peak flows associated with the assumed on-site detention ponds. The attenuated and prolonged releases from on-site detention ponds can facilitate the alignment of peak flow timing along the major drainageways and tributaries. The increase in peak flow rates as a result of on-site detention requirements has been recognized by the MHFD in Volume 2 of the USDCM. Consequently, the MHFD is now recommending that on-site detention ponds be designed using a full spectrum approach which limits the 100-year release rates from on-site detention ponds to 90% of the predevelopment 100-year runoff rate. Since both communities currently regulate to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirements, this assumption was maintained for the future condition and proposed improvement evaluation associated with the Godding Hollow Basin.

The future condition flow rates were compared to existing crossing capacities to reevaluate the performance of existing crossing structures under future conditions. Results of this comparison is provided in Table D.1.2 in Appendix D.1 and depicted on the future condition crossing map provided in Appendix D.2. As illustrated on Table D.1.2, the increased discharges associated with the future condition analysis further diminish the ability of existing crossings to convey the 100-year flow event.

7.5 Alternative Analysis

Results of the future condition analysis and crossing map were reviewed with community staff to identify the projects that would be evaluated as part of the alternative analysis. Conclusions from these discussions resulted in the following list of improvements for alternative evaluation in the Godding Hollow Basin.

Table 7.3 Godding Hollow Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path					
Frederick Planning Boundary	402	10,511	6,550	7,590	1,040
Bella Rosa Parkway	404	10,111	6,529	7,574	1,045
Godding Hollow Parkway	410	9,140	6,400	7,439	1,038
Tipple Parkway	414	7,583	5,885	6,771	886
Confluence with Erie Tributary	415	7,181	5,753	6,549	796
State Highway 52 Frederick/Dacono Boundary	418	4,226	4,450	4,960	510
Lower Boulder Ditch	419	3,732	3,904	4,444	539
Confluence with York Tributary	983	3,501	3,723	4,203	480
Grandview Boulevard	423	2,107	2,293	2,667	374
Confluence With Southeastern Tributary	925	1,969	2,150	2,541	391
Confluence With I-25 Tributary	428	1,527	1,665	1,943	278
I-25 Tributary East of I-25/ Dacono Planning Boundary	929	558	644	644	0
Speedway Boulevard	503	919	988	1,272	284
West of I-25 Crossing/ Dacono Planning Boundary	P-970	466	585	585	0
Erie Tributary					
Eastern I-25 Frontage Road	467	2,475	1,715	1,878	446
West of I-25 Crossing	462	2,172	1,515	1,638	287
State Highway 52/ Frederick Planning Boundary	P-675	1,270	1,158	1,192	138
Western Tributary					
West of I-25 Crossing/ Frederick Planning Boundary	431	388	279	323	44

- Due to increased discharges associated with the future condition analysis, both communities were supportive of investigating the effectiveness of regional detention throughout the basin. It was further agreed that potential regional detention facility locations should not significantly impact the ability for future development within the basin.
- Within the City of Dacono, improvements will be evaluated for all arterial roadway crossings that do not meet current criteria. As discussed in Section 5.2, these improvements will be designed to pass the 10-year event without road overtopping and maintain an overtopping depth of less than 12 inches for the 100-year event.
- Improvements will be evaluated to eliminate the overtopping of all Hwy 52 crossings for the 100-year event.
- Within the Town of Frederick, improvements will be evaluated for all arterial roadway crossings that currently do not have 100-year capacity per Town Criteria. This includes the undersized crossings along Tipple Parkway, Godding Hollow Parkway, and Bella Rosa Parkway.
- Since the multiple crossings of I-25 were found to generally meet CDOT criteria, improvements to these crossings were not evaluated as part of this study.

Utilizing this list of improvements, an alternative analysis was conducted to determine potential drainage facility solutions at the identified locations. These alternatives were presented and discussed with community staff and a recommended plan of improvements was identified.

7.6 Recommended Plan

The following recommended plan of improvements for the Godding Hollow Basin were identified and agreed to by community staff. Results of the regional detention investigation concluded that locating detention facilities on the tributaries, just upstream of their confluence with the main drainageway, was the most effective option for reducing flood peaks along the main channel. Five regional detention pond locations, including land acquisition and the formal designation of the existing sump areas south of Hwy 52 and the Lower Boulder Ditch as detention ponds, were incorporated into the recommended plan, with concurrence from of the City of Dacono.

It is noted that the following improvements were analyzed for the full buildout condition of the basin, which assumes all regional detention facilities have been constructed. As a result, it should be recognized that the implementation of the following improvements prior to the construction of all regional detention facilities, will result in an interim condition in which the proposed improvements will underperform until full buildout is reached. Maps depicting the proposed drainage improvements are provided in Appendix D.3. HY-8 models utilized to evaluate the proposed culvert improvements are provided digitally in Appendix J.

- Bella Rosa Parkway (WCR 20) Crossing (GH-C1): Evaluation of the existing 6’ H x 8’ W Arch CMP at the Bella Rosa Parkway crossing indicates that it has less than 2-year capacity. In order to provide 100-year capacity, the existing crossing will need to be significantly enlarged. Since the existing crossing already has adequate height, it was decided that raising the roadway was not necessary. It is proposed that the existing crossing be replaced with (10) 5’ H x 12’ W RCBCs to eliminate the overtopping of Bella Rosa Parkway during a 100-year event. Channel improvements upstream and downstream of the crossing will also be required to capture and

convey the 100-year from the relatively wide floodplain to the proposed crossing location and eliminate road overtopping.

- Godding Hollow Parkway (WCR 18) Crossing (GH-C2): This crossing location was repaired after the 2013 flood with (7) 6' H x 10' W RCBCs. Evaluation of the existing crossing indicates that it has greater than 10-year capacity, but less than 50-year capacity. It is proposed that an additional (2) 6' H x 10' W RCBCs be added to this crossing to eliminate the overtopping of Godding Hollow Parkway during a 100-year event. It is suggested that these additional culverts be installed west of the existing culvert crossing to provide overflow capacity when the existing crossing becomes surcharged. Channel improvements upstream and downstream of the existing crossing will likely be required to transition the new overflow culverts to the main channel.
- Tipple Parkway (WCR 16) Crossing (GH-C3): Similar to the Godding Hollow Parkway crossings, this crossing location was repaired after the 2013 flood with (3) 7' H x 14' W RCBCs. Evaluation of the existing crossing indicates that it has greater than 10-year capacity, but less than 50-year capacity. It is proposed that an additional 7' H x 11' W RCBC be added to this crossing to eliminate the overtopping of Tipple Parkway during a 100-year event. It is suggested that this additional culvert be installed west of the existing culvert crossing to provide overflow capacity when the existing crossing becomes surcharged. Channel improvements upstream and downstream of the existing crossing will likely be required to transition the new overflow culvert to the main channel.
- Main Channel Crossing of Hwy 52 and Regional Pond (GH-C4 and GH Pond 718): Evaluation of the existing 8' H x 8' W RCBC crossing of Hwy 52 indicates that it has greater than 10-year capacity, but less than 50-year capacity. As previously mentioned, this crossing was overtopped during the 2013 flood. It is recognized that the low area between the embankments of Hwy 52 and the Lower Boulder Ditch provide an ideal location for a regional detention as this area is already frequently inundated during larger rainfall events. To provide 100-year capacity at this location, several improvements are proposed. The first improvement is the addition of an additional 8' H x 8' W RCBC culvert crossing of the roadway to increase capacity. The second improvement is the proposed raising of approximately 1400 feet of Hwy 52 to provide additional detention storage south of the roadway. The proposed increase in roadway elevation could occur as part of a future widening project that is currently being discussed with CDOT. The final improvement for this crossing is the acquisition of land by the City of Dacono to formally designate and maintain this area as a regional detention facility. As part of the crossing improvements at this location, the City of Dacono also wanted to include the acquisition of land on the east side of York Street (WCR 11) where an existing detention regional detention facility currently exists. Acquisition of this property will ensure that this regional facility is properly managed and maintained in the future as it provides significant peak discharge reduction to the Hwy 52 crossing. It is noted that this pond is predicted to overtop York Street (WCR 11) during the 100-year event, but the overtopping depth is less than the 12-inch criteria utilized to evaluate improvements within the City of Dacono. Stage-storage-discharge curve documentation for the proposed regional pond is provided in Appendix C.3.
- Lower Boulder Ditch Crossing (GH-C5 and Pond 819): Evaluation of the existing 7' H X 7' W RCBC crossing of the Lower Boudler Ditch indicates that it has greater than 10-year capacity, but less than 50-year capacity. Based on proposed improvement conditions the predicted overtopping of the ditch is approximately 1.2-feet along the main channel crossing and 2.1-feet along the tributary crossing west of York Street of during a 100-year event. As a result, proposed improvements to the ditch crossing include adding erosion protection to the northern ditch embankment along the sections that are predicted to be overtopped. In addition, it is proposed that the City of Dacono acquire the land south of the ditch that will be inundated during a 100-year event to formally designate and maintain this area as a regional detention facility.
- Lower York Tributary Regional Pond (GH Pond 783): A new regional detention pond location was identified along the York Tributary, west of York Street (WCR 11) and north of Grandview Boulevard (WCR 12). This regional detention facility is proposed to provide 48 acre-feet of storage to reduce peak discharges along the main drainageway. An existing oil and gas crossing of the channel was identified as the preferred location for the pond embankment. Acquisition of land by the City of Dacono will be required for construction of the pond. Stage-storage-discharge curve documentation for the proposed regional pond is provided in Appendix C.3.
- York Street (WCR 11) Crossing North of Grandview Boulevard (GH-C33): Evaluation of the existing dual 18" RCP crossing at the sump location on York Street, north of Grandview Boulevard, indicates that it has less than 10-year capacity and that the culverts have negligible cover underneath the existing roadway. It is proposed that an additional 18" RCP be installed and that approximately 580 feet of the roadway be raised to provide a minimum 10-year crossing capacity and 100-year overtopping depth of less than 12 inches.
- Grandview Boulevard (WCR 12) Crossing East of Panoram Circle (GH-C32): The existing crossing of Grandview Boulevard east of Panoram Circle consists of a small CMP that has been obstructed by vegetation such that its capacity is negligible. It is proposed that a 34" H x 52" W HERCP be installed to provide a minimum 10-year crossing capacity of Grandview Boulevard. This will require approximately 525 feet of the existing roadway to be raised and the construction of drainage channel improvements north of the crossing. Excess flow from this crossing will be conveyed west along the southside of Grandview Boulevard to York Street.
- York Street (WCR 11) Crossing South of Grandview Boulevard (GH-C31) and Grandview Boulevard (WCR 12) Crossing West of York Street (GH-C30): The existing crossing of York Steet, south of Grandview Boulevard, and the existing crossing of Grandview Boulevard, west of York Street, are small and obstructed culverts with negligible capacity. Significant flows from drainage areas to the south and southeast drain to these locations and frequently overtop York Street and Grandview Boulevard. Due to the repeated flooding problems at theses crossings, the City of Dacono engaged Lamp Rynearson and Associates to develop a preliminary drainage improvement design for this intersection. This design proposed the installation of dual 36" RCPs across York Street and (3) 3' H x 6' W RCBCs across Grandview Boulevard. The proposed improvements also identified the York Street and Grandview Boulevard intersection to be elevated. Due to the proposed crossing improvements east of this location (GH-C32) and the proposed regional detention pond upstream of this crossing location (GH Pond 885), the proposed condition discharges conveyed to these crossing locations will be significantly reduced when compared to existing conditions. As a result of the reduced peak discharges, the preliminary Lamp Rynearson design was determined to meet the design criteria of providing minimum 10-year crossing capacity and 100-year overtopping depths of less than 12 inches. A copy of the preliminary Lamp Rynearson design has been provided in Appendix D.3.
- Upper York Tributary Regional Pond (GH Pond 885): A new regional detention pond location was identified along the York Tributary, east of York Street (WCR 11) and south of Grandview Boulevard (WCR 12). Two existing agricultural/livestock ponds are currently located in this area, and it is anticipated that a new regional detention facility could be constructed without inundating significantly more area than that taken up by the existing ponds. The proposed pond will provide 66 acre-feet of detention storage and require the acquisition of land for construction of the pond. Construction of this pond will significantly reduce the peak discharge

conveyed to the York Street and Grandview Boulevard intersection (crossings GH-C31 and Gh-C30). Stage-storage-discharge curve documentation for the proposed regional pond is provided in Appendix C.3.

- Grandview Boulevard (WCR 12) Crossing (GH-C6): Evaluation of the existing 36" CMP crossing at the main channel crossing of Grandview Boulevard indicates that it has less than 2-year capacity. In order to provide 100-year capacity, the existing crossing will need to be significantly enlarged. Since the existing crossing already has sufficient height, it was decided that elevating the roadway was not necessary. It is proposed that the existing crossing be replaced with (3) 4' H x 12' W RCBCs to provide a minimum 10-year crossing capacity and 100-year overtopping depth of less than 12 inches.
- Speedway Regional Pond (GH Pond 728): A new regional detention pond location was identified along the I-25 Tributary, just west of the Colorado National Speedway. This regional detention facility is proposed to provide 46 acre-feet of storage to reduce peak discharges along the main drainageway. Acquisition of land by the City of Dacono will be required for construction of the pond. Stage-storage-discharge curve documentation for the proposed regional pond is provided in Appendix C.3.
- Speedway Boulevard (WCR 10) Crossing (GH-C7): Evaluation of the existing 60" CMP crossing at the main channel crossing of Speedway Boulevard indicates that it has less than 10-year capacity. In order to provide 100-year capacity, the existing crossing will need to be significantly enlarged. Since the existing crossing already has sufficient height, it was decided that elevating the roadway was not necessary. It is proposed that the existing crossing be replaced with (2) 5' H x 7' W RCBCs to provide a minimum 10-year crossing capacity and 100-year overtopping depth of less than 12 inches.
- Erie Tributary Crossing of Hwy 52 (GH-C12): Evaluation of the existing dual 36" CMP crossing at the Erie Tributary crossing of Hwy 52 indicates that these culverts have less than 10-year capacity. In order to provide 100-year capacity, the existing crossing will need to be significantly enlarged. The Erie OSP proposed the installation of (3) 4' H x 12' W RCBCs at this location. Evaluation of the proposed Erie OSP improvements were found to be adequate for conveying the 100-year event without overtopping and were maintained as the proposed improvements for this crossing as part of this study.
- Hwy 52 Crossing, West of WCR 7 (GH-C29): Evaluation of the existing 24" RCP crossing of Hwy 52, west of WRC7 indicates that it has less than 10-year capacity. In order to provide 100-year capacity, the existing crossing will need to be significantly enlarged. The Erie OSP proposed the installation of (2) 3' H x 5' W RCBCs at this location. Evaluation of the proposed Erie OSP improvements were found to be adequate for conveying the 100-year event without overtopping and were maintained as the proposed improvements for this crossing as part of this study.

7.6.1 SWMM Model Development

Development of the Godding Hollow Basin proposed improvement SWMM model was based on the future condition model, with incorporated changes to reflect the recommended plan of improvements. A proposed improvement CUHP analysis was conducted to reflect the proposed acquisition of subbasin 18 by the City of Dacono to formalize the regional detention pond south of Hwy 52. The percent impervious value for subbasin 18 was changed back to existing conditions to reflect that this basin will not be developed as part of the proposed conditions. The proposed improvement hydrologic parameters, and the rainfall depths reported in Table 7.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table D.3.1 in Appendix D.3 presents the Godding Hollow hydraulic parameters and peak flow runoff rates for the proposed improvement analysis. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table D.3.1 in Appendix D.3 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model.

Review of the Erie OSP indicated that regional detention facilities were incorporated into the recommended plan to detain proposed condition discharges back to existing conditions at outfall locations. However, it was also realized that regional detention facilities were not incorporated into some of the outfall locations along I-25 due to the smaller drainage areas serving these locations. Thus, for the outfall locations that did not have an associated regional detention facility, the recommended plan discharges from the Erie OSP study are higher than existing conditions. Coordination with staff from the Town of Erie confirmed that it was decided to not model regional detention facilities for these smaller outfall locations as part of the Erie OSP, but that the Town will require all future development within these areas to provide on-site detention. Since the utilization of the recommended plan discharges from the Erie OSP study would be highly conservative for the downstream assessment of proposed improvement hydrology within the lower portion of the Godding Hollow Basin, and the fact that Erie will be requiring on-site detention for future development, it was decided to continue the use of the existing condition hydrographs from the Erie OSP SWMM models as inflow hydrographs for the proposed improvement SWMM models developed as part of this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP study has been digitally provided with the SWMM model documentation in Appendix J.

To accurately model the regional detention pond proposed on the upper York Tributary (GH Pond 885), subbasin 85 was further subdivided as part of the proposed improvement SWMM model to reflect the upper portion of the original basin that will drain to the proposed pond location and the northern portion of the basin that will not drain into the pond. Hydrographs for these subdivided basins were developed by area weighting the hydrograph associated with the original basin. A new conceptual on-site detention pond was also incorporated into the SWMM model to reflect future development criteria for the northern portion of the subbasin 85 that does not drain into the proposed regional detention facility. Documentation for the development of these hydrographs has been digitally provided in a spreadsheet with the SWMM model documentation. A detailed conveyance element map illustrating the proposed improvement SWMM model schematic for the Godding Hollow Basin is provided in Appendix D.3. Proposed improvement SWMM models for the Godding Hollow Basin are digitally provided as part of Appendix J.

7.6.2 Results of Analysis

Table 7.4 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the future condition analysis have also been included in Table 7.4. Table D.3.2 in Appendix D.3 provides a complete discharge comparison for all modeled flow events.

Table 7.4 Godding Hollow Basin Proposed Improvement Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Improvements 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path					
Frederick Planning Boundary	402	10,511	7,590	5,073	-2,517
Bella Rosa Parkway	404	10,111	7,574	5,059	-2,515
Godding Hollow Parkway	410	9,140	7,439	4,903	-2,535
Tipple Parkway	414	7,583	6,771	4,385	-2,386
Confluence with Erie Tributary	415	7,181	6,549	4,267	-2,282
State Highway 52 Frederick/Dacono Boundary	418	4,226	4,960	2,244	-2,716
Lower Boulder Ditch	419	3,732	4,444	3,202	-1,242
Confluence with York Tributary	983	3,501	4,203	2,966	-1,237
Grandview Boulevard	423	2,107	2,667	2,226	-441
Confluence With Southeastern Tributary	925	1,969	2,541	2,118	-423
Confluence With I-25 Tributary	428	1,527	1,943	1,539	-404
I-25 Tributary East of I-25/ Dacono Planning Boundary	929	558	644	644	0
Speedway Boulevard	503	919	1,272	1,272	0
West of I-25 Crossing/ Dacono Planning Boundary	P-970	466	585	585	0
Erie Tributary					
Eastern I-25 Frontage Road	467	2,475	1,878	1,880	2
West of I-25 Crossing	462	2,172	1,638	1,639	1
State Highway 52/ Frederick Planning Boundary	P-675	1,270	1,192	1,192	0
Western Tributary					
West of I-25 Crossing/ Frederick Planning Boundary	431	388	323	323	0

As presented in Table 7.4, results of proposed improvement analysis highlight the significant decrease in the proposed 100-year discharge for the main channel crossings when compared to future conditions. This reduction in discharge is a result of the implementation of the five regional detention facilities associated with the recommended plan.

Table D.3.3 in Appendix D.3 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. HY-8 models utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table D.3.3 has been depicted on the proposed improvement crossing map provided in Appendix D.3.

7.6.3 Cost Estimates

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed. For the more complicated improvements that included road modifications, proposed channels, and regional detention ponds, conceptual designs and gradings plans were digitally developed in an ACAD file for the estimation of earthwork quantities. A digital copy of this ACAD file have been provided in Appendix J.

The estimated quantities for each project were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. A summary of the project cost estimates for the Godding Hollow Basin have been provided as Table D.4.1 in Appendix D.4. The estimated quantities and cost breakdown assumptions for each individual project have also been provided in Appendix D.4. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP.

7.6.4 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities for each community was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from each community, a final scoring and ranking for each project were developed as presented in Tables 7.5 and 7.6. Total project costs have also been summarized in Tables 7.5 and 7.6. It is noted that the rankings presented in Tables 7.5 and 7.6 are meant to provide a general sequencing plan for each community as funding becomes available. However, these rankings should be considered flexible, with each community having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 7.5 Town of Frederick Selected Plan Costs and Implementation Plan for Godding Hollow Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick/ Dacono	GH-C4	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC	Frederick Portion (Half of Crossing[1])	$ 1,371,000	5	1	3	3	**12**	1
Frederick	GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC 7' H X 11 W RCBC	-	$ 434,000	3	3	1	2	**9**	2
Frederick	GH-C12	Highway 52 - Erie Tributary	(3) 4' H x 12' W RCBC	-	$ 762,000	5	2	1	1	**9**	3
Frederick/ Erie	GH-C29	Highway 52, West of County Road 7	(3) 3' H x 5' W RCBC	Frederick Portion (Half of Crossing[2])	$ 276,000	3	2	3	1	**9**	4
Frederick	GH-C2	County Road 18/Godding Hollow Parkway	(9) 6' H x 10' W RCBC	-	$ 606,000	3	2	1	2	**8**	5
Frederick	GH-C1	County Road 20/Bella Rosa Parkway	(10) 5' H x 12' W RCBC	-	$ 1,413,000	3	1	1	1	**6**	6
				Total Frederick Costs for Godding Hollow	**$ 4,862,000**				**Average Score**	**8.8**	

[1]Total Project Cost = $2,877,000. Other half of crossing costs ($1,506,000) allocated to City of Dacono.

[2]Total Project Cost = $540,000. Other half of crossing costs ($264,000) allocated to Town of Erie.

Table 7.6 City of Dacono Selected Plan Costs and Implementation Plan for Godding Hollow Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Dacono/ Frederick	GH-C4 GH Pond 718	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC 121 AC-FT Detention Pond	Dacono Portion (Half of Crossing and Detention Ponds[1])	$ 1,506,000	5	1	3	3	**12**	1
Dacono	GH-C5 GH Pond 819	Lower Boulder Ditch	45 AC-FT Detention Pond	Pond	Combined with GH-C4	5	1	3	3	**12**	2
Dacono	GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	34" H x 53" W HERCP	Channel Improvement	$ 459,000	3	2	2	3	**10**	3
Dacono	GH-C6	County Road 12/Grandview Blvd	(3) 4' H x 12' W RCBC	-	$ 612,000	4	2	1	3	**10**	4
Dacono	GH-C7	County Road 10/Speedway Blvd	(2) 5' H x 7' W RCBC	-	$ 560,000	4	2	1	3	**10**	5
Dacono	GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(3) 18" RCPS	-	$ 143,000	3	3	1	3	**10**	6
Dacono	GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	(3) 3' H x 6' W RCBC	-	$ 1,322,000	4	1	1	3	**9**	7
Dacono	GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	(3) 3' H x 6' W RCBC	-	Combined with GH-C30	4	1	1	3	**9**	8
Dacono	GH Pond 885	County Road 11/York St, South of Grandview Boulevard	66 AC-FT Detention Pond	Pond	$ 2,044,000	3	1	2	2	**8**	9
Dacono	GH Pond 728	I-25, North of County Road 10/ Speedway Boulevard	46 AC-FT Detention Pond	Pond	$ 1,520,000	3	1	1	2	**7**	10
Dacono	GH Pond 783	County Road 11/York St, North of County Road 12/Grandview Boulevard	48 AC-FT Detention Pond	Pond	$ 1,290,000	3	1	1	2	**7**	11
				Total Dacono Costs for Godding Hollow	**$ 9,456,000**				**Average Score**	**9.5**	

[1]Total Project Cost = $2,877,000. Other half of crossing costs ($1,371,000) allocated to Town of Frederick.

8 Idaho Creek Basin (IC)

8.1 Project Area

Figure 8.1 shows the extents of the Idaho Creek Basin and its geographical relation to the TOF and COD planning boundaries. As illustrated on Figure 8.1, the headwaters of the Idaho Creek Basin are located south of State Highway 52 (Hwy 52) and west of Interstate 25 (I-25). This area is located outside of the study area for this OSP but was evaluated as part of the Town of Erie OSP. Therefore, inflows from the Erie OSP were incorporated into the modeling of the Idaho Creek Basin as part of this study. The Idaho Creek Basin encompasses approximately 6,650 acres and is still predominately a rural watershed, but development has started to occur in several areas of the basin. Runoff from the basin generally flows south to north. Numerous county roads, Hwy 52, Hwy 119, and irrigation ditches/canals cross the major drainageway and its tributaries. Five irrigation ditches, the Lower Boulder Ditch, Boulder and Weld County Ditch, Rural Ditch, Cottonwood Extension Ditch, and the Godding Ditch, traverse the Idaho Creek Basin within the study area. These ditches convey irrigation flows within and through the basin but offer limited value as drainage features that will convey stormwater runoff during major flood events. Due to the limited capacity of the ditch systems, coupled with the magnitude of stormwater flows, these irrigation ditches were assumed to not significantly influence drainage patterns within the basin and flows were routed over them.

The major drainageway for the Idaho Creek Basin originates near the intersection of WCR 5 and Speedway Boulevard (WCR 10), west of I-25 within the Town of Erie Planning area. From this location, the Idaho Creek drainageway conveys runoff north through the Town of Erie and enters the TOF planning boundary at a wetland pond just south of Hwy 52 and west of WCR 5. A small tributary that originates south of Hwy 52, between WCR 5 and Aggregate Boulevard (WCR 7), enters the TOF planning boundary east of WCR 5 and combines with local runoff from the Wyndham Hill development. This eastern tributary flows west until it converges with the main drainageway at the northern end of the wetland pond system. From the wetland pond system, the upper segment of the main drainageway flows northwest and converges with the lower Idaho Creek drainageway that begins at a diversion from Boulder Creek. A small tributary that originates between the main drainageway and WCR 5 confluences with Idaho Creek north of WCR 16.5. Idaho Creek then flows northeast between gravel pits and crosses WCR 20.5 and Aggregate Boulevard (WCR 7) before exiting the TOF planning boundary at State Highway 119 (Hwy 119).

Two eastern tributaries that originate south of WCR 16.5, between WCR 5 and Aggregate Boulevard, flow north across Godding Hollow Parkway (WCR 18) separately before converging near the Godding Ditch. After converging, this tributary conveys runoff north across Bella Rosa Parkway (WCR 20) and confluences with the main channel of Idaho Creek. A segment of the Rural Ditch serves as another tributary for stormwater flows in the northeastern portion of the basin. Runoff is diverted into the ditch just south of WCR 20.5 and where the ditch conveys it northeast between Aggregate Boulevard and I-25. A diversion structure located just south of Hwy 119 diverts excess stormwater flows from the ditch and into a drainage channel along the south side of Hwy 119, where it confluences with Idaho Creek just south of Hwy 119. The existing conveyance element map provided in Appendix E.1 illustrates the complicated drainage network of the Idaho Creek Basin.

8.2 Previous Studies

In 2008, Civil Resources, LLC, completed a study of Idaho Creek for the TOF. This study, "Idaho Creek Master Drainage Study" provided the TOF with a regionalized plan for stormwater improvements within the Idaho Creek Basin. The 2008 study informed the current study of the drainage boundaries and flow patterns within the basin. It also identified proposed improvement locations that were reviewed and incorporated into the recommended plan for this study.

In 2020, Merrick completed the most recent master drainage plan update for the portion of the Idaho Creek Basin within the Town of Erie planning area. The study, "Town of Erie Outfall Systems Plan (East of Coal Creek)," developed updated baseline and recommended plan condition hydrology for the Idaho Creek Basin located in Erie. This study identified two locations where the Idaho Creek Basin in Erie outfalls to the portion of the basin located within the TOF planning area. To provide consistency between the Erie OSP study and this study, hydrographs at each outfall location were obtained from the Erie OSP SWMM models and utilized as inflow hydrographs for the SWMM models developed as part of this study. In addition, the 2020 study identified proposed improvements along the Hwy 52 corridor and within the upper portion of the Idaho Creek Basin that is within the TOF planning area. To provide consistency, these improvements were reviewed and incorporated into the recommended plan for this study. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

8.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Idaho Creek Basin is presented in the following sections.

8.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Idaho Creek Basin are presented in Table 8.1.

Table 8.1 Idaho Creek Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Idaho Creek (IC)	0.815	1.10	1.39	2.27	2.73

8.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 8.1, the larger Idaho Creek drainage basin was subdivided into smaller subbasins for the hydrologic analyses. The definition of smaller subbasins was conducted for the approximate 4,900 acres of the basin located within the TOF planning boundary. In total, 63 subbasins were delineated for the Idaho Creek Basin with an average basin size of approximately 60 acres. Detailed subbasin maps are provided in Appendix E.1.

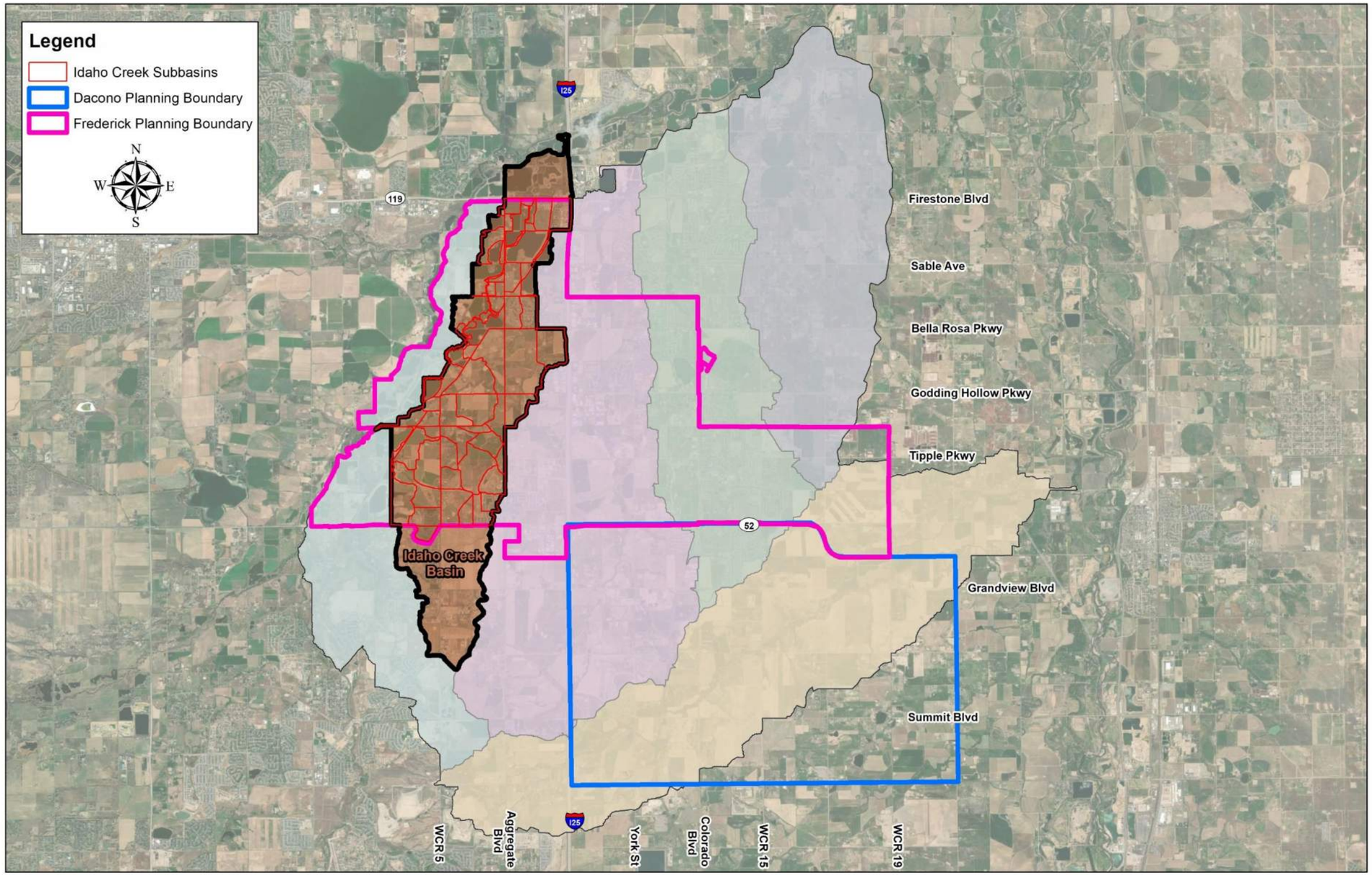

Figure 8.1 Idaho Creek Basin Study Area

Hydrologic modeling parameters, existing land use, and soil parameters were developed for each subbasin based on the procedures outlined in Section 3.3 of this report. These hydrologic parameters, and the rainfall depths reported in Table 8.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Results from the initial CUHP analysis were checked for reasonableness and adjustments to the parameters were made, as necessary. Table E.1.1 in Appendix E.1 presents the final Idaho Creek hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table E.1.1, the average existing condition percent impervious value for the basin is 8%, with an average unit runoff rate for the 100-year storm of 1.17 cfs/acre. The subbasin delineations and hydrologic modeling of the Idaho Creek Basin associated with the Erie OSP study were reviewed for general conformance to the assumptions associated with this study. No major inconsistencies were identified as part of this review and the Erie OSP information was utilized for the study.

In the Idaho Creek Basin, the presence of on-going gravel mining operations and reclaimed water storage reservoirs complicated the delineation of subbasins. Typically, berms are constructed around the perimeter of the gravel mines and reclaimed storage reservoirs to eliminate surface runoff from entering the pit or reservoir from the adjacent watershed area. As a result, the gravel pits and reservoirs become their own subbasin sinks that are cut off from the surrounding watershed. It was recognized that assuming these pits and reservoirs were completely full to the overtopping spillway elevation at the time of a significant rainfall event, such that they would contribute runoff to the adjacent drainageway, would be highly conservative. Especially if the water surface area of the pit was assumed to be highly impervious due to rain falling on an existing water body. Based on discussion with staff from the TOF, it was determined that the following assumptions would be made relative to existing gravel pits and reservoirs:

- Due to the freeboard that is usually built into the design of gravel pits and reservoirs, and the fact that berms around them do not allow runoff from the surrounding area to enter them, it was assumed that these areas would be able to accommodate the approximate 2.7 inches of rainfall that would fall upon them during a 100-year event without overtopping. As a result, the area of each gravel pit and reservoir within the study area was delineated and assumed to be non-contributing to the runoff within the larger basin.
- For the routing of hydrographs along drainageways that would potentially overtop into the adjacent gravel pits and reservoirs, the gravel pits and reservoirs were assumed to be completely full to the overtopping elevation such that they would not provide attenuation of the flood peak along the drainageway.

As a result of these assumptions, subbasins were delineated around existing gravel pits and reservoirs and shown on the subbasin maps as a non-contributing subbasin. Hydrology calculations for these areas were not conducted nor included in the hydrologic analysis.

8.3.3 Inventory of Existing Drainage Facilities

A thorough inventory of existing drainage facilities within the Idaho Creek Basin was conducted as part of this study and utilized to develop the drainage network incorporated into the SWMM models. Inventory of existing crossing structures and detention ponds followed procedures outlined in Section 4.1 of this report and typically included site survey and photographic documentation, which have been digitally provided as part of Appendix J. FHWA's HY-8 culvert analysis software was utilized to evaluate road crossing culvert capacities. Detention pond stage-storage relationships were developed from ground survey and the 2013 LiDAR data to reflect as-built conditions. Ground survey and field measurements of the pond outlet structures was collected to define the outlet geometry for establishing the discharge rating curves for the detention ponds. The Grand View Elementary School drains into an existing mine depression that was determined to have sufficient volume to retain the 100-year runoff generated from the school site. This depression was incorporated into the SWMM model as pond IC-654.

Inventory of the existing drainage facilities within the Idaho Creek Basin resulted in the evaluation of 21 individual crossing structures and 4 detention ponds. Maps depicting the locations of the existing crossings and detention basin facilities are provided in Appendix E.1. Table E.1.2 in Appendix E.1 provides detailed information on the existing condition crossing structure characteristics and capacity analysis. Additional documentation for the development of the stage-storage-discharge curves for each individual pond is also provided in Appendix E.1. HY-8 models utilized to evaluate the existing culvert improvements are provided digitally in Appendix E.

8.3.4 SWMM Model Development

Determination of peak discharges and hydrographs at pertinent locations required the use of SWMM (Version 5.1.015). Development of the Idaho Creek Basin existing condition SWMM model, based on information obtained from previous studies, site visits, and other data collected as part of this study, followed the general procedures described in Section 3.4 of this report. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table E.1.1 in Appendix E.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Hydrographs from the Erie OSP study were also incorporated into the SWMM models developed as part of this study to appropriately account for inflow from the upstream portion of the watershed. These hydrographs were obtained from the results of the Erie OSP existing condition SWMM model at the outfall locations where flow crosses the Erie planning boundary into the Frederick planning boundary. For consistency, the outfall node names and locations from the Erie OSP model were maintained and incorporated into the SWMM models developed as part of this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP study has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the existing condition SWMM model schematic for the Idaho Creek Basin is provided in Appendix E.1. Existing condition SWMM models for the Idaho Creek Basin are digitally provided as part of Appendix J.

8.3.5 Results of Analysis

Table 8.2 provides a summary of the existing condition peak discharge results at pertinent locations throughout the watershed. For comparison, results from the 2008 Civil Resources study have also been included in Table 8.2. Table E.1.3 in Appendix E.1 provides a complete discharge comparison for all modeled flow events.

Table 8.2 Idaho Creek Basin Existing Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	CR 2008 Study Existing Condition SWMM Model Peak Discharge (cfs)	2022 OSP Study 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path – Lower Idaho Creek					
Highway 119/ Frederick Planning Boundary	401	5,348	2,721	1,777	-944
County Road 7, South of Highway 119	407	4,701	2,370	1,737	-633
County Road 20.5	409	4,656	2,336	1,743	-593
Rural Ditch					
County Road 20.5	420	82	118	39	-79
County Road 20, East of County Road 7	440	162	196	241	45
Main Flow Path – Upper Idaho Creek					
Country Road 16.5	956	2,064	1,674	1,740	66
Decommissioned Railroad Embankment	457	2,064	1,697	1,782	85
HWY 52, West of County Road 5	P-479	1,181	1,379	1,252	-127
County Road 5/Boulder and Weld County Ditch	460	506	722	496	-226
HWY 52, East of County Road 5	P-475	214	310	288	-22
Other Tributary Crossings					
County Road 7, South of County Road 20	439	345	331	446	115
County Road 20, West of County Road 7	433	1,631	N/A	1,079	N/A
County Road 18, East of County Road 5	235 (Link)	721	745	403	-342
County Road 16.5, East of County Road 5	446	460	580	317	-263
County Road 16.5 at Decommissioned Railroad Embankment	448	458	745	435	-310

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

As presented in Table 8.2, peak discharges from the current OSP study depict both increases and decreases when compared to the 2008 study. The main factor in the reduction of discharges at the downstream portion of the Idaho Creek Basin is the decrease in the contributing drainage area assumed for this study as a result of the gravel mining operations. Approximately 870 acres of the basin were designated as gravel pits and assumed to be non-contributing.

On the western side of I-25, gravel mining operations and the 2013 LiDAR data indicated that an additional 400 acres that were originally identified to be tributary to Idaho Creek as part of the 2008 study are tributary to the Godding Hollow Basin. This re-delineation of the major basin boundaries between Idaho Creek and Godding Hollow further reduced the contributing area to Idaho Creek as part of this study.

Results of the existing condition SWMM models were also utilized to evaluate the performance of the existing crossing structures and detention basins located within the basin. Both adequate and under-performing drainage facilities are identified in Table E.1.2 and shown on the inventory maps presented in Appendix E.1. With respect to the identified under-performing detention facilities (ponds identified to overtop during the 100-year event), it is recognized that the design of existing on-site detention ponds associated with developments utilized different modeling software programs, assumptions, and was conducted at a more detailed level than those associated with this OSP study. Therefore, the identification of under-performing detention ponds as part of this study is intended as an informational tool for the communities and is not intended to be used as a regulatory tool for on-site detention pond compliance.

8.3.6 Identification of Existing Drainage Problems

As shown on the existing condition crossing inventory maps and tables provided in Appendix E.1, multiple drainage deficiencies exist throughout the Idaho Creek Basin. Most drainage problems can be summarized by the following:

- The lack of well-defined drainageways for tributaries. A significant portion of the existing tributaries are comprised of undefined drainageways, such as broad agricultural fields or small irrigation ditches.
- Due to presence of gravel mining operations, the main drainageway of Idaho Creek has been confined to a relatively narrow conveyance corridor. Consequently, the berms associated with the gravel pits that are adjacent to the main channel will be overtopped during larger flow events and the floodplain will encompass the gravel pits. As mentioned in Section 8.3.2, the gravel pits were assumed to be full for the routing of flood flows through the pits.
- The existing roadways within the basin are generally not elevated above the adjacent ground and lack adequate crossing structures to convey flood flows. This results in the overtopping of major arterial roadways during even minor storm events. Of the existing 21 crossing structures identified within the basin, only 4 have adeqaute capacity to convey a 10-year event.

8.4 Future Condition Analyses

The future condition analyses were based on the comprehensive land use and zoning maps of the communities to estimate hydrologic conditions representing a full buildout of the basin. Hydrologic results from the future condition analyses were evaluated with existing drainage infrastructure to provide an assessment of future buildout conditions without the implementation of drainage improvements. Design rainfall and subbasin delineations were not modified from the existing condition analysis.

8.4.1 Hydrograph Development

The hydrologic parameters defined as part of the existing condition analysis were maintained for the future condition analysis, except for the percent impervious and depression storage values of those subbasins that were assumed to be developed based on the comprehensive land use and zoning maps for each community. Of the 63 subbasins delineated for the Idaho Creek Basin, 43 of them were assumed to have future development. The future condition hydrologic parameters, and the rainfall depths reported in Table 8.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table E.2.1 in Appendix E.2 presents the final Idaho Creek Basin hydrologic parameters and peak flow runoff rates for the future condition analysis. As shown in Table E.2.1, the average future condition percent impervious value for the basin is 18%, approximately doubling the average percent impervious value of existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 1.35 cfs/acre.

8.4.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the future conditions analysis to simulate the impact of on-site detention as part of future development. All conceptual on-site detention ponds within the Idaho Creek Basin were assumed to adhere to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. The Grand View Elementary School Pond, labeled IC-654 in the existing condition SWMM model, was assumed to be filled in as part of future development per direction from community staff. Therefore, runoff from this basin was directed into a conceptual on-site pond as part of the future condition analysis. Outflow from this pond was routed to the north where it combines with the adjacent tributary. Release rates for the conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Documentation for the stage-storage-discharge curves developed for the conceptual Idaho Creek Basin detention ponds is provided in Appendix E.2.

8.4.3 SWMM Model Development

Development of the Idaho Creek Basin future condition SWMM model was based on the existing condition model. The only changes to the SWMM model were the implementation of the conceptual on-site design ponds in subbasins that were assumed to be developed as part of the future conditions. Subbasin hydrographs developed from the future condition CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table E.2.1 in Appendix E.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Runoff for basins assumed to be developed as part of the future conditions were imported into a conceptual on-site detention pond node.

It is noted that the Erie OSP did not evaluate a future condition with conceptual on-site detention pond scenario for incorporation with the future condition analysis conducted as part of this study. Coordination with staff from the Town of Erie confirmed that Erie also regulates the 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirement for future development. As a result, the future condition with on-site detention hydrology from Erie's portion of the Idaho Creek Basin should not be significantly different than the existing condition hydrology. Therefore, it was decided to utilize the existing condition hydrographs from the Erie OSP SWMM models at the outfall locations as inflow hydrographs for the future condition modeling associated with this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the future condition SWMM model schematic for the Idaho Creek Basin is provided in Appendix E.2. Future condition SWMM models for the Idaho Creek Basin are digitally provided as part of Appendix J.

8.4.4 Results of Analysis

Table 8.3 provides a summary of the future condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 8.3. Table E.2.2 in Appendix E.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 8.3, results of the future condition analysis indicate increased discharges in comparison to existing conditions. This predicted increase in peak flow rates along the main drainageways can be attributed to the additional volume of future condition runoff caused by development, as well as the attenuated and prolonged peak flows associated with on-site detention ponds. The attenuated and prolonged peak releases from on-stie detention ponds can facilitate the alignment of peak flow timing along the major drainageways and tributaries. This increase in peak flow rates because of on-site detention requirements has been recognized by the MHFD in Volume 2 of the USDCM. Consequently, the MHFD is now recommending that on-site detention ponds be designed using a full spectrum approach which limits the 100-year release rates from on-site detention ponds to 90% of the predevelopment 100-year runoff rate. Since the TOF currently regulates to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirements, this assumption was maintained for the future condition and proposed improvement evaluation associated with the Idaho Creek Basin.

The future condition flow rates were compared back to existing crossing capacities to reevaluate the performance of existing crossing structures under future conditions. Results of this comparison is provided in Table E.1.2 in Appendix E.1 and depicted on the future condition crossing map provided in Appendix E.2. As illustrated on Table E.1.2, the increased discharges associated with the future condition analysis further diminish the ability of existing crossings to convey the 100-year flow event.

Table 8.3 Idaho Creek Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path – Lower Idaho Creek					
Highway 119/ Frederick Planning Boundary	401	5,348	1,777	1,962	185
County Road 7, South of Highway 119	407	4,701	1,737	1,907	170
County Road 20.5	409	4,656	1,743	1,913	170
Rural Ditch					
County Road 20.5	420	82	39	39	0
County Road 20, East of County Road 7	440	162	241	237	-4
Main Flow Path – Upper Idaho Creek					
Country Road 16.5	956	2,064	1,740	1,837	97
Decommissioned Railroad Embankment	457	2,064	1,782	1,883	101
HWY 52, West of County Road 5	P-479	1,181	1,252	1,252	0
County Road 5/Boulder and Weld County Ditch	460	506	496	518	22
HWY 52, East of County Road 5	P-475	214	288	288	0
Other Tributary Crossings					
County Road 7, South of County Road 20	439	345	446	439	-7
County Road 20, West of County Road 7	433	1,631	1,079	1,253	174
County Road 18, East of County Road 5	235 (Link)	721	403	555	153
County Road 16.5, East of County Road 5	446	460	317	457	140
County Road 16.5 at Decommissioned Railroad Embankment	448	458	435	457	22

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

8.5 Alternative Analysis

Results of the future condition analysis and crossing map were reviewed with community staff to identify the projects that would be evaluated as part of the alternative analysis. Conclusions from these discussions resulted in the following list of improvements for alternative evaluation in the Idaho Creek Basin.

- Improvements will be evaluated for all arterial roadway crossings that currently do not have 100-year capacity per Town Criteria. This includes the undersized crossings along Hwy 52, Aggregate Boulevard, Godding Hollow Parkway, and Bella Rosa Parkway.
- Channel improvements will be evaluated for significant tributaries within the agricultural areas.
- Improvements from the Town of Erie OSP will be evaluated as potential solutions at identified locations.
- The current capacity of Highway 119 was identified to adhere to current CDOT criteria. Therefore, proposed improvements were not evaluated at this crossing per direction from community staff.

During the development of the alternative analysis, it was realized the Erie OSP recommended plan proposed channel improvements and a large regional detention facility south of Hwy 52, east of WCR 5. These proposed improvements significantly reduce the amount of flow being conveyed to the western wetland pond crossing of Hwy 52 and increase the amount of flow being conveyed to the eastern Hwy 52 crossing, east of WCR 5. These proposed improvements will require the incorporation of the recommended plan outflow hydrographs from the Erie OSP models. Based on a review of these proposed improvements with TOF staff, it was decided that the evaluation of alternatives and the proposed improvement analysis associated with this study will utilize the recommended plan flows from the Erie OSP.

8.6 Recommended Plan

The following recommended plan of improvements for the Idaho Creek Basin were identified and agreed to by community staff. Diverting the upper main drainageway into Boulder Creek, as identified by the Erie OSP recommended plan, was confirmed as the most effective way for reducing flows along the lower portions of the Idaho Creek drainage. As previously discussed, the Erie OSP's recommended plan redirects the main drainageway east into to a regional detention pond located south of Hwy 52, between WCR 5 and Aggregate Boulevard (WCR 7). This location is the eastern inflow location from the existing condition model. As a result of the proposed improvements associated with the Erie OSP, the amount of flow directed to the wetland pond crossing will be significantly decreased, while the amount of flow directed towards the eastern crossing, where the proposed regional detention facility is located, will significantly increase. With the exception of the proposed regional detention facility recommended by the Erie OSP, regional detention facilities within the TOF's portion of the Idaho Creek Basin were not identified. It is also recommended that a drainage channel be constructed to confine flood flow along the tributary that begins near the Aggregate Boulevard and Godding Hollow Parkway (WCR 18) intersection, and that the land for this channel be acquired by the Town.

It is noted that the following improvements were analyzed for the full buildout condition of the basin, which assumes the regional detention facility and channel improvements south of Hwy 52, within the Erie planning area, have been constructed. As a result, it should be recognized that the implementation of the following improvements prior to the

construction of these facilities, will result in an interim condition in which the proposed improvements will under-perform until full buildout is reached. Maps depicting the proposed drainage improvements are provided in Appendix E.3. HY-8 models utilized to evaluate the proposed culvert improvements are provided digitally in Appendix J.

- Aggregate Boulevard (WCR7) South of Hwy 119 Crossing (IC-C2): Evaluation of the existing 3' H x 12' W RCBC indicates that it has greater than 10-year capacity, but less than 50-year capacity. The inlet area to the existing culvert limits the capacity of the existing crossing as a low point on the upstream side of the crossing allows for flows to bypass the crossing and be conveyed north where they overtop the roadway. To provide 100-year capacity for this crossing, the following improvements are recommended.
  - Increase the elevation of existing channel banks at the inlet location to a minimum elevation of 4871 feet and relocate the existing irrigation turnout.
  - Extend the existing 3' H x 12' W culvert upstream to accommodate the new inlet configuration and add an additional (2) 3' H x 12' W RCBCs.
  - Increase the existing channel capacity between the current irrigation turnout structure and the intersection of Harbor Drive and Aggregate Boulevard to convey the excess overflow during the 100-year storm.
  - Install (2) 3' H x 12' W RCBCs that cross underneath Aggregate Boulevard at the intersection of Harbor Drive and Aggregate Boulevard to direct excess flows back to the main drainageway on the east of Aggregate Boulevard.
  - To maintain irrigation flows north of Harbor Drive, it is proposed that an elevated spillway be constructed along the improved channel. This will allow irrigation flows to continue to the north during normal operating conditions. During flooding events, flow will pond upstream of the Harbor Drive crossing where excess flows will spill from the channel, through the spillway, into the proposed culvert crossing and back to the main channel.
- County Road 20.5 West of Aggregate Boulevard (WCR 7) Crossing (IC-C3): Evaluation of the existing 38" H x 60" W HERCP indicates that is has less than a 10-year capacity. It is recommended that (5) 4' H x 12' W RCBCs be installed to provide 100-year capacity and prevent flooding of nearby houses.
- Intersection of Aggregate Boulevard (WCR 7) and Bella Rosa Parkway (WCR 20) Crossings (IC-C5, IC-C14, and IC-C15): No existing drainage facilities are located at the intersection of Aggregate Boulevard and Bella Rosa Parkway. Evaluation of the existing 42" CMP (IC-C5) east of the intersection indicates that it has larger than a 10-year capacity, but less than 50-year capacity. Since the stormwater channel that directs runoff from this crossing back to the main channel along the north side of Bella Rosa Parkway was determined to not have additional capacity, it was decided to convey the excess flows from this crossing west along the south side of Bella Rosa Parkway to the southeast corner of the Aggregate Boulevard intersection (IC-C14). It is recommended that (2) 3' H x 12' W RCBCs be installed at Aggregate Boulevard (IC-C14) to provide 100-year capacity. It is also recommended that (5) 5' H x 12' W RCBCs be installed to provide 100-year capacity of Bella Rosa Parkway (IC-C15). Since an existing gravel pit is located on the north side of the roadway, the culverts for the Bella Rosa Parkway crossing (IC-15) were extended north along the east side of Aggregate Boulevard to bypass the existing gravel pit due to potential water rights implications. Channel improvements will be required on the downstream end of the culvert system to convey the flow back to the main channel of Idaho Creek. The proposed improvements to this intersection will also require the roadway to be elevated to provide adequate cover for existing utilities and the proposed culverts. As shown on the proposed improvements map provided in Appendix E.3, an alternative improvement option for this crossing was evaluated. This alternative would direct flow leaving the proposed culvert crossing of Bella Rosa Parkway into the existing gravel pit, assuming that it in the future the pit will be able to accommodate stormwater. This alternative would significantly reduce the costs of the proposed culverts, but will require improvements to the gravel pit such that stormwater flows can be safely conveyed into and out of the pit.
- WCR 16.5 Crossing (IC-C20), Godding Hollow Parkway (WCR 18) East of WCR 5 (IC-C18), Godding Ditch Crossing (IC-C21), and Associated Stormwater Channel Improvements: Due to lack of existing drainage infrastructure along this tributary, a stormwater channel improvement is proposed to convey water from WCR 16.5, east of WCR 5, to the intersection of Aggregate Boulevard (WCR 7) and Bella Rosa Parkway (WCR 20). It is noted that these channel improvements should be constructed from downstream to upstream to properly convey stormwater between the crossing improvements. Therefore, the implementation order of the crossings associated with these improvements are IC-C14 and IC-C15, IC-C21, IC-C18, and IC-C20. Upstream of the Aggregate Boulevard and Bella Rosa Parkway intersection, the proposed stormwater channel crosses the Godding Ditch. Due to the relatively small size of the ditch in comparison to the proposed drainage channel, a 6' RCP siphon is proposed to convey the Godding Ditch underneath the proposed stormwater channel. The existing crossings of Godding Hollow Parkway, east of WCR 5, consists of small CMP crossings that have been obstructed by vegetation such that their capacities are negligible. It is recommended that (4) 3' H x 11' W RCBCs be installed and that a berm be constructed along the western side of the existing drainage channel to a minimum elevation of 4904 feet to convey stormwater across Godding Hollow Parkway, east of the existing oil and gas facility. To provide an adequate crossing for localized flows that drain to the northwestern end of the oil and gas facility, it is proposed that a 2' H x 5' W RCBC be installed and that the Godding Hollow Parkway and WCR 5 intersection be elevated to provide adequate cover and room for utilities. No existing drainage facilities are located at the WCR 16.5 crossing, east of WCR 5. It is recommended that (2) 3' H x 10' W RCBCs be installed at this location to provide 100-year capacity.
- Intersection of Aggregate Boulevard (WCR 7) and Godding Hollow Parkway (WCR 18) Crossings (IC-C16 and IC-C17): No existing drainage facilities were located at this intersection. It is recommended that a 3' H x 7' W RCBC be installed from the southeast corner of the intersection across Aggregate Boulevard to the southwest corner (IC-C16) to provide 100-year capacity for Aggregate Boulevard crossing. An additional 3' H x 9' W RCBC is proposed to cross Godding Hollow Parkway (IC-C17) to the north to provide 100-year capacity for the Godding Hollow Parkway crossing. The proposed culvert installations will also require the existing roadways to be elevated to provide adequate cover for the culvert and room for utilities.
- WCR 16.5 West of WCR 5 Crossing (IC-C19): No existing drainage facilities are located at the crossing. It is recommended that (5) 2' H x 8' W RCBCs be installed to provide 100-year capacity for this crossing. The proposed culvert installation will require 580 feet of roadway to be elevated to provide adequate cover for the culvert and room for utilities.
- Decommissioned Railroad Embankment Near WCR 3.25 Between WCR 16.5 and Hwy 52 Crossing (IC-C7): This is the location that the Erie OSP identified to redirect the upper main drainageway into Boulder Creek. Evaluation of the existing 36" CMP at this location indicates that it has less than a 2-year capacity. It is recommended that (5) 4' H x 12' W RCBCs be installed to provide 100-year capacity for the WCR 3.25 crossing. Proposed channel improvements will also be needed to convey the redirected drainageway into Boulder Creek.

- WCR 16.5 and WCR 3.25 Intersection Crossing (IC-C6): Evaluation of the existing 18" CMP indicates that it has less than a 2-year capacity. However, with the proposed improvement that redirects the upper drainageway from the Idaho Creek Basin into Boulder Creek, the existing culvert will have 100-year capacity as it will only need to convey localized runoff once the upper drainageway is redirected.
- Wetland Pond System near Highway 52 Crossings (IC-C8 through IC-C13): The wetland pond system consists of the two drainageways that cross Hwy 52 from the Town of Erie, where they confluence at the northern end of the wetland pond system (IC-8). As part of the Erie OSP, proposed channel improvements south of Hwy 52 will redirect the majority of the inflows from the Town of Erie toward the proposed regional detention facility located east of WCR 5. The redirected main drainageway includes crossings IC-C8, IC-C11, IC-C12, and IC-C13, from downstream to upstream. Within the redirected main drainageway crossings, only the Hwy 52 crossing (IC-C13) has existing drainage infrastructure. The evaluation of the existing 24" RCP determined that the current crossing has less than a 10-year capacity. To provide 100-year capacity for this drainage system, it is recommended that (4) 5' H x 10' W RCBCs, (3) 5' H x 11' W RCBCs, an 8' H x 10' W RCBC, and an 8' H x 10' W RCBC be installed for crossings IC-C8, IC-C11, IC-C12, and IC-C13, respectively. Channel improvements will be required to effectively convey flow between the proposed crossing improvements. It should be noted that crossing IC-C11 would convey flow underneath the Boulder and Weld County Ditch and WCR 5. Crossing IC-C12 would convey flow underneath the Lower Boulder Ditch. The western drainageway that crosses Hwy 52 from the Town of Erie conveys flow through the series of existing wetland ponds that include crossings IC-C8, IC-C9, and IC-C10, from downstream to upstream. The Hwy 52 crossing, IC-C10, was the only crossing identified to have existing drainage infrastructure. The 36" RCP crossing of Hwy 52 was evaluated to have less than a 5-year capacity. To provide 100-year capacity for this drainage system, it is recommended that (3) 4' H x 7' W RCBCs and a 6' H x 12' W RCBC be installed for crossings IC-C9 and IC-C10, respectively. Crossing IC-C9 would convey flows underneath the Lower Boulder Ditch.

It is noted the proposed improvements recommended in the vicinity of Hwy 52 and the wetland ponds were originally identified as part of the Erie OSP recommended plan. Evaluation of the proposed Erie OSP improvements as part of this study confirmed that they meet the TOF criteria.

8.6.1 SWMM Model Development

Development of the Idaho Creek Basin proposed improvement SWMM model was based on the future condition model, with incorporated changes to reflect the recommended plan of improvements. Results of the future condition CUHP analysis were utilized for the proposed improvement SWMM model. Inflow hydrographs for the proposed improvement SWMM model were also revised to reflect the recommended plan outflows from the Erie OSP at Hwy 52. A spreadsheet documenting the development of the recommended plan inflow hydrographs from the Erie OSP has been digitally provided with the SWMM model documentation in Appendix J.

Multiple subbasins were further divided to provide a more accurate depiction of runoff flowing into the proposed stormwater channel along the tributary between WCR 16.5 and Bella Rosa Parkway. Hydrographs for these subdivided basins were developed by area weighting the hydrograph associated with the original basin. Revised conceptual ponds were also incorporated into to these subbasins based on their subdivided area and were assumed to adhere to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. Documentation for the development of these hydrographs has been digitally provided in a spreadsheet with the SWMM model documentation. Documentation for the stage-storage-discharge curves developed for the revised conceptual Idaho Creek Basin detention ponds is provided in Appendix E.3. A detailed conveyance element map illustrating the proposed improvement SWMM model schematic for the Idaho Creek Basin is provided in Appendix E.3. Proposed improvement SWMM models for the Idaho Creek Basin are digitally provided as part of Appendix J.

8.6.2 Results of Analysis

Table 8.4 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the future condition analysis have also been included in Table 8.4. Table E.3.1 in Appendix E.3 provides a complete comparison for all modeled flow events.

As presented in Table 8.4, results of proposed improvement analysis highlight both an increase and decrease in discharge when compared to future conditions. There are two main explanations for this result. The decrease in discharge for the downstream portion of the basin is a result of redirecting the upper drainageway into Boulder Creek (IC-C7). The increase in discharges reported along the eastern drainageway crossing from Erie are associated with the recommended Erie OSP plan that will redirect upstream flows towards a proposed regional detention facility south of Hwy 52 and east of WCR 5. Increases in proposed improvement discharges were also reported along the tributaries where proposed channel improvements were identified. This increase in discharge is associated with the loss of attenuation that occurs with the channelization of flows along improved and prismatic drainage channels. Table E.3.2 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. HY-8 models utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table E.3.2 has been depicted on the proposed crossing map provided in Appendix E.3.

Table 8.4 Idaho Creek Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Improvements 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path – Lower Idaho Creek					
Highway 119/ Frederick Planning Boundary	401	5,348	1,962	1,741	-220
County Road 7, South of Highway 119	407	4,701	1,907	1,706	-201
County Road 20.5	409	4,656	1,913	1,730	-183
Rural Ditch					
County Road 20.5	420	82	39	39	0
County Road 20, East of County Road 7	440	162	237	237	0
Main Flow Path – Upper Idaho Creek					
Country Road 16.5	956	2,064	1,837	N/A	-1,837
Decommissioned Railroad Embankment	457	2,064	1,883	2,061	178
HWY 52, West of County Road 5	P-479	1,181	1,252	674	-578
County Road 5/Boulder and Weld County Ditch	460	506	518	1,259	741
HWY 52, East of County Road 5	P-475	214	288	1,062	774
Other Tributary Crossings					
County Road 7, South of County Road 20	439	345	439	452	13
County Road 20, West of County Road 7	433	1,631	1,253	1,619	366
County Road 18, East of County Road 5	235 (Link)	721	555	700	145
County Road 16.5, East of County Road 5	446	460	457	457	0
County Road 16.5 at Decommissioned Railroad Embankment	448	458	457	457	0

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

8.6.3 Cost Estimates

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed. For the more complicated improvements, that included road modifications, proposed channels, and regional detention ponds, conceptual designs and gradings plans were digitally developed in an ACAD file for the estimation of earthwork quantities. A digital copy of this ACAD file have been provided in Appendix J.

The estimated quantities for each project were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. A summary of the project cost estimates for the Idaho Creek Basin have been provided as Table E.4.1 in Appendix E.4. The estimated quantities and cost breakdown assumptions for each individual project have also been provided in Appendix E.4. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP study.

8.6.4 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from the TOF, a final scoring and ranking for each project were developed as presented in Table 8.5. Total project costs have also been summarized in Table 8.5. It is noted that the rankings presented in Table 8.5 are meant to provide a general sequencing plan for the TOF as funding becomes available. However, these rankings should be considered flexible, with the TOF having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 8.5 Town of Frederick Selected Plan Costs and Implementation Plan for Idaho Creek Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick/ Erie	IC-C13	HWY 52, East of County Road 5	8'H X 10'W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvemets[1])	$ 606,000	5	2	2	2	**11**	1
Frederick	IC-C9	Boulder and Weld County Ditch	(3) 4'H X 7'W RCBC	-	$ 1,354,000	4	1	2	2	**9**	2
Frederick	IC-C10	HWY 52, West of County Road 5	6'H X 12'W RCBC	-	$ 1,054,000	5	1	1	2	**9**	3
Frederick	IC-C8	Wetland Pond Embankment	(4) 5'H X 10'W RCBC	-	$ 2,100,000	4	1	1	2	**8**	4
Frederick	IC-C12	Lower Boulder Ditch	8'H X 10'W RCBC	Channel	$ 2,522,000	3	1	2	2	**8**	5
Frederick	IC-C11	County Road 5/Boulder and Weld County Ditch	(3) 5'H X 11'W RCBC	Channel	$ 1,609,000	3	1	2	2	**8**	6
Frederick	IC-C16	County Road 18, East of County Road 7	3'H X 7'W RCBC	-	$ 642,000	3	2	1	2	**8**	7
Frederick	IC-C17	County Road 18, West of County Road 7	3'H X 9'W RCBC	-	Combined with IC-C16	3	2	1	2	**8**	8
Frederick	IC-C14	County Road 7, South of County Road 20	(2) 3'H X 12'W RCBC	-	$ 8,582,000	3	1	1	2	**7**	9
Frederick	IC-C15	County Road 20, West of County Road 7	(5) 4'H X 12'W RCBC	Channel	Combined with IC-C14	3	1	1	2	**7**	10
Frederick	IC-C18	County Road 18, East of County Road 5	(4) 3'H X 11'W RCBC	Channel	$ 1,799,000	3	1	1	2	**7**	11
Frederick	IC-C7	Decommissioned Railroad Embankment	(5) 4'H X 12'W RCBC	Channel	$ 2,820,000	3	1	1	2	**7**	12
Frederick	IC-C3	County Road 20.5	(5) 4'H x 12' W RCBC	-	$ 762,000	3	2	1	1	**7**	13
Frederick	IC-C21	Godding Ditch Crossing	Proposed Channel Improvements 6' RCP Siphon for Ditch Crossing	Channel	$ 734,000	2	2	1	2	**7**	14
Frederick	IC-C2	County Road 7, South of Highway 119	(4) 3'H x 12' W RCBC (2) 3'H x 12' W RCBC	Channel	$ 1,638,000	3	1	1	1	**6**	15
Frederick	IC-C20	County Road 16.5, East of County Road 5	(2) 3'H X 10'W RCBC	Channel	$ 1,140,000	2	1	1	2	**6**	16
Frederick	IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	(5) 2'H X 8'W RCBC	-	$ 1,143,000	2	1	1	2	**6**	17
				Total Frederick Costs for Idaho Creek	**$ 28,515,000**				**Average Score**	**7.6**	

[1]Total Project Cost = $824,000. Other half of crossing costs ($218,000) allocated to Town of Erie.

9 Sump Basin (SB)

9.1 Project Area

Figure 9.1 shows the extents of the Sump Basin and its geographical relation to the TOF and COD planning boundaries. The headwaters of the Sump Basin are located south of Tipple Parkway (WC16) and are entirely within the TOF planning area. Therefore, incorporating inflows from the Erie OSP study was not necessary for the modeling the Sump Basin. The Sump Basin encompasses approximately 7,740 acres and includes both the TOF and the Town of Firestone planning areas within its boundaries. Runoff from the basin predominately flows south to north. Within the study area, the major drainageway and its tributaries cross two unpaved county roads and the Stanley Ditch. Due to the limited capacity of the ditch, coupled with the magnitude of stormwater flows, the ditch was assumed to not significantly influence drainage patterns within the basin and flows were routed the ditch.

The major drainageway for the Sump Basin originates just south of Tipple Parkway and flows north through agricultural fields. A tributary on either side of the major drainageway flows similarly through agricultural fields. These drainageways exit the TOF planning boundary separately before converging in a sump area just south of Grant Avenue in the Town of Firestone planning area.

9.2 Previous Studies

In 2010, Colorado Civil Group, Inc (CCG) completed the most recent stormwater master drainage plan for the Sump Basin. The study called "Sump Basin Master Drainage Plan" was conducted for the Town of Firestone to identify drainage improvements that would help alleviate the effects of future development on drainage problems within the basin. CCG's study evaluated the majority of the Sump Basin drainage area shown in Figure 7.1, whereas the area evaluated by this study terminated at Grant Avenue (WCR 18).

The CCG recommended plan identified three improvements within the current study area. These improvements included: 1) construction of a 100-year crossing structure located at Tipple Parkway in the TOF; 2) construction of a 100-year crossing structure located at Grant Avenue in the Town of Firestone; and 3) construction of a conveyance channel connecting these two structures. To date, these improvements have not been implemented. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

9.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Sump Basin is presented in the following sections.

9.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Sump Basin are presented in Table 9.1.

Table 9.1 Sump Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Sump (SB)	0.823	1.10	1.39	2.25	2.71

9.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 9.1, the larger Sump Basin was subdivided into smaller subbasins for the hydrologic analyses. The definition of smaller subbasins was conducted for the approximate 470 acres of the basin located with the within the TOF planning boundary. Within the northern portion of the study area, modeling of subbasins within an approximate 440-acre area of the Town of Firestone, and its associated planning area, was necessary to better define basin runoff. In total, 7 subbasins were delineated for the Sump Basin with an average basin size of approximately 130 acres.

Hydrologic modeling parameters, existing land use, and soil parameters were developed for each subbasin based on the procedures outlined in Section 3.3 of this report. These hydrologic parameters, and the rainfall depths reported in Table 9.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Results from the initial CUHP analysis were checked for reasonableness and adjustments to the parameters were made, as necessary. Table F.1.1 in Appendix F.1 presents the final Sump Basin hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table F.1.1, the average existing condition percent impervious value for the basin is 8%, with an average unit runoff rate for the 100-year storm of 1.4 cfs/acre.

9.3.3 Inventory of Existing Drainage Facilities

Locations of possible drainage facilities were identified, but no existing facilities were found. Table F.1.2 in Appendix F.1 provides more detailed information on the existing conditions discharges at these locations.

9.3.4 SWMM Model Development

Determination of peak discharges and hydrographs at pertinent locations required the use of SWMM (Version 5.1.015). Development of the Sump Basin existing condition SWMM model, based on information obtained from previous studies, site visits, and other data collected as part of this study, followed the general procedures described in Section 3.4 of this report. Since the headwaters of the Sump Basin are located entirely within the TOF planning area, it was not necessary to incorporate inflows from the Erie OSP study into the Sump Basin SWMM models. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface

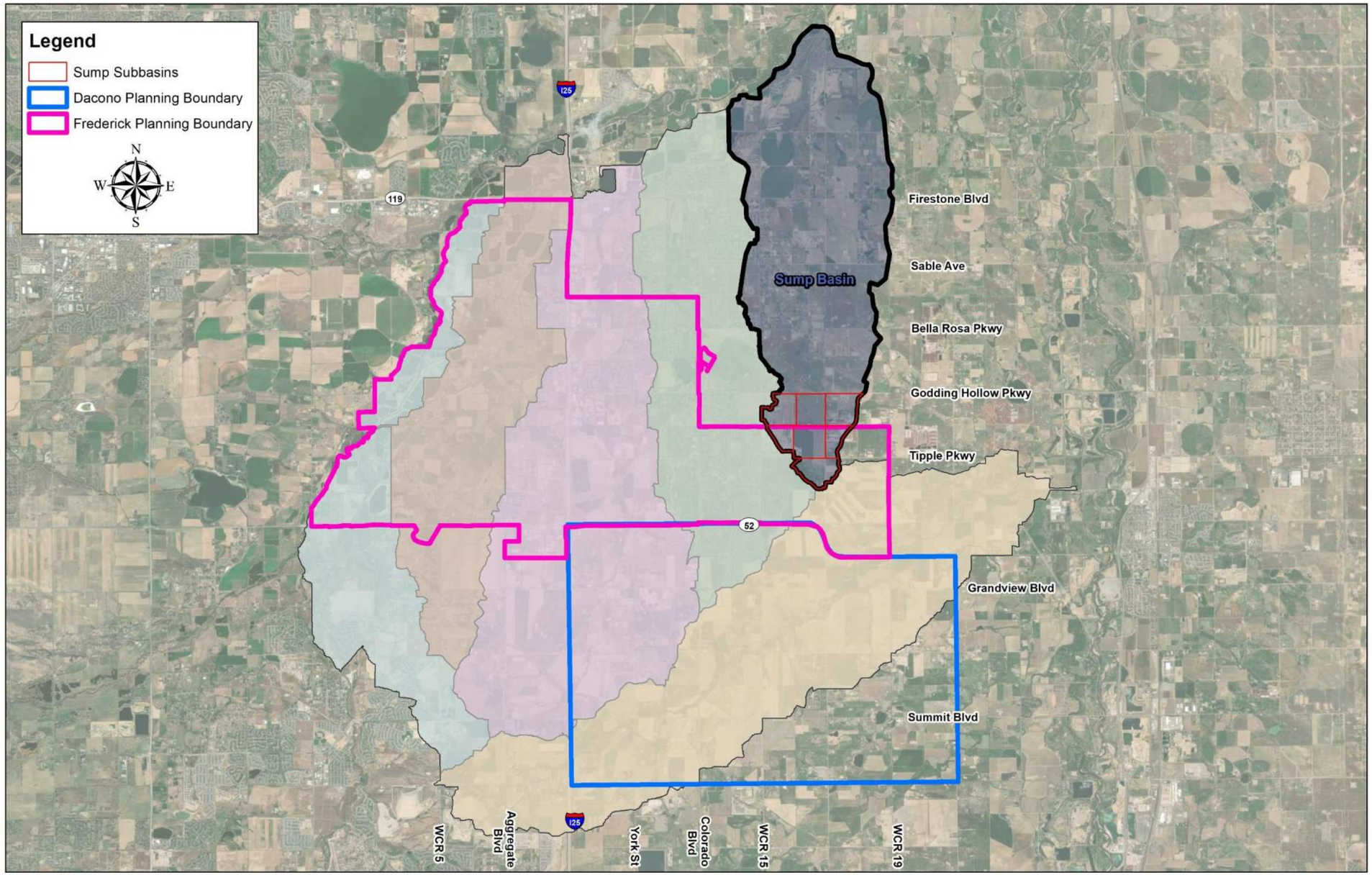

Figure 9.1 Sump Basin Study Area

files that were generated from the CUHP software. Table F.1.1 in Appendix F.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. A detailed conveyance element map illustrating the existing condition SWMM model schematic for the Sump Basin is provided in Appendix F.1. Existing condition SWMM models for the Sump Basin are digitally provided as part of Appendix J.

9.3.5 Results of Analysis

Table 9.2 provides a summary of the existing condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the 2010 CCG study have also been included in Table 9.2. Table F.1.3 in Appendix F.1 provides a complete discharge comparison for all modeled flow events.

Table 9.2 Sump Basin Existing Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2010 CCG Study 100-Year Peak Discharge (cfs)	2022 OSP Study 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Grant Avenue	400	913	835	1097	262
Future McClure Avenue Crossing/Frederick Planning Boundary	406	312	N/A	473	N/A
Tipple Parkway	405	153	178	252	74

As presented in Table 9.2, peak discharges from the current OSP study are generally higher than the peak discharges reported in the 2010 study. Several factors can be attributed to these differences. However, the largest factor is the difference in the percent imperviousness values and other hydrologic parameters assumed between the studies. Since there are no existing drainage facilities identified within the study area, the results reported in Table 9.2 were not utilized to assess the performance of any facilities.

9.3.6 Identification of Existing Drainage Problems

The identification of existing drainage problems is limited by the lack of paved roads and existing drainage facilities. Within the TOF boundary, it is anticipated that Tipple Parkway is overtopped during most storm events.

9.4 Future Condition Analyses

The future condition analyses were based on the comprehensive land use and zoning maps of the communities to estimate hydrologic conditions representing a full buildout of the basin. Design rainfall and subbasin delineations were not modified from the existing condition analysis.

9.4.1 Hydrograph Development

The hydrologic parameters defined as part of the existing condition analysis were maintained for the future condition analysis, except for the percent impervious and depression storage values of those subbasins that were assumed to be developed based on the comprehensive land use and zoning maps for each community. All 7 of the subbasins delineated for the Sump Basin were assumed to have future development. The future condition hydrologic parameters, and the rainfall depths reported in Table 9.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table F.2.1 in Appendix F.2 presents the final Sump Basin hydrologic parameters and peak flow runoff rates for the future condition analysis. As shown in Table F.2.1, the average future condition percent impervious value for the basin is 18%, an increase of approximately 10% when compared to existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 1.54 cfs/acre.

9.4.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the future conditions analysis to simulate the impact of on-site detention as part of future development. All but one proposed development within the Sump Basin were assumed to provide conceptual on-site detention to meet the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. The known release rates for the conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Conceptual Pond 702 for subbasin SB-02 was based on the approved detention facility within the Hidden Creek development that limits the proposed 100-year flows to the pre-development 2-year peak runoff. Documentation for the stage-storage-discharge curves developed for the conceptual Sump Basin detention ponds is provided in Appendix C.2.

9.4.3 SWMM Model Development

Development of the Sump Basin future condition SWMM model was based on the existing condition model, with the only change being the implementation of the conceptual on-site design ponds in subbasins that were assumed to be developed as part of the future conditions. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the future condition CUHP software. Table F.2.1 in Appendix F.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Runoff for basins assumed to be developed as part of the future conditions were imported into a conceptual on-site detention pond node. A detailed conveyance element map illustrating the future condition SWMM model schematic for the Sump Basin is provided in Appendix F.2. Future condition SWMM models for the Sump Basin are digitally provided as part of Appendix J.

9.4.4 Results of Analysis

Table 9.3 provides a summary of the future condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 9.3. Table F.2.2 in Appendix F.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 9.3, results of future condition analysis indicated a slight reduction in discharges compared to existing conditions. The larger reduction of discharge at Grant Avenue is a result of the developed 100-year flow being detained back to the pre-development 2-year peak runoff rate within the Hidden Creek development. A comparison of existing and future condition discharges at identified crossing locations is provided in Table F.1.2 in Appendix F.1.

Table 9.3 Sump Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Grant Avenue	400	913	1097	1050	-47
Future McClure Avenue Crossing/Frederick Planning Boundary	406	312	473	470	-4
Tipple Parkway	405	153	252	249	-3

9.5 Alternative Analysis

Results of the future condition analysis and crossing map were reviewed with community staff to identify the projects that would be evaluated as part of the alternative analysis. Conclusions from these discussions resulted in the following list of improvements for alternative evaluation in the Sump Basin.

- Within the Town of Frederick, improvements will be evaluated for all arterial roadway crossings that currently do not have 100-year capacity per Town Criteria. This includes the non-existent crossings along Tipple Parkway and the future roadway crossing (extension of McClure Avenue) assumed at the border between the Town of Frederick and the Town of Firestone.

Utilizing this list of improvements, an alternative analysis was conducted to determine potential drainage facility solutions at the identified locations. These alternatives were presented and discussed with community staff and a recommended plan of improvements was identified.

9.6 Recommended Plan

The following recommended plan of improvements for the Sump Basin was identified and agreed to by community staff. It is noted that the following improvements were analyzed for the full buildout condition of the basin. Due to the on-site detention requirements in this basin, peak flows rates associated with full buildout are lower than existing conditions. As a result, it should be recognized that the implementation of the following improvements while development within the basin is ongoing, will result in an interim condition in which the proposed improvements will underperform until full buildout is reached. Maps depicting the proposed drainage improvements are provided in Appendix F.3. HY-8 models utilized to evaluate the proposed culvert improvements are provided digitally in Appendix J.

- Tipple Parkway (WCR 16) Crossing (SB-C1): Improvements identified for the Tipple Parkway crossing included installing a 4’ H x 6’ W RCBC. To provide sufficient room for the box culverts and other utility crossings, it is proposed that the existing roadway be elevated approximately 3-feet from its low point, requiring improvements to approximately 1,220 feet of roadway. The improvements also identified the construction of a downstream drainage channel.
- Future McClure Avenue Crossing/Frederick Planning Boundary (SB-C2): Improvements identified for the future McClure Avenue Crossing included a 4’ H x 9’ W RCBC that is connected to the SB-C1 channel upstream. The improvements will require a downstream drainage channel. Associated cost estimates for this crossing assume that construction of the new roadway will be conducted as part of another capital improvement project.

9.6.1 SWMM Model Development

Development of the Sump Basin proposed improvement SWMM model was based on the future condition model, with incorporated changes to reflect the recommended plan of improvements. Results of the future condition CUHP analysis were utilized for the proposed improvement SWMM model. A detailed conveyance element map illustrating the proposed improvement SWMM model schematic for the Sump Basin is provided in Appendix F.3. Proposed improvement SWMM models for the Sump Basin are digitally provided as part of Appendix J.

9.6.2 Results of Analysis

Table 9.4 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the future condition analysis have also been included in Table 9.4. Table F.3.1 in Appendix F.3 provides a complete discharge comparison for all modeled flow events.

As presented in Table 9.4, results of proposed improvement analysis show a slight increase in the peak discharges when compared to future conditions. This increase in discharge is associated with the loss of attenuation that occurs with the channelization of flows along improved and prismatic drainage channels. Table F.3.2 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. HY-8 models

utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table F.3.2 has been depicted on the proposed improvement crossing map provided in Appendix F.3.

Table 9.4 Sump Basin Proposed Improvement Peak Discharge Comparison

Location	SWMM Node	Drainage Area* (acres)	2022 OSP Study Future Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Improvements 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Grant Avenue	400	913	1050	1056	5
Future McClure Avenue Crossing/Frederick Planning Boundary	406	312	470	488	18
Tipple Parkway	405	153	249	249	0

9.6.3 Cost Estimates and Implementation Planning

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed. For the more complicated improvements that included road modifications, proposed channels, and regional detention ponds, conceptual designs and gradings plans were digitally developed in an ACAD file for the estimation of earthwork quantities. A digital copy of this ACAD file have been provided in Appendix J.

The estimated quantities for each project were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. A summary of the project cost estimates for the Sump Basin have been provided as Table F.4.1 in Appendix F.4. The estimated quantities and cost breakdown assumptions for each individual project have also been provided in Appendix F.4. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP.

9.6.4 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from the TOF, a final scoring and ranking for each project were developed as presented in Table 9.5. Total project costs have also been summarized in Table 9.5. It is noted that the rankings presented in Table 9.5 are meant to provide a general sequencing plan for the TOF as funding becomes available. However, these rankings should be considered flexible, with the TOF having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 9.5 Town of Frederick Selected Plan Costs and Implementation Plan for Sump Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick	SB-1	County Road 16/Tipple Parkway	4' H x 6' W RCBC	Channel	$ 1,228,000	3	1	2	2	**8**	1
Frederick/ Firestone	SB-2	Future McClure Avenue Crossing	4' H x 9' W RCBC	Frederick Portion (Half of Crossing[1])	$ 107,000	1	2	2	2	**7**	2
				Total Frederick Costs for Sump Basin	**$ 1,335,000**				**Average Score**	**7.5**	

[1]Total Project Cost = $549,000. Other half of crossing and downstream channel costs ($442,000) allocated to Town of Firestone. Costs are for stormwater improvements only. Future road construction costs assumed to be part of another capital improvement project.

10 Little Dry Creek Basin (LDC)

10.1 Project Area

Figure 10.1 shows the extents of the Little Dry Creek Basin and its geographical relation to the TOF and COD planning boundaries. As illustrated on Figure 10.1, the headwaters of the Little Dry Creek Basin are located south of Summit Boulevard (WCR 8) and west of Interstate 25 (I-25). This area is located outside of the current study area, but was evaluated as part of the Town of Erie OSP. Therefore, inflows from the Erie OSP were incorporated into the modeling of the Little Dry Creek Basin as part of this study. The Little Dry Creek Basin encompasses approximately 12,270 acres and is predominately a rural watershed with some development starting to occur throughout the basin. Runoff from the basin generally flows southwest to northeast. Numerous county roads, I-25, Hwy 52, and irrigation ditches/canals cross the major drainageway and its tributaries. These crossings tend to constrict the channel and create overtopping and flooding issues during major storm events. Three irrigation ditches, the Bull Canal, the Brantner Ditch, and the Lupton Bottom Ditch, traverse the Little Dry Creek Basin within the study area. These ditches convey irrigation flows within and through the basin, but offer limited value as drainage features that will convey stormwater runoff during major flood events. Due to the limited capacity of the ditch systems, coupled with the magnitude of stormwater flows, these irrigation ditches were assumed to not significantly influence drainage patterns within the basin and flows were routed over them.

The major drainageway for the Little Dry Creek Basin originates near the Front Range Landfill at the intersection of WCR 6 and WCR 5, west of I-25 and within the Town of Erie planning area. From this location, the drainageway conveys runoff northeast, under the Stanley Ditch and through a 72" RCP crossing of I-25 where it enters the Dacono planning area. East of I-25, the main drainageway continues northeast where it crosses the Union Pacific Railroad and York Street (WCR 11) and then confluences with a southern tributary before crossing Summit Boulevard (WCR 8). North of Summit Boulevard, the main channel continues northeast where it confluences with a large southern tributary. This large southern tributary originates near I-25, south of WCR 6, and conveys runoff northeast as it crosses the Bull Canal, WCR 6, the Union Pacific Railroad, and Summit Boulevard. Downstream of this confluence, the main channel continues northeast where it crosses Colorado Boulevard (WCR 13) and WCR 15. East of WCR 15, several small tributaries confluence with the main channel prior to the next major crossing at WCR 19. East of WCR 19, the main drainageway crosses the Brantner Ditch and is then conveyed through an existing bridge at the Hwy 52 crossing and exits the Dacono planning area.

North of Hwy 52, the main channel confluences with a western tributary that originates in the Town of Frederick's planning boundary, west of WCR 19. The main drainageway then continues northeast to the crossings of WCR 14, WCR 21, WCR 23, and WCR 14.5. North of the WCR 14.5 crossing, the drainageway crosses underneath the Lupton Bottom Ditch and continues east before turning northeast and converging with the South Platte River.

10.2 Previous Studies

A previous master drainage plan study was not identified within the TOF and COD portions of the Little Dry Creek Basin as part of the data collection efforts associated with this study. In 2020, Merrick completed a stormwater master drainage plan for the portion of the Little Dry Creek Basin located within the Town of Erie planning area. The study, "Town of Erie Outfall Systems Plan (East of Coal Creek)," developed updated baseline and recommended plan condition hydrology for the Little Dry Creek Basin located in the Town of Erie planning area. This study identified two separate locations where Erie's portion of the Little Dry Creek Basin outfalls to the portion of the basin located within the COD planning area. To provide consistency between the Erie OSP and this study, hydrographs at each outfall location were obtained from the Erie OSP SWMM models and utilized as inflow hydrographs for the SWMM models developed as part of this study. In addition, the 2020 study identified proposed improvements west of the I-25 corridor that share a jurisdictional boundary with the COD. To provide consistency, these improvements were reviewed and incorporated into the recommended plan for this study. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

10.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Little Dry Creek Basin is presented in the following sections.

10.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Little Dry Creek Basin are presented in Table 10.1.

Table 10.1 Little Dry Creek Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Little Dry Creek (LDC)	0.822	1.11	1.38	2.22	2.65

10.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 10.1, the larger Little Dry Creek Basin was subdivided into smaller subbasins for the hydrologic analyses. The definition of smaller subbasins was conducted for the approximate 8,230 acres of the basin located within the TOF and COD planning areas. The definition of subbasins was also conducted for the approximate 2,570 acres of the lower watershed located north of Hwy 52. In total, 164 subbasins were delineated for the Little Dry Creek Basin with an average basin size of approximately 70 acres. Detailed subbasin maps are provided in Appendix G.1.

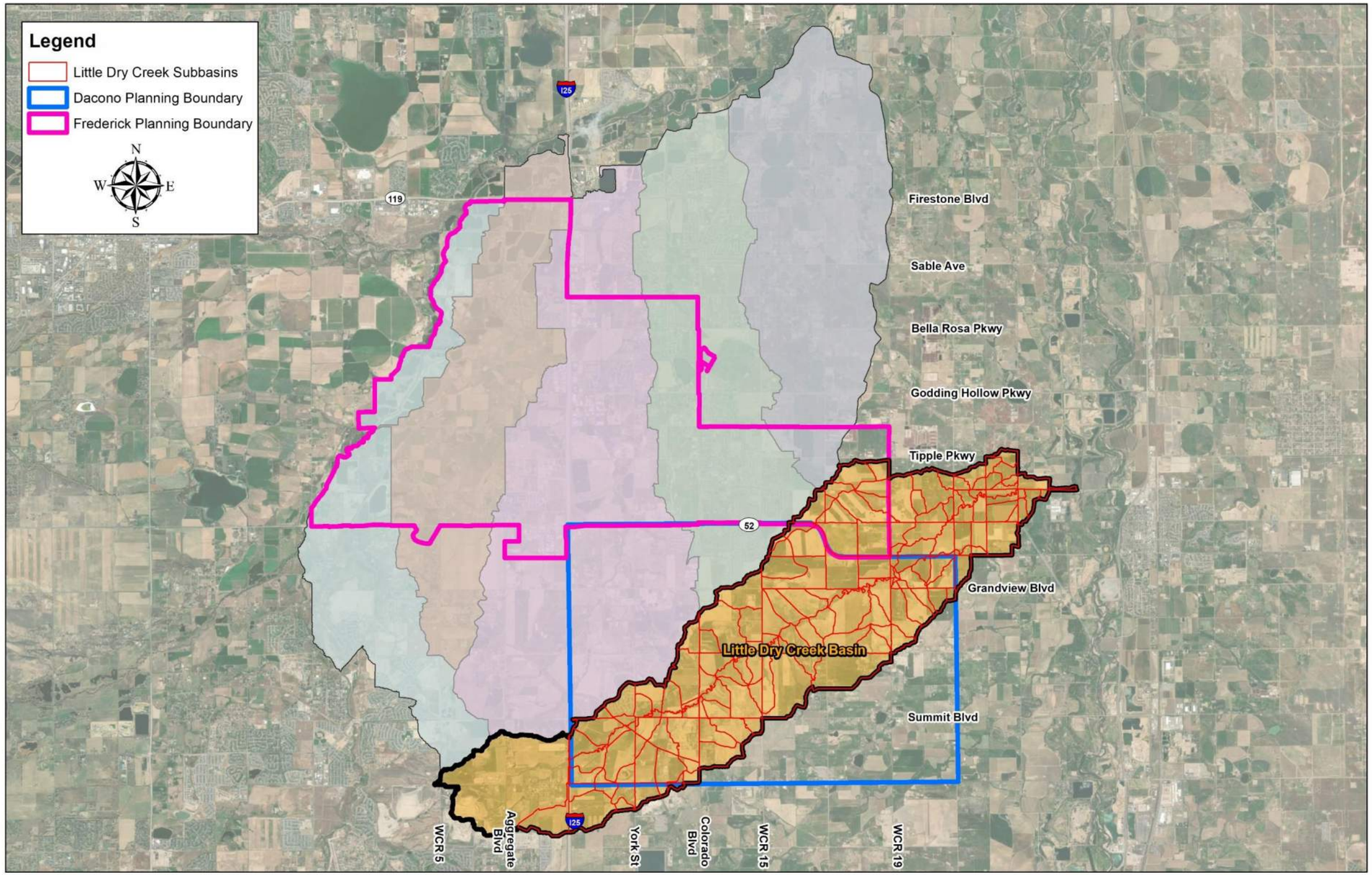

Figure 10.1 Little Dry Creek Basin Study Area

Hydrologic modeling parameters, existing land use, and soil parameters were developed for each subbasin based on the procedures outlined in Section 3.3 of this report. These hydrologic parameters, and the rainfall depths reported in Table 10.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Results from the initial CUHP analysis were checked for reasonableness and adjustments to the parameters were made, as necessary. Table G.1.1 in Appendix G.1 presents the final Little Dry Creek hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table G.1.1, the average existing condition percent impervious value for the basin is 6%, with an average unit runoff rate for the 100-year storm of 1.28 cfs/acre. The subbasin delineations and hydrologic modeling of the Little Dry Creek Basin associated with the Erie OSP were reviewed for general conformance to the assumptions associated with this study. No major inconsistences were identified as part of this review and the Erie OSP information was utilized for this study.

10.3.3 Inventory of Existing Drainage Facilities

A thorough inventory of existing drainage facilities within the Little Dry Creek Basin was conducted as part of this study and utilized to develop the drainage network incorporated into the SWMM models. Inventory of existing crossing structures and detention ponds followed procedures outlined in Section 4.1 of this report and typically included site survey and photographic documentation, which have been digitally provided as part of Appendix J. FHWA's HY-8 culvert analysis software was utilized to evaluate road crossing culvert capacities and HEC-RAS was utilized to the bridge crossings of Hwy 52 and WCR 23. Only one existing detention pond, associated with the Sweetgrass Development located northwest of the Summit Boulevard and York Street intersection, was identified within the basin. Stage-storage relationships for this pond were developed from ground survey and the 2013 LiDAR data to reflect as-built conditions. Ground survey and field measurements of the pond outlet structure was collected to define the outlet geometry for establishing the discharge rating curve for the detention pond.

Inventory of the existing drainage facilities within the Little Dry Creek Basin resulted in the evaluation of 20 individual crossing structures. Maps depicting the locations of the existing crossings and detention basin facilities are provided in Appendix G.1. Table G.1.2 in Appendix G.1 provides detailed information on the existing condition crossing structure characteristics and capacity analysis. Additional documentation for the development of the stage-storage-discharge curve for the Sweetgrass detention pond is also provided in Appendix G.1. HY-8 and HEC-RAS models utilized to evaluate the existing culvert improvements are provided digitally in Appendix J.

10.3.4 SWMM Model Development

Determination of peak discharges and hydrographs at pertinent locations required the use of SWMM (Version 5.1.015). Development of the Little Dry Creek Basin existing condition SWMM model, based on information obtained from previous studies, site visits, and other data collected as part of this study, followed the general procedures described in Section 3.4 of this report. Subbasin hydrographs developed from the CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table G.1.1 in Appendix G.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Hydrographs from the Erie OSP were also incorporated into the SWMM models developed as part of this study to appropriately account for inflow from the upstream portion of the watershed. These hydrographs were obtained from the results of the Erie OSP existing condition SWMM model at the outfall locations where flow crosses the Erie planning boundary into the Dacono planning boundary at I-25. For consistency, the outfall node names and locations from the Erie OSP model were maintained and incorporated into the SWMM models developed as part of this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the existing condition SWMM model schematic for the Little Dry Creek Basin is provided in Appendix G.1. Existing condition SWMM models for the Little Dry Creek Basin are digitally provided as part of Appendix J.

10.3.5 Results of Analysis

Table 10.2 provides a summary of the existing condition 100-year peak discharge results at pertinent locations throughout the watershed. Since no previous drainage studies of this area were identified, comparison to previous hydrologic results has not been conducted. Table G.1.3 in Appendix G.1 provides a complete discharge table for all modeled flow events. Results of the existing condition SWMM models were also utilized to evaluate the performance of the existing crossing structures and detention basin located within the basin. Both adequate and under-performing drainage facilities are identified in Table G.1.2 and the inventory maps presented in Appendix G.1. With respect to the identified under-performing detention facility (the Sweetgrass detention pond is predicted to overtop during the 100-year event), it is recognized that the design of existing on-site detention ponds associated with developments utilized different modeling software programs, assumptions, and was conducted at a more detailed level than those associated with this OSP study. Therefore, the identification of under-performing detention ponds as part of this study is intended as an informational tool for the communities and is not intended to be used as a regulatory tool for on-site detention pond compliance.

10.3.6 Identification of Existing Drainage Problems

Due to the well-defined drainageways and predominately rural nature of the Little Dry Creek Basin, existing drainage problems within the basin are mostly attributed to inadequate culvert capacities at the major roadway crossings as shown on the existing condition crossing inventory maps and tables provided in Appendix G.1. Within the TOF and COD planning areas, crossing deficiencies were noted along the main channel at the Summit Boulevard, Colorado Boulevard, WCR 15, and WCR 19 crossings. Crossing deficiencies were also noted along several tributaries at arterial roadway crossings.

Table 10.2 Little Dry Creek Basin Existing Condition Peak Discharges

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study 100-Year Peak Discharge (cfs)
Main Flow Path			
Country Road 11	547	1,229	2,028
Summit Boulevard	541	1,314	2,316
East of County Road 11	544	2,272	2,327
Colorado Boulevard	526	2,363	3,399
County Road 15	515	3,344	3,883
County Road 19	469	6,403	4,363
County Road 14	439	8,784	4,754
County Road 21	433	9,524	4,821
County Road 14 1/2	402	10,597	4,862
Tributaries to Little Dry Creek			
I-25 south of Country Road 6	573	168	142
County Road 6	538	614	548
Summit Boulevard	531	1384	1,437
West of Country Road 19	467	702	712
County Road 11	554	501	472
County Road 23	415	326	385
County Road 11	551	183	225
Colorado Boulevard	523	185	225
County Road 15	507	42	58
County Road 15	502	136	144
County Road 10	501	311	372
County Road 10	462	319	335
County Road 19	461	56	94
County Road 12	460	125	143
County Road 12	459	92	102
County Road 19	472	836	761
County Road 14	482	94	144
County Road 14	475	84	105
North of Highway 52	474	259	297
County Road 19	473	251	680
County Road 14	476	185	150
County Road 19	477	58	57

10.4 Future Condition Analyses

The future condition analyses were based on the comprehensive land use and zoning maps of the communities to estimate hydrologic conditions representing a full buildout of the basin. Hydrologic results from the future condition analyses were evaluated with existing drainage infrastructure to provide an assessment of future buildout conditions without the implementation of drainage improvements. Design rainfall and subbasin delineations were not modified from the existing condition analysis.

10.4.1 Hydrograph Development

The hydrologic parameters defined as part of the existing condition analysis were maintained for the future condition analysis, except for the percent impervious and depression storage values of those subbasins that were assumed to be developed based on the comprehensive land use and zoning maps for each community. Due to the rural nature of the existing watershed, all 164 of the subbasins delineated for the Little Dry Creek Basin were assumed to have future development. The future condition hydrologic parameters, and the rainfall depths reported in Table 10.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50-, and 100-year design storms. Table G.2.1 in Appendix G.2 presents the final Little Dry Creek hydrologic parameters and peak flow runoff rates for the future condition analysis. As shown in Table G.2.1, the average future condition percent impervious value for the basin is 32%, which is a significant increase from existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 1.96 cfs/acre.

10.4.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the future conditions analysis to simulate the impact of on-site detention as part of future development. All conceptual on-site detention ponds within the Little Dry Creek Basin were assumed to adhere to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. Release rates for the conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Documentation for the stage-storage-discharge curves developed for the conceptual Little Dry Creek Basin detention ponds is provided in Appendix G.2.

10.4.3 SWMM Model Development

Development of the Little Dry Creek Basin future condition SWMM model was based on the existing condition model. The only changes to the SWMM model were the implementation of the conceptual on-site design ponds within the subbasins. Subbasin hydrographs developed from the future condition CUHP analysis were imported into the SWMM model through interface files that were generated from the CUHP software. Table G.2.1 in Appendix G.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. Runoff for basins as part of the future conditions were imported into a conceptual on-site detention pond node. It is noted that the Erie OSP study did not evaluate a future condition with conceptual on-site detention pond scenario for incorporation with the future condition analysis conducted as part of this study. Coordination with staff from the Town of Erie confirmed

that Erie also regulates the 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirement for future development. As a result, the future condition with on-site detention hydrology from Erie's portion of the Little Dry Creek Basin should not be significantly different than the existing condition hydrology. Therefore, it was decided to utilize the existing condition hydrographs from the Erie OSP SWMM models at the outfall locations as inflow hydrographs for the future condition modeling associated with this study. A spreadsheet documenting the development of the inflow hydrographs from the Erie OSP study has been digitally provided with the SWMM model documentation in Appendix J. A detailed conveyance element map illustrating the future condition SWMM model schematic for the Little Dry Creek Basin is provided in Appendix G.2. Future condition SWMM models for the Little Dry Creek Basin are digitally provided as part of Appendix J.

10.4.4 Results of Analysis

Table 10.3 provides a summary of the future condition 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 10.3. Table G.2.2 in Appendix G.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 10.3, results of future condition analysis indicate increased discharges in comparison to existing conditions within the upstream portion of the watershed and decreased discharges in comparison to existing conditions within the downstream portion of the watershed. The predicted increase in peak flow rates along the main drainageway within the upstream portion of the basin can be attributed to the additional volume of future condition runoff caused by development, as well as the attenuated and prolonged peak flows associated with the assumed on-site detention ponds. The attenuated and prolonged releases from on-site detention ponds can facilitate the alignment of peak flow timing along the major drainageways and tributaries. The increase in peak flow rates as a result of on-site detention requirements has been recognized by the MHFD in Volume 2 of the USDCM. Consequently, the MHFD is now recommending that on-site detention ponds be designed using a full spectrum approach which limits the 100-year release rates from on-site detention ponds to 90% of the predevelopment 100-year runoff rate. Since both communities currently regulate to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing detention requirements, this assumption was maintained for the future condition and proposed improvement evaluation associated with the Little Dry Creek Basin.

The future condition flow rates were compared back to existing crossing capacities to reevaluate the performance of existing crossing structures under future conditions. Results of this comparison is provided in Table G.1.2 in Appendix G.1 and depicted on the future condition crossing map provided in Appendix G.2. As illustrated on Table G.1.2, the increased discharges associated with the future condition analysis will further diminish the ability of existing crossings to convey the 100-year flow event within the upstream portion of the basin. Table G.2.3 in Appendix G.2 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis for the future condition analysis. HY-8 models utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table G.2.3 has been depicted on the proposed improvement crossing map provided in Appendix G.3.

Table 10.3 Little Dry Creek Basin Future Condition Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Future Condition[1] 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path					
Country Road 11	547	1,229	2,028	2,151	124
Summit Boulevard	541	1,314	2,316	2,392	77
East of County Road 11	544	2,272	2,327	2,476	149
Colorado Boulevard	526	2,363	3,399	3,715	316
County Road 15	515	3,344	3,883	4,113	230
County Road 19	469	6,403	4,363	4,274	-89
County Road 14	439	8,784	4,754	4,458	-296
County Road 21	433	9,524	4,821	4,484	-337
County Road 14 1/2	402	10,597	4,862	4,445	-417
Erie Tributary					
I-25 south of Country Road 6	573	168	142	142	0
County Road 6	538	614	548	578	30
Summit Boulevard	531	1384	1,437	1539	102
West of Country Road 19	467	702	712	766	54
County Road 11	554	501	472	540	68
County Road 23	415	326	385	407	21
County Road 11	551	183	225	241	16
Colorado Boulevard	523	185	225	202	-23
County Road 15	507	42	58	58	0
County Road 15	502	136	144	149	5
County Road 10	501	311	372	372	0
County Road 10	462	319	335	335	0
County Road 19	461	56	94	94	0
County Road 12	460	125	143	143	0
County Road 12	459	92	102	101	0
County Road 19	472	836	761	805	45
County Road 14	482	94	144	144	0
County Road 14	475	84	105	108	3
North of Highway 52	474	259	297	309	11
County Road 19	473	251	680	700	20
County Road 14	476	185	150	156	6
County Road 19	477	58	57	57	0

[1]Future condition discharges are based on existing condition inflows from Erie OSP

10.5 Alternative Analysis

Results of the future condition analysis and crossing map were reviewed with community staff to identify the projects that would be evaluated as part of the alternative analysis. Conclusions from these discussions resulted in the following list of improvements for alternative evaluation in the Little Dry Creek Basin.

- Due to the rural nature of the watershed, both communities preferred a conveyance based approach for future improvements rather than a detention based approach for this basin. As a result, regional detention facilities were not evaluated as part of the alternative analysis.
- Within the City of Dacono, improvements will be evaluated for all arterial roadway crossings that do not meet current criteria. As discussed in Section 5.2, these improvements will be designed to pass the 10-year event without road overtopping and maintain an overtopping depth of less than 12 inches for the 100-year event.
- Within the Town of Frederick, improvements will be evaluated for all arterial roadway crossings that currently do not have 100-year capacity per Town Criteria.

During the development of the alternative analysis, it was realized that the Erie OSP proposed a large regional detention facility along the main drainageway of Little Dry Creek, just west of I-25. The regional detention facility, with a proposed volume of 162 acre-feet, would be located in the low area created by the Stanley Ditch and would require the acquisition of land and relocation of an existing business. The purpose of the proposed detention facility is the attenuation of flood peaks such that the existing 72" RCP crossing of I-25 would be capable of conveying the 100-year discharge. This requires the attenuation of the future condition 100-year flood peak of approximately 1,470 cfs down to approximately 270 cfs, which is the estimated capacity of the existing 72" RCP culvert. It is recognized the potential implementation of this pond would have significant impact on the inflows into Dacono's portion of the Little Dry Creek Basin and the sizing of recommended improvements.

Based on discussions with the COD, it was decided that the alternative analysis for the Little Dry Creek Basin would include two scenarios. The first scenario will utilize the existing condition inflows from the Erie OSP to size proposed improvements with within the Dacono planning area. This would represent the worst-case scenario from a planning perspective and reflect a condition where the proposed regional detention facility is not constructed and CDOT enlarges the existing crossing to convey the 100-year storm event. The second scenario will utilize the recommended plan inflows from the Erie OSP (this assumes the regional detention facility is constructed) to size proposed improvements within the Dacono planning area. Evaluation of this scenario provides the necessary information to facilitate the construction of future improvements within the Dacono planning area should the regional detention pond be constructed. It is noted that the future condition SWMM model, as described in Section 10.4.3, was utilized to evaluate the first scenario described above. The proposed improvement SWMM model, as discussed in Section 10.6.1, was utilized to evaluate the second scenario.

10.6 Recommended Plan

The following recommended plan of improvements for the Little Dry Creek Basin were identified and agreed to by community staff. Results of the two alternative inflow scenarios concluded that the reduction of inflows resulting from the proposed regional detention facility west of I-25 will significantly impact the sizing of proposed improvements along the main drainage channel. Therefore, the proposed crossing improvement sizes for both scenarios have been provided in the discussion of the recommended plan. Recommended sizes for Scenario 1 are associated with existing condition inflows from the Erie OSP and recommended sizes for Scenario 2 are associated with the recommended plan inflows (with regional detention facility) from the Erie OSP. Maps depicting the proposed drainage improvements are provided in Appendix G.3. HY-8 models utilized to evaluate the proposed culvert improvements are provided digitally in Appendix J.

Little Dry Creek Basin crossing improvements are located within both the TOF and COD planning boundaries and have different design criteria for their evaluation. As previously noted, the TOF has a requirement of 100-year capacity for arterial roadways, and the COD has a minimum 10-year capacity requirement with a 100-year overtopping depth of 12 inches or less. The following recommended crossing improvements adhere to these criteria.

- York Street (WCR 11) Main Channel Crossing (LDC-6): Evaluation of the existing 36" CMP at the York Street crossing within the COD indicates that it has less than a 5-year capacity. It is proposed that the existing crossing be replaced with (5) 4' H x 9' W RCBCs for Scenario 1 and a single 4' H x 5' W RCBC for Scenario 2.
- Summit Boulevard (WCR 8) Main Channel Crossing (LDC-7): Evaluation of the existing (3) 38" H x 57" W elliptical CMPs at the Summit Boulevard crossing within the COD indicates that the culverts have less than a 5-year capacity. It is proposed that the existing crossing be replaced with (3) 4' H x 13' W RCBCs for Scenario 1 and a single 4' H x 7' W RCBC for Scenario 2.
- Colorado Boulevard (WCR 13) Main Channel Crossing (LDC-11): Evaluation of the existing (4) 26" x 15.5" elliptical CMPs at the Colorado Boulevard crossing within the COD indicates that the culverts have less than a 5-year capacity. It is proposed that the existing crossing be replaced with (4) 4' H x 8' W RCBCs for Scenario 1 and (3) 4' H x 19' W RCBC for Scenario 2. It is noted that the improvements associated with Scenario 2 reflect a preliminary design prepared by Tait for the City of Dacono. A copy of this preliminary design has been included in Appendix G.3. Both scenarios include elevating the existing roadway.
- WCR 15 Main Channel Crossing (LDC-12): Evaluation of the 72" CMP at WCR 15 within the COD indicates that it has less than a 10-year capacity. It is proposed that the existing crossing be replaced with (5) 6' H x 11' W RCBCs for Scenario 1 and (3) 6' H x 13' W RCBCs for Scenario 2. Alternative crossing scenarios include the addition of (11) 6' RCPs and (7) 6' RCPs for Scenario 1 and 2, respectively.
- WCR 19 Main Channel Crossing (LDC-14): Evaluation of the 72" CMP at WCR 19 within the COD indicates that it has less than a 10-year capacity. It is proposed that the existing crossing be replaced with (6) 6' H x 10' W RCBCs for Scenario 1 and (5) 6' H x 10' W RCBCs for Scenario 2. Alternative crossing scenarios include the addition of (11) 6' RCPs and (9) 6' RCPs for Scenario 1 and 2, respectively.
- Colorado Boulevard (WCR 13) North of the Main Channel Crossing (LDC-21): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 36" RCP be installed for both

scenarios. The elevation of the roadway associated with the main channel crossing improvement (LDC-11) would be includes for this crossing.

- WCR 15 South of Main Channel Crossing (LDC-22): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 24" RCP be installed for both scenarios.
- WCR 15 and WCR 10 (LDC-23): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 24" RCP be installed for both scenarios.
- WCR 10 East of WCR 15 (LDC-24): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that (2) 30" RCPs be installed for both scenarios.
- WCR 10 West of WCR 19 (LDC-25): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that (2) 30" RCPs be installed for both scenarios.
- WCR 19 North of WCR 10 (LDC-26): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 24" RCP be installed for both scenarios.
- WCR 12, East of WCR 19 (LDC-27): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 24" RCP be installed for both scenarios.
- WCR 12, East of WCR 19 (LDC-28): Existing infrastructure was either not evaluated or located at this crossing within the COD. This crossing is east of LDC-27. It is proposed that a 24" RCP be installed for both scenarios.
- WCR 19 South of Highway 52 (LDC-29): Existing infrastructure was either not evaluated or located at this crossing within the COD. It is proposed that a 42" RCP be installed for both scenarios.
- WCR 14 and WCR 17 (LDC-31): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (4) 36" RCPs be installed for both scenarios.
- WCR 14 West of WCR 19 (LDC-32): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (2) 30" RCPs be installed for both scenarios.
- North of Highway 52 West of WCR 19 (LDC-33): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (5) 4' H x 5' W RCBCs be installed for both scenarios.
- WCR 19 North of Highway 52 (LDC-34): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (8) 5' H x 8' W RCBCs be installed for both scenarios.
- WCR 14 West of WCR 19 (LDC-35): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (3) 36" RCPs be installed for both scenarios.
- WCR 19 North of WCR 14 (LDC-36): Existing infrastructure was either not evaluated or located at this crossing within the TOF. It is proposed that (3) 24" RCPs be installed for both scenarios.
- WCR 19 North of WCR 14 (LDC-37): Existing infrastructure was either not evaluated or located at this crossing within the TOF. This crossing is north of LDC-36. It is proposed that (2) 3' H x 7' W RCBCs be installed for both scenarios.
- Other Crossings: Other crossings outside of the COD or TOF planning boundaries, but within the Little Dry Basin, were also evaluated for proposed improvements. More information on these crossings can be found on the proposed improvement map in Appendix G.3.

10.6.1 SWMM Model Development

Development of the Little Dry Creek Basin proposed improvement SWMM model was identical to the future condition model, with the exception that the recommended plan inflows, which assume the proposed regional detention facility west of I-25 is constructed, were incorporated into the SWMM model. Since all proposed improvements for the Little Dry Creek Basin are conveyance based, additional changes to the future condition SWMM model to develop the proposed improvement SWMM model were not necessary. A spreadsheet documenting the development of the recommended plan inflow hydrographs from the Erie OSP has been digitally provided with the SWMM model documentation in Appendix J. Since the SWMM models for the future condition and proposed improvements are identical, with the exception of the incorporated inflows from the Erie OSP, a proposed improvement SWMM model schematic was not developed. Reference is made to the future condition conveyance element map provided in Appendix G.2. Proposed improvement SWMM models for the Little Dry Creek Basin are digitally provided as part of Appendix J.

10.6.2 Results of Analysis

Table 10.4 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 10.4. Table G.3.1 in Appendix G.3 provides a complete discharge comparison for all modeled flow events.

As presented in Table 10.4, results of the proposed improvement analysis highlight the significant decrease in the proposed 100-year discharge for the main channel crossings when compared to existing conditions. This reduction in discharge is a direct result of the proposed regional detention facility identified by the recommended plan of improvements from the Erie OSP. This proposed regional detention facility is anticipated to decrease the discharge being conveyed across I-25 and into the Dacono portion of the basin by approximately 80%. As previously identified, this reduction in discharge results in the significant size reduction of the proposed crossing improvements.

Table G.3.2 in Appendix G.3 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. HY-8 models utilized to evaluate the proposed improvements are provided digitally in Appendix J. Information provided in Table G.3.2 has been depicted on the proposed improvement crossing map provided in Appendix G.3.

Table 10.4 Little Dry Creek Basin Proposed Improvement Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Imp.[1] 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Main Flow Path					
Country Road 11	547	1,229	2,028	679	-1285
Summit Boulevard	541	1,314	2,316	932	-815
East of County Road 11	544	2,272	2,327	1,042	-600
Colorado Boulevard	526	2,363	3,399	2,585	-727
County Road 15	515	3,344	3,883	3,284	-823
County Road 19	469	6,403	4,363	3,636	-847
County Road 14	439	8,784	4,754	3,931	-896
County Road 21	433	9,524	4,821	3,974	-1285
County Road 14 1/2	402	10,597	4,862	3,966	-815
Erie Tributary					
I-25 south of Country Road 6	573	168	142	142	0
County Road 6	538	614	548	578	30
Summit Boulevard	531	1384	1,437	1539	102
West of Country Road 19	467	702	712	766	54
County Road 11	554	501	472	540	68
County Road 23	415	326	385	407	21
County Road 11	551	183	225	241	16
Colorado Boulevard	523	185	225	202	-23
County Road 15	507	42	58	58	0
County Road 15	502	136	144	149	5
County Road 10	501	311	372	372	0
County Road 10	462	319	335	335	0
County Road 19	461	56	94	94	0
County Road 12	460	125	143	143	0
County Road 12	459	92	102	101	0
County Road 19	472	836	761	805	45
County Road 14	482	94	144	144	0
County Road 14	475	84	105	108	3
North of Highway 52	474	259	297	309	11
County Road 19	473	251	680	700	20
County Road 14	476	185	150	156	6
County Road 19	477	58	57	57	0

[1]Proposed improvement discharges are based on recommended plan inflows (with regional detention facility west of I-25) from Erie OSP

10.6.3 Cost Estimates

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed. The estimated quantities for each project were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. Based on discussion with COD staff, it was decided that costs would be developed for the two proposed improvement scenarios. However, costs associated with Scenario 1, which utilized the existing condition inflow from the Erie OSP and resulted in the larger crossing sizes and higher costs, will be utilized for the implementation, prioritization, and funding evaluations.

A summary of the project cost estimates associated with the two analyzed scenarios for the Little Dry Creek Basin have been provided in Tables G.4.1 and G.4.2 in Appendix G.4. The estimated quantities and cost breakdown assumptions for each individual project and scenario have also been provided in Appendix G.4. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP.

10.6.4 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities for each community was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from each community, a final scoring and ranking for each project were developed as presented in Tables 10.5 and 10.6. Total project costs have also been summarized in Tables 10.5 and 10.6. It is noted that the rankings presented in Tables 10.5 and 10.6 are meant to provide a general sequencing plan for each community as funding becomes available. However, these rankings should be considered flexible, with each community having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 10.5 Town of Frederick Selected Plan Costs and Implementation Plan for Little Dry Creek Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick/ Weld County*	LDC-37	County Road 19, North of County Road 14	(2) 3' H x 7' W RCBC	-	$ 452,000	3	3	2	1	**9**	1
Frederick/ Weld County*	LDC-36	County Road 19, North of County Road 14	(3) 24" RCP	-	$ 198,000	3	3	2	1	**9**	2
Frederick/ Weld County*	LDC-35	County Road 14, West of County Road 19	(3) 36" RCP	-	$ 199,000	3	3	2	1	**9**	3
Frederick/ Weld County*	LDC-34	County Road 19, North of Highway 52	(4) 5' H x 8' W RCBC	-	$ 1,036,000	3	1	2	1	**7**	4
Frederick	LDC-31	County Road 14 and County Road 17	(4) 36" RCP	-	$ 223,000	2	3	1	1	**7**	5
Frederick	LDC-32	County Road 14, West of County Road 19	(2) 30" RCP	-	$ 152,000	2	3	1	1	**7**	6
Frederick	LDC-33	North of Highway 52, East of County Road 19	(5) 4' H x 5' W RCBC	-	$ 1,077,000	1	1	1	1	**4**	7
				Total Frederick Costs for Little Dry Creek	**$ 3,337,000**				**Average Score**	**7.4**	

*All project costs allocated to Frederick for planning purposes. Potential cost sharing opportunity.

Table 10.6 City of Dacono Selected Plan Costs and Implementation Plan for Little Dry Creek Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Dacono	LDC-6	County Road 11, South of Summit Blvd	(5) 4' H x 9' W RCBC	-	$ 1,103,000	5	1	3	3	**12**	1
Dacono	LDC-21	Colorado Blvd, North of Summit Blvd	36" RCP	-	$ 101,000	5	3	1	3	**12**	2
Dacono	LDC-11	Colorado Blvd, North of Summit Blvd	(4) 4'H x 8' W RCBC	-	$ 2,437,000	5	1	1	3	**10**	3
Dacono	LDC-7	Summit Blvd, East of County Road 11	(3) 4' H x 13' W RCBC	-	$ 850,000	4	2	1	3	**10**	4
Dacono	LDC-12	County Road 15, North of County Road 10	(5) 6'H x 11' W RCBC	-	$ 1,020,000	4	1	1	2	**8**	5
Dacono	LDC-14	County Road 19, North of County Road 12	(6) 6' H x 10' W RCBC	-	$ 2,109,000	4	1	1	2	**8**	6
Dacono	LDC-29	County Road 19, South of Highway 52	42" RCP	-	$ 127,000	3	3	1	1	**8**	7
Dacono	LDC-23	County Road 15 and County Road 10	24" RCP	-	$ 91,000	3	3	1	1	**8**	8
Dacono	LDC-27	County Road 12, East of County Road 19	24" RCP	-	$ 73,000	3	3	1	1	**8**	9
Dacono	LDC-28	County Road 12, East of County Road 19	24" RCP	-	$ 68,000	3	3	1	1	**8**	10
Dacono	LDC-22	County Road 15, South of County Road 10	24" RCP	-	$79,000	2	3	1	1	**7**	11
Dacono	LDC-26	County Road 19, North of County Road 10	24" RCP	-	$ 93,000	2	3	1	1	**7**	12
Dacono	LDC-24	County Road 10, East of County Road 15	(2) 30" RCP	-	$ 104,000	2	3	1	1	**7**	13
Dacono	LDC-25	County Road 10, West of County Road 19	(2) 30" RCP	-	$ 124,000	2	3	1	1	**7**	14
				Total Dacono Costs for Little Dry Creek	**$ 8,379,000**				**Average Score**	**8.6**	

11 Boulder Creek Basin (BC)

11.1 Project Area

The larger Boulder Creek watershed has a drainage area of 440 square miles, with the majority of the watershed located in Boulder County. The downstream portion of the watershed extends into Weld County and encompasses portions of the Town of Frederick's and Town of Erie's planning boundaries. Boulder Creek confluences with St. Vrain Creek on the south side of State Highway 119 (Hwy 119) and west of I-25. Figure 11.1 shows the extents of the Boulder Creek Basin and its geographical relation to the TOF planning boundary. As illustrated on Figure 11.1, a tributary watershed to Boulder Creek originates south of Hwy 52, near Erie High School. This area is located outside of the current study area, but was evaluated as part of the Erie OSP study. Therefore, inflows from the Erie OSP study were incorporated into the modeling of the Boulder Creek Basin as part of this study. The portion of the Boulder Creek Basin shown in Figure 11.1 encompasses approximately 5,230 acres. Portions of the basin located within the TOF planning area are still predominately rural with some active gravel mining operations. Runoff from the portion of the basin evaluated by this study is conveyed northwest and flows directly into Boulder Creek.

It is noted that the Erie OSP evaluated a large portion of the basin that is located north of Hwy 52 and within the TOF planning area. In addition, the northern portion of the TOF planning boundary is located in the Boulder Creek floodplain and floodway (as shown on the maps presented in Appendix B.2), which will limit the potential development of land within this portion of the basin. Based on discussions with TOF staff, it was decided that this study will review and modify, as necessary, the hydrologic assessment of the Erie OSP located north of Hwy 52. For the northern portion of the basin located within the Boulder Creek floodplain, detailed hydrologic modeling was not developed due floodplain regulations limiting the ability for future development. However, the recommendations from the Boulder Creek Master Plan that was prepared by ICON in 2015, will be reviewed and incorporated into this study.

11.2 Previous Studies

In 2015, ICON Engineering completed a restoration master plan for Boulder Creek following the damage caused by the 2013 flood. The study, "Boulder Creek Restoration Master Plan", was conducted for Boulder County, the City of Boulder, and the City of Longmont and identified a system of restoration improvements aimed at improving the resiliency of Boulder Creek, between its confluence with Fourmile Creek and St. Vrain Creek. The 2015 study did not conduct hydrologic analyses, but provided general guidance for stream restoration, identified ecological needs and benefits, and developed a set of recommended improvements with associated project costs and an implementation strategy. The recommended improvements from the 2015 that are located within the TOF planning area were reviewed and incorporated into this study.

In 2020, Merrick completed the most recent stormwater master drainage plan update for the portion of the Boulder Creek Basin located within the Town of Erie planning area. The study, "Town of Erie Outfall Systems Plan (East of Coal Creek)," developed updated baseline and recommended plan condition hydrology for the Boulder Creek Basin located in the Town of Erie planning area. This study extended into the TOF planning area, north of Hwy 52 and west of WCR 3.25. Consequently, the modeling developed for the Erie OSP was reviewed and modified to provide the hydrologic assessment associated with the study. Reference is made to Section 2.4 of this report for documentation pertaining to previous flood studies and currently effective flood hazard information.

11.3 Existing Condition Analyses

The baseline hydrology was developed in general accordance with the discussion presented in Chapter 3 of this report. Specific information pertaining to the existing condition analyses with respect to the Boulder Creek Basin is presented in the following sections.

11.3.1 Design Rainfall

Discussion and documentation with respect to the determination of design rainfall for this OSP is presented in Chapter 3.2 and Appendix B.4, respectively. Design rainfall depths utilized for the Boulder Creek Basin are presented in Table 11.1 and were not modified from the rainfall depths utilized for the Erie OSP.

Table 11.1 Boulder Creek Basin One-Hour Point Rainfall Depths (inches)

Drainage Basin	2-Year	5-Year	10-Year	50-year	100-Year
Boulder Creek (BC)*	0.81	1.11	1.39	2.25	2.70

*Rainfall depths obtained from Erie OSP Study

11.3.2 Subbasin Characteristics and Hydrograph Development

As shown on Figure 11.1, the Boulder Creek Basin was subdivided into smaller subbasins for the hydrologic analyses as part of the Erie OSP. In total, 15 smaller subbasins were delineated by the Erie OSP study for the approximate 860 acres of the basin located north of Hwy 52 and within the TOF planning area. The subbasin delineations and hydrologic modeling of the Boulder Creek Basin associated with the Erie OSP study were reviewed for general conformance to the assumptions associated with this study. No major inconsistences were identified as part of this review and the Erie OSP information was utilized for this study. Detailed subbasin maps are provided in Appendix H.1.

The hydrologic parameters developed as part of the Erie OSP study were also maintained for the evaluation associated with this study, with the exception that the land use and percent impervious values were updated to be consistent with those utilized for the TOF throughout the rest of this study. The hydrologic parameters, and the rainfall depths reported in Table 11.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50- and 100-year design storms. Table H.1.1 in Appendix H.1 presents the final Boulder Creek hydrologic parameters and peak flow runoff rates for the existing condition analysis. As shown in Table H.1.1, the average existing condition percent impervious value for the basin is 28%, with an average unit runoff rate for the 100-year storm of 1.40 cfs/acre.

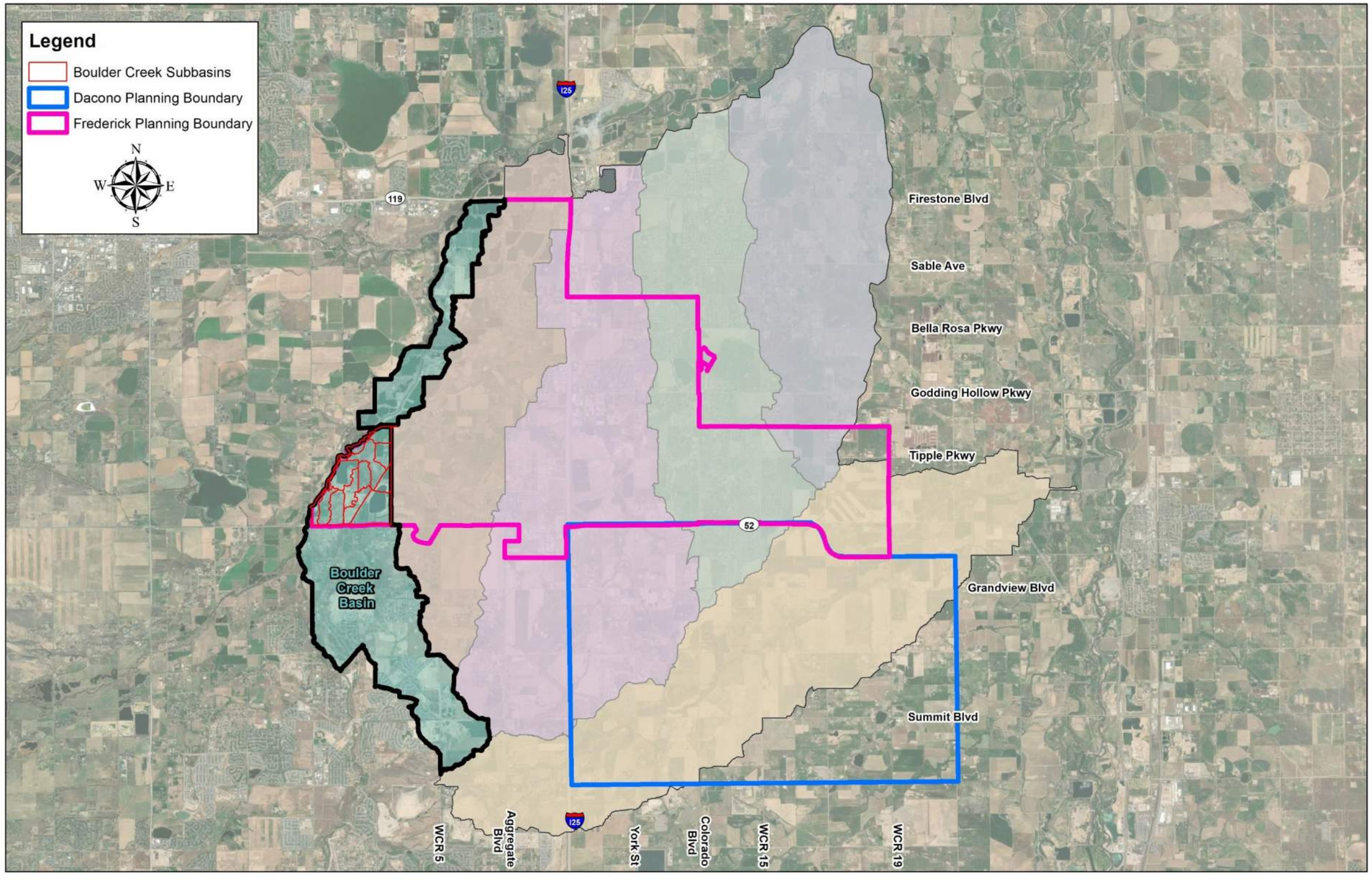

Figure 11.1 Boulder Creek Basin Study Area

11.3.3 Inventory of Existing Drainage Facilities

An inventory of existing drainage facilities within the Boulder Creek Basin was conducted as part of the Erie OSP and not reevaluated as part of this study. The Erie OSP study identified a 48" RCP crossing of Hwy 52, approximately 2,300 feet west of WCR 3, and a 30" RCP crossing of Hwy 52 at WCR 1. The Boulder Creek Restoration Master Plan also documented the existing Hwy 52 and WCR 16.5 crossings of Boulder Creek. No existing detention facilities were identified or modeled within the portion of the Boulder Creek that is being evaluated as part of this study. Maps depicting the locations of the existing crossings are provided in Appendix H.1. Table H.1.2 in Appendix H.1 provides detailed information on the existing condition crossing structure characteristics and capacity analysis.

11.3.4 SWMM Model Development

The baseline condition SWMM model developed as part of the Erie OSP study was utilized for the existing condition analysis of Boulder Creek as part of this study without modification. Subbasin hydrographs developed from the revised CUHP analysis that reflect the TOF land use values were imported into the SWMM model through interface files that were generated from the CUHP software. Table H.1.1 in Appendix H.1 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. The conveyance element map from the Erie OSP study that illustrates the existing condition SWMM model schematic for the Boulder Creek Basin is provided in Appendix H.1. Existing condition SWMM models for the Boulder Creek Basin associated with this study are digitally provided as part of Appendix J.

11.3.5 Results of Analysis

Table 11.2 provides a summary of the existing condition 100-year peak discharge results at pertinent locations throughout the watershed. Since no previous drainage studies of this area were identified, comparison to previous hydrologic results has not been conducted. Table H.1.3 in Appendix H.1 provides a complete discharge comparison for all modeled flow events. Results of the existing condition SWMM models were also utilized to evaluate the performance of the existing crossing structures within the basin. Both adequate and under-performing drainage facilities are identified in Table H.1.2 and the inventory maps presented in Appendix H.1.

Table 11.2 Boulder Creek Basin Existing Condition Peak Discharges

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study 100-Year Peak Discharge (cfs)
Hwy 52 and County Road 1	J107	50	393
Hwy 52, West of County Road 3	P-459	2,194	1,612

11.3.6 Identification of Existing Drainage Problems

As shown on the existing condition crossing inventory maps and tables provided in Appendix H.1, major crossing deficiencies were noted for the Hwy 52 crossings, and the WCR 16.5 crossing of Boulder Creek. The Hwy 52 crossing of Boulder Creek was found to have adequate capacity for the 100-year storm event. Additional flood conveyance problems will be experienced along the main drainageway north of Hwy 52, west of WCR 3. However, gravel mining operations are located adjacent to this drainageway, and the anticipated flooding of this channel will not impact any existing structures.

11.4 Future Condition Analyses

Since the Erie OSP did not evaluate a future condition analysis without the implementation of recommended drainage improvements, it was decided that a future condition scenario would also not be evaluated for the Boulder Creek Basin as part of this study. The implementation of comprehensive land use and conceptual on-site detention ponds was reserved for the proposed improvement analyses.

11.5 Recommended Plan

Review of the recommended plan associated with the Erie OSP report revealed that the plan identified the implementation of a drainage channel south of Hwy 52 to divert upstream flows that drain to the Hwy 52 crossing, east of WCR 3, into Boulder Creek. This improvement will significantly reduce the flow conveyed across Hwy 52 and into the portion of the Boulder Creek Basin located within the TOF planning area. In addition, the recommended plan from the Erie OSP identified a regional detention facility south of Hwy 52 to detain the localized proposed condition runoff down to the capacity of the existing 48" RCP crossing at this location. Based on a review of these proposed improvements with TOF staff, it was decided to maintain the recommended plan of improvements from the Erie OSP for this study.

Improvements identified within the TOF planning area from the Erie OSP also included channel improvements along the western side of the decommissioned railroad embankment and a culvert crossing of an existing driveway off WCR 3.25 to maintain access to an existing structure. Improvements associated with the Boulder Creek Restoration Master Plan were also reviewed and incorporated into this study. Maps showing the proposed plan of improvements from the Erie OSP and Boulder Creek Restoration Master Plan studies have been provided in Appendix H.2.

11.5.1 Hydrograph Development

The hydrologic parameters developed as part of the Erie OSP study for the recommended plan were also maintained for the evaluation associated with this study, with the exception that the land use and percent impervious values were updated to be consistent with those associated with the comprehensive land use and zoning maps for the TOF. Of the 16 subbasins that were reevaluated for the Boulder Creek Basin within the TOF planning area, 6 of them were assumed to have future development. The subbasins assumed to be developed as part of the proposed improvements are generally those along the Hwy 52 corridor. The future condition hydrologic parameters, and the rainfall depths

reported in Table 11.1, were input into CUHP (Version 2.0.1) to generate subbasin hydrographs for the 2-, 5-, 10-, 50- and 100-year design storms. Table H.2.1 in Appendix H.2 presents the final Boulder Creek hydrologic parameters and peak flow runoff rates for the proposed improvement analysis. As shown in Table H.2.1, the average proposed conditions percent impervious value for the basin is 33%, an approximate increase of 18% when compared to existing conditions. The average future condition unit runoff rate for the 100-year storm also increased to 1.71 cfs/acre.

11.5.2 Conceptual Detention Ponds

Conceptual on-site detention ponds were incorporated into the proposed improvement analysis to simulate the impact of on-site detention as part of future development. All conceptual on-site detention ponds within the Boulder Creek Basin were assumed to adhere to the standard 10-year proposed to 10-year existing, and 100-year proposed to 100-year existing requirement. Release rates for the conceptual on-site ponds were based on the existing condition subbasin runoff values and the required detention storage was then optimized through the modeling of the ponds in the SWMM model. Documentation for the stage-storage-discharge curves developed for the conceptual Boulder Creek Basin detention ponds is provided in Appendix H.2.

11.5.3 SWMM Model Development

The recommended plan SWMM model developed as part of the Erie OSP study was utilized for the proposed improvement analysis with changes to reflect the incorporation of the conceptual on-site detention ponds. Subbasin hydrographs developed from the revised CUHP analysis that reflect the TOF comprehensive land use values were imported into the SWMM model through interface files that were generated from the CUHP software. Table H.2.1 in Appendix H.2 identifies the SWMM model node where each subbasin hydrograph was imported into the SWMM model. A detailed conveyance element map illustrating the proposed improvement SWMM model schematic for the Boulder Creek Basin is provided in Appendix H.2. Proposed improvement SWMM models for the Boulder Creek Basin associated with this study are digitally provided as part of Appendix J.

11.5.4 Results of Analysis

Table 11.3 provides a summary of the proposed improvement 100-year peak discharge results at pertinent locations throughout the watershed. For comparison, results from the existing condition analysis have also been included in Table 11.3. Table H.2.2 in Appendix H.2 provides a complete discharge comparison for all modeled flow events.

As presented in Table 11.3, results of proposed improvement analysis highlight the significant decrease in the proposed 100-year discharge for the Hwy 52 crossings when compared to existing conditions. This reduction in discharge is a result of the Erie OSP recommended plan to redirect flow from the upstream portion of the watershed into Boulder Creek prior to it reaching the Hwy 52 crossings. This proposed plan significantly reduces flow at the existing Hwy 52 crossings such that they will be capable of conveying future flood flows without additional improvements.

Table 11.3 Boulder Creek Basin Proposed Improvement Peak Discharge Comparison

Location	SWMM Node	Drainage Area (acres)	2022 OSP Study Existing Condition 100-Year Peak Discharge (cfs)	2022 OSP Study Proposed Improvements 100-Year Peak Discharge (cfs)	Difference in Peak Discharge (cfs)
Hwy 52 and County Road 1	J107	50	393	43	-350
Hwy 52, West of County Road 3	P-459	2,194	1,612	43	-1,569

Table H.2.3 in Appendix H.2 provides detailed information for the proposed improvement crossing structure characteristics and capacity analysis. Information provided in Table H.2.3 has been depicted on the proposed improvement crossing map provided in Appendix H.2.

11.5.5 Cost Estimates

To facilitate the development of cost estimates for the recommended plan of improvements, construction quantities were estimated for each project. For general crossing improvement locations, the existing culvert crossing length was maintained, and appropriate headwall, erosion protection, and localized channel improvements were assumed.

The estimated quantities for the two proposed improvement projects north of Hwy 52 were then incorporated into the cost estimation spreadsheet for the development of project cost estimates. Cost estimates for the proposed improvements associated with the Boulder Creek Restoration Master Plan were obtained from that report and utilized for this study. A summary of the project cost estimates for the Boulder Creek Basin have been provided as Table H.3.1 in Appendix H.3. The estimated quantities and cost breakdown assumptions for each individual project have also been provided in Appendix H.3. It should be noted that the cost estimates developed as part of this OSP are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which should hopefully generate value engineering opportunities to optimize project components and reduce project cost. It is also recognized that the collection of more detailed information may also present alternative drainage solutions that were not evaluated as part of this OSP.

11.5.6 Implementation Planning and Project Sequencing

To provide a plan for the implementation and sequencing of projects as funding becomes available, a ranking of project priorities for the TOF was conducted based on the four categories and scoring criteria discussed in Section 5.5 of this report. An initial scoring for each project was conducted by the consultant team and reviewed with community staff. Based on input received from the TOF, a final scoring and ranking for each project were developed as presented in Table 11.4. Total project costs have also been summarized in Tables 11.4. It is noted that the rankings presented in Table 11.4 are meant to provide a general sequencing plan for each community as funding becomes available. However, these rankings should be considered flexible, with each community having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin.

Table 11.4 Town of Frederick Selected Plan Costs and Implementation Plan for Boulder Creek Basin

Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
						Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
Frederick/ Weld County*	2A	County Road 20 1/2	Bridge Replacement	-	$ 2,778,000	5	1	2	1	**9**	1
Frederick/ Weld County*	2E	County Road 16 1/2	Bridge Replacement	-	$ 2,778,000	5	1	2	1	**9**	2
Frederick/ Weld County*	2C	Approximately 1.5 miles Downstream of County Road 16 1/2 Along Boulder Creek	Rural Ditch Modification	-	$ 451,000	2	3	2	1	**8**	3
Frederick/ Weld County*	2D	County Road 16 1/2	Idaho Creek Diversion Modification	-	$ 451,000	2	3	2	1	**8**	4
Frederick/ Weld County*	C26	North of Highway 52, West of County Road 3 1/4	Proposed Channel for 100 Year Conveyance	-	$ 322,000	2	3	2	1	**8**	5
Frederick/ Weld County*	C239	South of County Road 16 1/2, West of County Road 3 1/4	4' RCP	-	$ 177,000	2	3	2	1	**8**	6
Frederick/ Weld County*	2B	Approximately 2.25 miles Downstream of County Road 16 1/2 Along Boulder Creek	Replace Existing Grade Control	-	$ 369,000	2	3	1	1	**7**	7
Frederick/ Weld County*	2G	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Stream Restoration	-	$ 1,634,000	1	1	2	1	**5**	8
Frederick/ Weld County*	2F	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Protection to Gravel Pond Inlets and Outlets	-	$ 8,495,000	1	1	1	1	**4**	9
				Total Frederick Costs for Boulder Creek	**$ 17,455,000**				**Average Score**	**7.3**	

*All project costs allocated to Frederick for planning purposes. Potential cost sharing opportunity.

12 Implementation and Funding Evaluation

Results of the alternative analyses, identification of recommended improvement plans, and the development of cost estimates for projects within each of individual watersheds associated with this study are presented and discussed in more detail in the previous chapters documenting the individual basins. To facilitate the sequencing of project improvements across all of the studied watersheds, a holistic prioritization plan was developed for both the TOF and COD. Funding evaluations were also conducted for each community to develop conceptual financial plans and identify funding mechanisms to generate revenue to fund the capital improvements costs identified by this study.

12.1 Total Community Project Cost Estimates

The cost estimates developed for each individual basin for each community have been summarized in Tables 12.1 and 12.2. The cost estimates were developed based on the estimated quantities for each project and the MHFD's Cost Spreadsheet as discussed in Section 5.4 of this report and presented in previous chapters documenting each basin. It is reiterated that the cost estimates developed as part of this OSP study are based on high level conceptual designs and intended to be conservative for planning purposes. It is recognized that more detailed information will need to be collected during the preliminary and final design stages of each project, which will hopefully generate value engineering opportunities to optimize project components and reduce project cost. The costs identified in Tables 12.1 and 12.2 do not account for contributions that may be provided by future development.

Table 12.1 Total Project Improvement Costs for the Town of Frederick

Basin	Total Number of Projects	Total Cost
Tri-Town (TT)	13	$ 3,494,000
Godding Hollow (GH)	6	$ 4,862,000
Idaho Creek (IC)	17	$ 28,515,000
Sump (SB)	2	$ 1,335,000
Little Dry Creek (LDC)	7	$ 3,337,000
Boulder Creek (BC)	9	$ 17,455,000
Totals	**54**	**$ 58,998,000**

Table 12.2 Total Project Improvement Costs for the City of Dacono

Basin	Total Number of Projects	Total Cost
Tri-Town (TT)	6	$ 4,120,000
Godding Hollow (GH)	11	$ 9,456,000
Little Dry Creek (LDC)	14	$ 8,379,000
Totals	**31**	**$ 21,955,000**

As shown in Table 12.1, the total costs identified for the TOF is approximately $59 million. The majority of the proposed costs are associated with the Idaho Creek and Boulder Creek Basins where few drainage facilities currently exist. The relatively flat topography of these basins also complicates the implementation of new drainage improvements. It is noted that some of the costs associated with the Boulder Creek Basin are allocated to proposed restoration projects along Boulder Creek that were identified as part of the Boulder Creek Restoration Master Plan prepared by ICON in 2015 for Boulder County, the City of Boulder, and the City of Longmont.

As presented in Table 12.2, the total costs identified for the COD is approximately $22 million. The majority of the proposed costs are associated with the Godding Hollow and Little Dry Creek Basins where few drainage facilities currently exist. Dacono anticipates that the Little Dry Creek Basin will begin to develop rapidly once existing water and sewer services are extended to this area.

12.2 Community Implementation and Prioritization Plans

To facilitate the implementation of improvement projects across the entire study area, holistic prioritization plans were developed for both communities. The development of the community implementation plans involved the reprioritization of all projects identified for each community across the entire OSP study area. The total prioritization score presented for each project in the previous chapters documenting the individual basins were utilized to re-rank all projects identified for each community. Prioritization scores for each project were based on the four categories and scoring criteria discussion in Section 5.5 of this report. Projects receiving the same total score were ranked based on input provided by community staff. Tables I.1 and I.2 in Appendix I present the holistic implementation and prioritization plans developed for the TOF and COD, respectively. The top 15 project priorities for each community have been summarized in Tables 12.3 and 12.4. It is noted that the rankings associated with the implementation plans should considered flexible, with each community having the ability to reprioritize them based on funding availability, potential collaboration opportunities with adjacent jurisdictions or CDOT, and the sequencing of future development within the basin. As illustrated in Tables 12.3 and 12.4, crossing improvements to the Hwy 52 corridor and other roadways that currently serve the populated areas are high priorities for both Frederick and Dacono.

Table 12.3 Town of Frederick Selected Plan Costs and Implementation Plan (Top 15-Projects)

Basin	Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
							Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
TT	Frederick	TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	29" H x 45" W HERCP/ 36" HDPE	-	$ 221,000	5	3	2	3	**13**	1
TT	Frederick/ Firestone	TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	(4) 36" RCP 3' H x 11' W RCBC	Frederick Portion (Half of Crossing[1])	$ 155,000	5	3	2	3	**13**	2
GH	Frederick/ Dacono	GH-C4	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC	Frederick Portion (Half of Crossing[2])	$ 1,371,000	5	1	3	3	**12**	3
TT	Frederick/ Dacono	TT-C9	Highway 52 - Main Channel	3' H x 10' W RCBC	Frederick Portion (Half of Crossing[3])	$ 248,000	5	2	3	2	**12**	4
TT	Frederick/ Dacono	TT-C23	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvements[4])	$ 411,000	5	2	3	2	**12**	5
TT	Frederick	TT-C8	Access Road Crossing North of Highway 52	Existing Crossing Proposed to be Removed and Replaced With Low Flow Crossing	-	$ 59,000	5	3	1	2	**11**	6
TT	Frederick	TT-C2	County Road 20/Bella Rosa Parkway	(3) 5' H x 9' W RCBC	-	$ 1,057,000	5	1	2	3	**11**	7
IC	Frederick/ Erie	IC-C13	HWY 52, East of County Road 5	8'H X 10'W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvemets[5])	$ 606,000	5	2	2	2	**11**	8
TT	Frederick	TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP 36" RCP	-	$ 137,000	4	3	1	3	**11**	9
TT	Frederick/ Firestone	TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	(2) 19" H x 30" W HERCP	Frederick Portion (Half of Crossing[6])	$ 59,000	3	3	2	2	**10**	10
IC	Frederick	IC-C9	Boulder and Weld County Ditch	(3) 4'H X 7'W RCBC	-	$ 1,354,000	4	1	2	2	**9**	11
TT	Frederick	TT Ponds 667 & 668	Prairie Green Ponds 2 & 3	Raise Spillway and Embankment of Pond 2 Remove Orifice Plate on Pond 2 and Enlarge Orifice Opening Area on Pond 3	-	$ 108,000	3	3	1	2	**9**	12
TT	Frederick	TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate to tie into upsized 36" RCP outfall	-	$ 417,000	3	3	1	2	**9**	13
GH	Frederick	GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC 7' H X 11 W RCBC	-	$ 434,000	3	3	1	2	**9**	14
GH	Frederick	GH-C12	Highway 52 - Erie Tributary	(3) 4' H x 12' W RCBC	-	$ 762,000	5	2	1	1	**9**	15

[1]Total Project Cost = $310,000. Other half of crossing costs ($155,000) allocated to Town of Firestone.

[2]Total Project Cost = $2,877,000. Other half of crossing and detention pond costs ($1,506,000) allocated to City of Dacono.

[3]Total Project Cost = $549,000. Other half of crossing costs ($301,000) allocated to City of Dacono.

[4]Total Project Cost = $721,000. Other half of crossing costs ($310,000) allocated to City of Dacono.

[5]Total Project Cost = $824,000. Other half of crossing costs ($218,000) allocated to Town of Erie.

[6]Total Project Cost = $143,000. Other half of crossing costs ($84,000) allocated to Town of Firestone.

Table 12.4 City of Dacono Selected Plan Costs and Implementation Plan (Top 15-Projects)

Basin	Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement/ Information	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)	Rank
							Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe		
GH	Dacono/ Frederick	GH-C4 GH Pond 718	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC 121 AC-FT Detention Pond	Dacono Portion (Half of Crossing and Detention Ponds[1])	$ 1,506,000	5	1	3	3	**12**	1
GH	Dacono	GH-C5 GH Pond 819	Lower Boulder Ditch	45 AC-FT Detention Pond	Pond	Combined with GH-C4	5	1	3	3	**12**	2
TT	Dacono/ Frederick	TT-C9	Highway 52 - Main Channel	3' H x 10' W RCBC	Dacono Portion (Half of Crossing[2])	$ 301,000	5	2	3	2	**12**	3
TT	Dacono	TT-C10	Eighth Street	3' H x 10' W RCBC	-	Combined with TT-C9	5	2	3	2	**12**	4
TT	Dacono/ Frederick	TT-C23	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Dacono Portion (Half of Crossing[3])	$ 310,000	5	2	3	2	**12**	5
TT	Dacono	TT-C37	Carbondale Drive Storm Sewer	78" RCP	-	$ 1,793,000	5	1	3	3	**12**	6
TT	Dacono	TT-C38	Forest Avenue Storm Sewer	(2) 3' H x 12' W RCBC	-	$ 1,420,000	5	1	3	3	**12**	7
LDC	Dacono	LDC-6	County Road 11, South of Summit Blvd	(5) 4' H x 9' W RCBC	-	$ 1,103,000	5	1	3	3	**12**	8
LDC	Dacono	LDC-21	Colorado Blvd, North of Summit Blvd	36" RCP		$ 101,000	5	3	1	3	**12**	9
GH	Dacono	GH-C6	County Road 12/Grandview Blvd	(3) 4' H x 12' W RCBC	-	$ 612,000	4	2	1	3	**10**	10
GH	Dacono	GH-C7	County Road 10/Speedway Blvd	(2) 5' H x 7' W RCBC	-	$ 560,000	4	2	1	3	**10**	11
GH	Dacono	GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	34" H x 53" W HERCP	Channel Improvement	$ 459,000	3	2	2	3	**10**	12
GH	Dacono	GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(3) 18" RCPS	-	$ 143,000	3	3	1	3	**10**	13
LDC	Dacono	LDC-7	Summit Blvd, East of County Road 11	(3) 4' H x 13' W RCBC	-	$ 850,000	4	2	1	3	**10**	14
LDC	Dacono	LDC-11	Colorado Blvd, North of Summit Blvd	(4) 4'H x 8' W RCBC	-	$ 2,437,000	5	1	1	3	**10**	15

[1]Total Project Cost = $2,877,000. Other half of crossing costs ($1,371,000) allocated to Town of Frederick.

[2]Total Project Cost = $549,000. Other half of crossing costs ($248,000) allocated to Town of Frederick.

[3]Total Project Cost = $721,000. Other half of crossing and downstream channel costs ($411,000) allocated to Town of Frederick.

12.3 Community Funding Evaluation

The purpose of the funding evaluation for this OSP study is to assess each community's ability to implement the recommended plan of capital improvements within a reasonable time frame such that it corresponds with the anticipated growth of each community. The Town of Frederick currently collects a stormwater development impact fee and monthly user fees from residents and commercial property owners to help fund stormwater improvement projects. These charges and fees were set in a market-based manner to be consistent with surrounding communities as presented in Table 12.5. The City of Dacono does not currently assess stormwater related fees or hold financial reserves specifically for stormwater related projects. As such, drainage improvement projects are typically conducted as part of transportation improvement projects with General Fund dollars. As shown in Table 12.5, the Town of Frederick's fees are on the lower end of the regional average.

Table 12.5 Comparison of Regional Stormwater Rates and Fees

Community	Monthly Stormwater Fee to Residents ($/SFRE)	Stormwater Impact Fee ($/SFRE)
Dacono	**N/A**	**N/A**
Fort Lupton	$ 3.80	$ 864
Johnstown	$ 5.00	$ 1,100/acre
Frederick	**$ 7.25**	**$ 977**
Firestone	$ 7.42	Combined with other fees
Loveland	$ 10.44	$ 3,300
Erie	$ 11.98	$ 1,628
Greeley	$ 13.00	$ 466
Longmont	$ 13.05	$ 1,031
Boulder	$22.00	$ 12,000

The following financial evaluations were developed with a combination of variables and assumptions that affect the analyses and resulting implementation time frame. It is recognized that these assumptions will likely change as the future rate of development changes due to market conditions and costs rise due to inflation. Consequently, the funding evaluation was conducted with alternative implementation time frames to provide options for the communities to consider as they grow and their funding needs change.

12.3.1 Town of Frederick Financial Evaluation

12.3.1.1 Background Information

As presented in Table 12.1, the portion of the OSP recommended plan of improvements (Plan) allocated to Frederick is estimated to be approximately $59 million in 2022 dollars. This should be considered a "worst case" estimate because it does not include potential funding assistance from Weld County or CDOT for projects involving regional and State roadways and it does not include the contribution from future development projects that are often required to provide funding for improvements from which their developments will benefit. In addition, the costs do not reflect the possibility of obtaining grant funding to implement these projects. While the sources of grant funding for these particular projects may be limited, it is suggested that Frederick investigate grant opportunities as projects are being constructed. Table 12.3, and Table I.1 in Appendix I provide the proposed sequencing of projects that are associated with the recommended plan.

Inflation, or cost escalation, is an important issue that is currently in the news and has chronically characterized the construction industry. This is especially the case for the high-growth areas of the Colorado Northern Front Range. Although inflation is assumed for the financial analysis, the discussion of financial analysis results is presented in relation to 2022 dollars. The financial projection for future years assumes an initial annual inflation rate of 3.0 percent for the first 5-year period (2022-2026), which is intended to reflect current strong economic conditions, and reduced to 2.5 percent rate for the remainder of the time frames considered to reflect assumed long-term cost escalation rates.

Although Frederick's population has recently been growing at an annual rate approaching 6 percent or greater, long-term planning documents, including the Town's Water Efficiency Plan and the Draft Water Resources Plan, have focused upon a more sustainable long-term growth rate of 2.5 percent. With this growth rate and estimates of remaining developable land in both the Town and its planning boundaries, it is assumed that the Town will near full buildout conditions within a window between year 2050 and year 2070.

Using data provided by the Town, and other data incorporated into the Town's Water Resources Plan, it appears that the Town's current population is nearing 15,600 and there are approximately 2.99 people per household. This estimate results in approximately 5,250 households, or residences, currently within the Town. Of these 5,250 households, 4,200 of them are estimated to be east of I-25, with the remainder on the west side. Planning estimates also indicate that there are approximately 11,000 dwelling units yet to be developed within the Town's planning area east of I-25. Out of these 11,000 units, 6,960 have been annexed into the Town limits and the remainder are located within the planning boundary. Planning estimates also indicate that there are an additional 2,925 developable residential units that have been annexed into the Town on the west side of I-25. Similar estimates indicate that approximately 468 acres of developed non-residential (commercial and industrial) properties currently exist east of I-25, with approximately 829 acres remaining to be developed for non-residential use within the annexed Town limits and planning boundary. West of I-25, it is estimated that there are approximately 253 acres of developed non-residential parcels, with 938 acres remaining to be developed for non-residential use within the annexed Town limits and planning boundary.

As a result of the Town's collection of stormwater and impact fees, the stormwater fund currently has a strong reserve of nearly $6 million. It is anticipated that some of these reserves can be utizlied to fund the construction of high priority projects in the near future, while providing the Town time to consider incremental adjustments to future rates and fees to facilitate the buildout of projects in accordance the alternative time frames analyzed as part of the following financial evaluation. It is noted that the Town currently charges $39.58 and $52.38 per acre of development for future industrial and commercial parcels, respectively. For simplicity, the following financial evaluation assumed a constant value of $40.00 per acre for all non-residential parcels. With respect to impervious area impact fees for non-residential development, Frederick charges $0.488 per square foot of impervious area. The following financial evaluation assumed that 80% of the future non-residential parcels will be impervious.

12.3.1.2 Financial Pro Forma

The funding evaluation was conducted using a financial pro forma spreadsheet developed for this specific purpose, beginning in 2022 through anticipated buildout. The spreadsheet accounts for the following sources and uses of funds on an annual basis:

- Sources of funds include the stormwater enterprise fund balance (for the initial year of 2022), annual user charge revenues, and annual impact fee revenues. Other revenues, as they become available in the future, can be added to the spreadsheet to evaluate their impact on future financial needs. These additional funding sources could include grants, debt issuance, and developer contributions.
- Uses of funds include stormwater enterprise operation and maintenance, the Plan's capital expenditures, and other expenditures as they occur, such as debt service.
- The annual difference between sources and uses of funds are carried over to the next year. As long as carryover funds are greater than zero, considering the assumptions underlying the financing scenario, the Plan is considered financially feasible.

The following scenarios were evaluated with the use of the pro forma spreadsheet. It is noted that these scenarios do no consider the effects of inflation; addressing the potential impact of inflation on capital costs and fees is discussed after the scenario descriptions.

- Baseline Revenue and Costs, Without Increasing Fees: Figure 12.1 shows the combination of user charge and impact fee revenues compared to anticipated stormwater O&M expenditures. Years 2013 through 2021 include historical data, with years 2022 and beyond representing estimated future revenues and costs. The drop off in the graph at year 2061-62 indicates that the east side of I-25 has reached full buildout conditions, with buildout on the west side occurring just past 2070. The area between the revenues and costs in Figure 12.1 represent the amount of funds anticipated to be available to implement the Plan under current rates and fees, assuming no inflation. Overall, this scenario indicates that under the current funding mechanisms approximately $52 million will be generated for stormwater improvements through 2070.
- Plan Implementation by 2070: Results of the baseline analysis indicate that the current rates and fees will fall just short of the estimated recommended plan costs of $59 million if the Plan were to be fully implemented by 2070. However, the financial pro forma indicates that a less than 5 percent across-the-board stormwater rate and fee increase implemented by 2026 would ensure all projects could be financed by 2070.
- 40-year Implementation Plan, 2061: A 40-year implementation plan (with a 2.5 percent population growth rate) assumes that $1.5 million is spent per year on stormwater improvements and that the plan would be fully implemented in year 2061. In this case, stormwater rates and fees would have to increase by 40 percent by year 2026 to fund the Plan on a pay-as-you-go basis. An increase of rates to this magnitude (in 2022 dollars) by 2026 puts Frederick squarely in the middle of the regional range presented in Table 12.5.
- 30-year Implementation Plan, 2051: A 30-year implementation plan (with a 2.5 percent population growth rate) assumes that $2.0 million is spent per year on stormwater improvements and that the plan would be fully implemented in year 2051. Under this scenario, the stormwater enterprise starts to accumulate significant reserves in the latter 10 years of the 30 years considered, indicating some form of rate relief could be considered at this time. A doubling of rates (in 2022 dollars) by 2026 would most likely put Frederick in the middle to slightly higher end of the regional range.

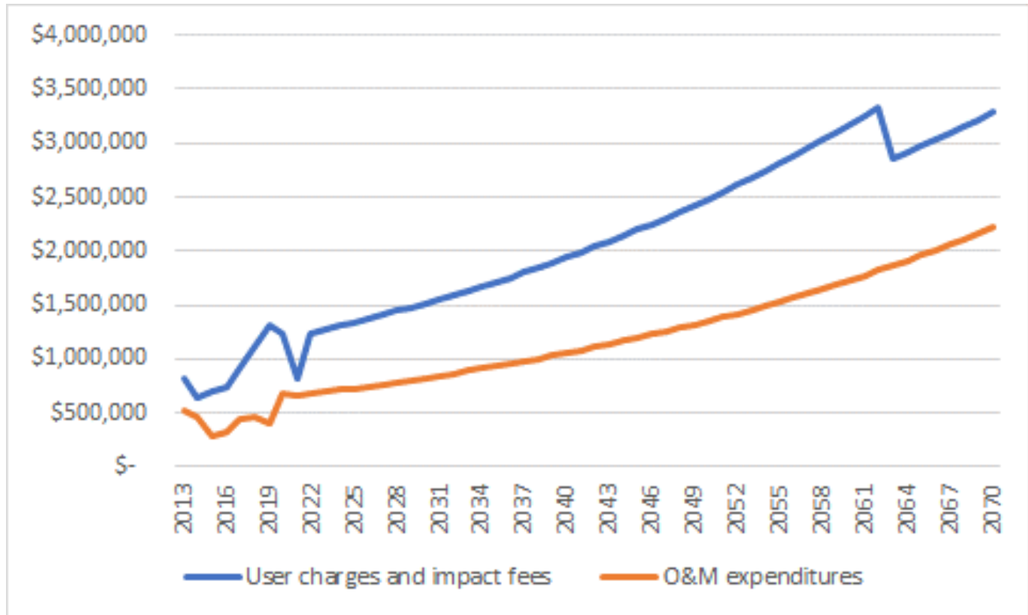

Figure 12.1 Town of Frederick Baseline Stormwater Revenue and Costs

- 20-year Implementation Plan, 2041: A 20-year implementation plan (with a 2.5 percent population growth rate) assumes that $3 million is spent per year on stormwater improvements and the plan would be fully implemented in year 2041. In this case, annual stormwater revenue, via rates and fees, would have to increase by a factor of 3.0, plus some adjustments would be required to back-load the expenditure schedule in order to better manage capital funds. A rate and fee increase of this size would place Frederick near the top of the region in rates and fees.

Figure 12.2 summarizes the tradeoff between the time needed to fully implement the Plan and required increases in annual revenue, assuming no inflation and 2.5 percent annual population growth. Table 12.6 recasts Table 12.5 with Frederick's possible future stormwater rates and charges for the implementation plan scenarios in relation to nearby communities.

Assuming relatively smooth and uniform expenditure patterns, the above observations hold the same with or without inflation, ***provided rates and fees are systematically increased with inflation over time.*** It is recommended that some form of indexing mechanism be utilized to justify the need for rate and fee increases due to inflation. Two sources for these indices include the Engineering News Record's Construction Cost Index (ENR CCI) and Producer Price Index (PPI), but other indices do exist. If future rates and fees are not indexed to inflation, relatively frequent and highly unpopular periodic adjustments may be required to keep pace with construction costs.

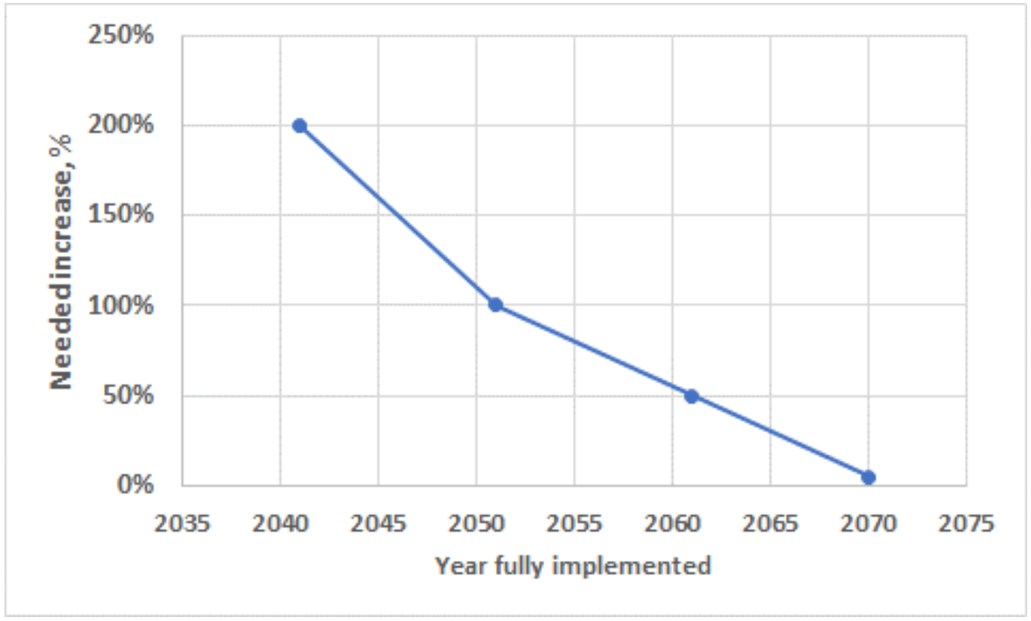

Figure 12.2 Town of Frederick Implementation Time Frame Compared to Needed Increases to Annual Revenue

Table 12.6 Town of Frederick's Potential Fee Scenarios in Comparison to Regional Stormwater Rates and Fees

Community	Monthly Stormwater Fee to Residents ($/SFRE)	Stormwater Impact Fee ($/SFRE)
Dacono	N/A	N/A
Fort Lupton	$ 3.80	$ 864
Johnstown	$ 5.00	$ 1,100/acre
Frederick (current)	$ 7.25	$ 977
Firestone	$ 7.42	Combined with other fees
Loveland	$ 10.44	$ 3,300
Frederick, 40-Year Implementation	**$ 10.88**	**$ 1,470**
Erie	$ 11.98	$ 1,628
Greeley	$ 13.00	$ 466
Longmont	$ 13.05	$ 1,031
Frederick, 30-Year Implementation	**$ 14.50**	**$ 1,950**
Frederick, 20-Year Implementation	**$ 21.75**	**$ 2,950**
Boulder	$22.00	$ 12,000

12.3.1.3 Conclusions

Assuming the Town's long-term rate of residential and non-residential growth is approximately 2.5 percent annually and, for the moment, inflation concerns are set aside, the final analysis for Frederick indicates that current rates and fees will be nearly sufficient to fund the Plan through the Town's buildout near year 2070. A minor rate and fee increase of 5 percent or less, above inflation, within the next few years would assure this based on the financial analysis. However, this also assumes that the Town will adjust rates and fees with inflation over time. Under the same assumptions, the financial evaluation also indicates that if the Town would like to accelerate the Plan's implementation to a period of 40-, 30-, or 20-years, annual revenues would need to increase by 50 percent, 100 percent, and 200 percent, respectively, after 2026. This increase would be above regular increases needed for inflation.

Although the assumption of 2.5 percent growth is relatively high from a historical perspective, recent growth has greatly exceeded this annual rate. A faster rate of growth accelerates both revenue generation and the pace at which the projects need to be implemented. If, for instance, a 6.0 percent growth rate could be sustained, buildout would occur within 20 years and the Plan could be fully financed within 20 years through a 50 percent increase in annual revenues. Adjustments to the assumed rate of growth and inflation can be incorporated into the pro forma spreadsheet to determine how future changes to these rates will impact the presented final plan.

Per direction of community staff and Town Board Members, this financial analysis assumed no rate or fee increases until year 2026 as a result of the current stormwater fund reserves of approximately $6 million. This reserve allows for the immediate implementation of the recommended plan of improvements and provides a margin of time for the Town to consider adjustments to rates and fees to match their chosen implementation timeline. Based on the financial analysis and current reserves, the Town of Frederick appears to be in a good position to fund and implement the recommended plan of improvements.

12.3.2 City of Dacono Financial Evaluation

12.3.2.1 Background Information

As presented in Table 12.2, the portion of the OSP recommended plan of improvements (Plan) allocated to Dacono is estimated to be approximately $22 million in 2022 dollars. This should be considered a "worst case" estimate because it does not include potential funding assistance from Weld County or CDOT for projects involving regional and State roadways and it does not include the contribution from future development projects that are often required to provide funding for improvements from which their developments will benefit. In addition, the costs do not reflect the possibility of obtaining grant funding to implement these projects. While the sources of grant funding for these particular projects may be limited, it is suggested that Dacono investigate grant opportunities as projects are being constructed. Table 12.4, and Table I.2 in Appendix I provide the proposed sequencing of projects that are associated with the recommended plan.

Inflation, or cost escalation, is an important issue that is currently in the news and has chronically characterized the construction industry. This is especially the case for the high-growth areas of the Northern Front Range. Although

inflation is assumed for the financial analysis, the discussion will initially focus upon comparisons in 2022 dollars. The financial projection for future years assumes an initial annual inflation rate of 3.0 percent for the first 5-year period (2022-2026), which is intended to reflect current strong economic conditions, and reduced to 2.5 percent rate for the remainder of the time frames considered to reflect assumed long-term cost escalation rates.

The City of Dacono is in transition from a small rural town to a fast-growing suburban community. It does not yet have a have a stormwater utility or special revenue accounts to finance stormwater, nor does it assess stormwater related fees, charges, or hold financial reserves for stormwater projects. Like many communities of Dacono's size, stormwater and drainage issues have been handled through transportation improvements, primarily to support local streets and roads. To finance the identified improvement projects associated with this OSP study, it is reasonable to assume that Dacono will need to take a similar approach as other nearby growing communities and either create a stormwater utility enterprise or manage a dedicated portion of the City's General Fund for stormwater activities. Whether the creation of this enterprise occurs in 2022, 2023, 2024, or later is uncertain, but the following funding evaluation assumes that the creation of an enterprise will eventually occur. For purposes of this financial analysis, it is assumed that the enterprise or similar arrangement is created in 2023.

Based on discussion with community staff, Dacono desires to finance the Plan primarily with stormwater impact fees. This is due to the fact that most of the proposed stormwater improvements are located within currently undeveloped areas of the City's planning boundary. Current residents may not see immediate benefits from these future improvements and will likely resist paying a monthly stormwater charge. To the degree that impact fees are intended to contribute to new improvements, the City's desire is reasonable. However, with growth and increasing investment in drainage assets, operation and maintenance expenditures will be needed on a regular basis. Impact fees are not intended to cover operation and maintenance costs. Therefore, in addition to stormwater impact fees, the imposition of monthly stormwater charges for residential and non-residential land uses must also be considered.

For purposes of this analysis, it is assumed that impact fees are imposed in 2023 and user charges in 2024. It is further assumed that these fees and charges will be market-based in the sense that Dacono will set fees at a level that keeps them competitive relative to other nearby communities as illustrated in Table 12.5. In addition, since the City does not have available reserves to fund projects in the near-term, stormwater expenditures are expected to initially be modest and grow over time at approximately the same pace as population and development. The level of initial expenditures is an important factor when considering the time frame of implementation.

12.3.2.2 Financial Pro Forma

The funding evaluation was conducted using a financial pro forma spreadsheet developed for this specific purpose, beginning in 2022 through 2061. The spreadsheet accounts for the following sources and uses of funds on an annual basis:

- Sources of funds include the stormwater enterprise fund balance (for the initial year of 2022), annual user charge revenues, and annual impact fee revenues. Other revenues, as they become available in the future, can be added to the spreadsheet to evaluate their impact on future financial needs. These additional funding sources could include grants, debt issuance, and developer contributions.
- Uses of funds include stormwater enterprise operation and maintenance, the Plan's capital expenditures, and other expenditures as they occur, such as debt service.
- The annual difference between sources and uses of funds are carried over to the next year. As long as carryover funds are greater than zero, considering the assumptions underlying the financing scenario, the Plan is considered financially feasible.

Two major sources of local population and demographic information, the Census's American Community Surveys and the State's Department of Local Affairs (DOLA), show the population of Dacono is increasing rapidly and is currently 6,340, with the number of households near 2,174. People per household appears stable at 2.85, reflecting primarily single-family housing and relatively little multi-family. The City's growth rate in 2020 was 5.3 percent, outpacing the 3.1 percent for Weld County and 0.50 percent for the State of Colorado. Since 2010, population has grown at a compound annual rate of 4.0 percent which, if extrapolated into the long-term future, would appear explosive. Future population estimates specific to Dacono are not available, but DOLA has estimated a long-term, 2021-2050, population growth rate of 2 percent per year for Weld County and nearby areas that appear applicable to Dacono.

Dacono examined growth and future land uses in their 2017 Comprehensive Plan "Dacono Forward" and its appendices, which in retrospect tended to underestimate the pace of growth since, but established limits to growth within the City's annexed area and planning boundaries as follows:

- Residential land use: 9,829 acres, or 82.5% of potentially developable land.
- Commercial – 1,217 acres, 10.2%.
- Industrial – 875 acres, 7.3%.
- In addition, 1,980 acres were designated for open and civic space.

Although representing upper limits to growth, the following financial analysis did not find these areas limiting within the planning horizons considered.

A recent impact fee analysis for the City consolidated planning information for the City for purposes of revising fees for transportation, City Hall, and parks and trails. The Development Fee Study [TischlerBise, 2021] examined future residential growth and growth in commercial, industrial, and institutional land uses, through 2030. It assumed a 4 percent rate of growth in residential and annual rates ranging from 8 percent to 10 percent for non-residential land uses.

The financial analysis for Dacono incorporates the Tischler growth assumptions through 2030 on the basis that it is the most recent information available. However, for years beyond 2030, the financial analysis reduces the annual expected rate of growth to 2.5 percent through 20-, 30-, and 40- year planning horizons. This reduced rate is still aggressive but reflects that as Dacono grows, incremental additions to population and housing will represent a lesser percent of the total. Plus, over the long-term, physical resources may become constraining to explosive growth rates, such as water supply and other infrastructure. Figure 12.3 summarizes the assumed growth for residential and non-residential land uses over the period 2022 through 2061. Please note there are two y-axes on the figure to allow for comparison of different units of measures and that commercial and industrial land uses tend to graphically overlap.

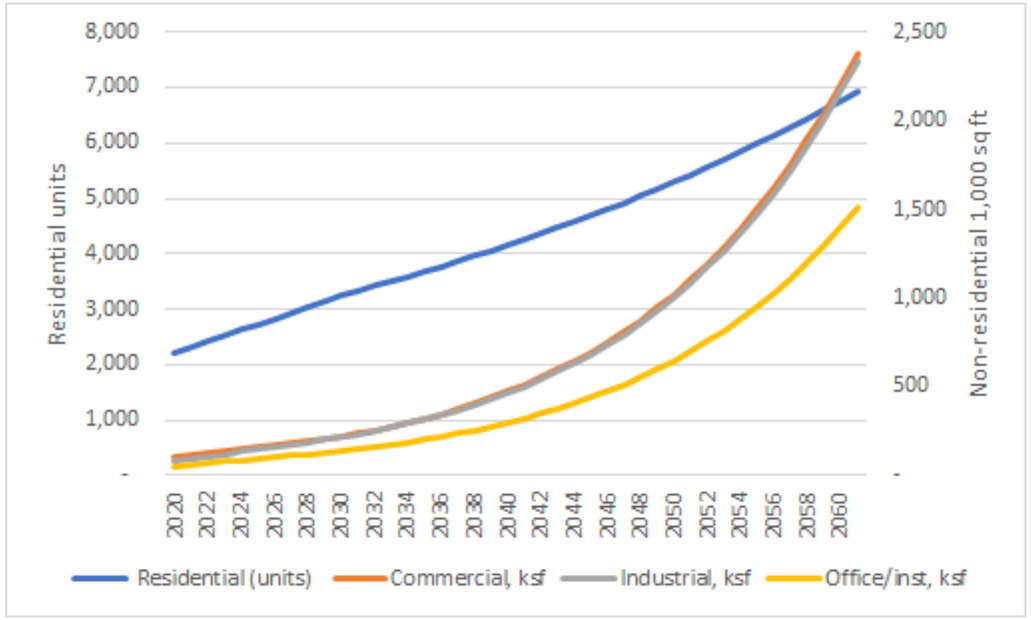

Figure 12.3 Historical and Anticipated Future Growth for City of Dacono, 2022-2061

As previously noted, implementation of the OSP Plan is assumed to require the creation of a stormwater utility enterprise or some alternative structure within the City's General Fund to ensure projects can be financed and maintained. The major uncertainties are the time frame of implementation and the stormwater charges and fees that would be needed to fit this time frame. Under any implementation scenario, it is assumed the City will start with a relatively modest investment and grow it over time with population and economic growth.

Specifically, the financial evaluation considered three implementation scenarios resulting in a 40-, 30-, and 20-year duration. Assuming the City imposes some form of impact fee in 2023 and monthly user charges in 2024, the financial pro forma model was utizlied to estimate the approximate levels of impact fees and user charges needed for the three time frame scenarios. Variables considered in the pro forma model include:

- Initial investment in the Plan, set to an initial level that annually grows with the rate of population and results in sufficient revenue to fund the Plan over the desired time frame, expressed in 2022 dollars.
- Initial levels of impact fees to the various land uses and how they must change over time to generate sufficient revenues.
- Initial levels of monthly user charges to the various land uses and how they must change over time to generate sufficient revenues.
- The ending balance of the hypothetical Stormwater Fund, demonstrating that the Plan can be financed and result in a positive ending balance.

Figure 12.4 illustrates the annual stormwater expenditure calculated under the various implementation scenarios. All scenarios result in $22 million being collected. Table 12.7 summarizes the assumptions of the financial analysis, showing the initial investment, initial impacts fees and user charges, and how they must change over time. Table 12.8 recasts Table 12.5 with Dacono's possible future stormwater rates and charges in relation to nearby communities.

Assuming relatively smooth and uniform expenditure patterns, the above observations hold the same with or without inflation, ***provided rates and fees are systematically increased with inflation over time.*** It is recommended that some form of indexing mechanism be utilized to justify the need for rate and fee increases due to inflation. Two sources for these indices include the Engineering News Record's Construction Cost Index (ENR CCI) and Producer Price Index (PPI), but other indices do exist. If future rates and fees are not indexed to inflation, relatively frequent and highly unpopular periodic adjustments may be required to keep pace with construction costs.

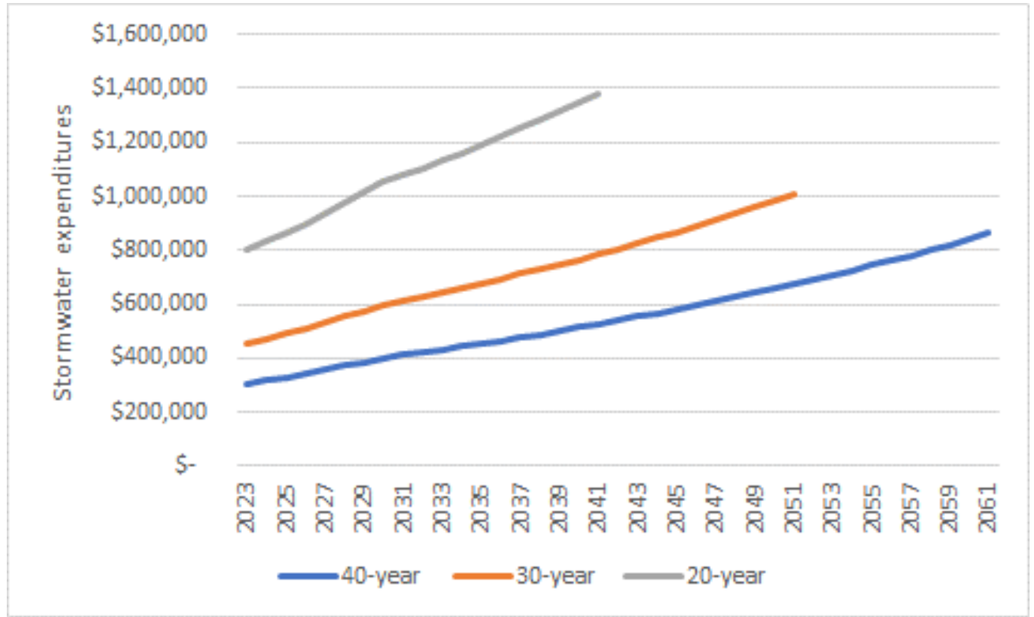

Figure 12.4 Annual Expenditures for Dacono's 40-, 30-, and 20-Year Implementation Scenarios (2022 Dollars)

Table 12.7 City of Dacono's Financial Analysis Assumptions (2022 Dollars)

Time Frame	Initial Investment*	Stormwater Impact Fees (Beginning in 2023)		Monthly Stormwater Charges (Beginning in 2024)		Ending Fund Balance
		Initial Fee	Change Over Time	Initial Fee	Change Over Time	
40-Year (2022-2061)	$305,000	Residential: $1,200/unit	$1,500/unit (2025-2027) $2,000/unit (2028-2061)	Residential: $5.00/month	$6.00/month (2027-2061)	$423,000
		Non Residential: $0.49/sq ft**	$0.55/sq ft (2025-2027) $0.60/sq ft (2028-2061)	Non Residential: Comm/Indust: $75/acre/month Institutional: $40/acre/month	No Change	
30-Year (2022-2051)	$455,000	Residential: $2,000/unit	$3,000/unit (2029-2051)	Residential: $7.50/month	$10.00/month (2027-2051)	$410,000
		Non Residential: $0.55/sq ft**	$0.70/sq ft (2029-2051)	Non Residential: Comm/Indust: $75/acre**/month (2029-2051) Institutional: $40/acre**/month (2029-2051)	Comm/Indust: $90/acre**/ month (2027-2051) Institutional: $60/acre**/ Month (2027-2051)	
20-Year (2022-2041)	$800,000	Residential: $3,000/unit	$4,000/unit (2027-2041)	Residential: $15.00/month	$19.00/month (2027-2061)	$107,000
		Non Residential: $0.75/sq ft**	$0.95/sq ft (2027-2041)	Non Residential: Comm/Indust: $100/acre**/month (2027-2041) Institutional: $60/acre**/month (2027-2041)	Comm/Indust: $120/acre**/ month (2027-2041) Institutional: $80/acre**/ Month (2027-2041)	

*Investment increases each year with inflation and population growth
**of impervious area

Table 12.8 City of Dacono's Potential Fee Scenarios in Comparison to Regional Stormwater Rates and Fees

Community	Monthly Stormwater Fee to Residents ($/SFRE)	Stormwater Impact Fee ($/SFRE)
Fort Lupton	$ 3.80	$ 864
Johnstown	$ 5.00	$ 1,100/acre
Dacono, 40-Year Implementation	**$ 5.00 - $6.00**	**$ 1,200 - $2,000**
Frederick (current)	$ 7.25	$ 977
Firestone	$ 7.42	Combined with other fees
Dacono, 30-Year Implementation	**$ 7.50 - $10.00**	**$ 2,000 - $3,000**
Loveland	$ 10.44	$ 3,300
Erie	$ 11.98	$ 1,628
Greeley	$ 13.00	$ 466
Longmont	$ 13.05	$ 1,031
Dacono, 20-Year Implementation	**$ 15.00 - $19.00**	**$ 3,000 - $4,000**
Boulder	$22.00	$ 12,000

12.3.2.3 Conclusions

If the City's long-term rate of residential and non-residential growth is approximately 4.0 percent annually through 2030 and 2.5 percent thereafter and, for the moment, inflation concerns are set aside, this analysis indicates that Dacono could potentially finance the Plan with rates and fees set within regional ranges as illustrated on Table 12.8. The 4 percent growth rate is supported by a recent historical rate of this level and few reasons to think it will slow down in the near-term. However, as the City grows and potential limitations to growth are observed, the growth rate is assumed to back-off to 2.5 percent through the planning horizon.

The analysis has assumed that impact fees are imposed in 2023 and user charges in 2024. They are initially set at relatively low "market based" levels to reduce concerns about the City's near-term economic development competitiveness and allowed to increase over time to levels that ensure the Plan's viability through the planning horizon. Under the 30-year and 40-year implementation time frames, the resulting rates and fees tend to be in the mid-range of regional averages. A 20-year implementation time frame increases charges to the high range of regional observations.

The analysis has assumed that some institutional accommodations will be made to finance the Plan, primarily the creation of a stormwater utility enterprise, and has not discussed its alternative implementation under the City's General Fund, constrained by the Taxpayers Bill of Rights (TABOR). Whether to create a stormwater enterprise or use a special revenue fund is a decision that Dacono should consider in the near future to begin implementation of the proposed stormwater improvements associated with this study. The intent of this financial evaluation is to provide the City with information to help them make this decision.

12.3.3 Secondary Funding and Financing Sources

Secondary funding and financing sources should be considered and actively pursued to supplement the community's impact and user fee revenues. These sources likely will not provide a continuous revenue stream but can be obtained on a periodic basis to construct specific improvement projects associated with the recommended plan. The following identifies some of the secondary funding and financing options that the communities can consider to supplement their normal stormwater revenues.

12.3.3.1 Grants

Grants are a desirable yet unreliable method of funding capital improvements. However, the level of assistance associated with some federal grants provides plenty of incentive to apply. The 2013 Flood brought significant levels of grant funding to the Northern Colorado Front Range through the Federal Emergency Management Agency (FEMA), the Department of Housing and Urban Development (HUD), and the Economic Development Administration (EDA). In a post-flood environment, these sources are still valid, but the lack of current Major Disaster Declaration reduces the region's priority for getting funding in comparison to areas with more recent natural disasters. It is important to note that most grants have an associated local cost share. The local cost share can either be in the form of cash or it can be in the form of in-kind services or other non-cash contributions. Potential grants from federal sources include FEMA and the U.S. Army Corps of Engineers. Potential state grant funding sources include the Colorado Water Conservancy Board, Colorado Department of Transportation, Department of Labor and Affairs, and Community Development Block Grants (CDBG).

12.3.3.2 Debt Financing

Debt financing can come in the form of two types of bonded indebtedness, General Obligation bonds and Revenue bonds. Loans also serve as another form of debt financing. The following describes the potential types of debt financing that could be implemented to accelerate or supplement funding for the more expensive projects identified as part of the recommended plan.

- General Obligation Bonds: General Obligation (GO) bonds require an election of affected residents and are backed, or guaranteed, by property tax revenues. As a result, GO bonds are considered secure and their associated interest rates tend to be lower than with a revenue bond. Offsetting the relatively lower interest rate are two disadvantages: (1) voter approval takes time and holds the risk that the bond issue may be turned down by voters; and (2) the municipality's bonding capacity is limited to a percentage of the community's total assessed value. Using GO bonds for stormwater facilities could tie-up a substantial proportion of a community's bonding capacity for a regional benefit, thereby leaving the bonding capacity unavailable for other worthy projects or emergencies.
- Revenue Bonds: Revenue bonds would require approval of a Town Board or City Council but do not require a public vote. They are backed by the revenues generated by the improvements they finance. For instance, a stormwater-related revenue bond would be backed by revenues from monthly stormwater charges. Revenue bonds would not affect the community's bonding capacity because they are not backed by property taxes. However, they do require that some minimum reserves be maintained to assure timely payments. The terms of a municipal, tax-free revenue bond, including period of repayment, interest rates charged, issuance costs, and other fees, can vary with the issuance. The credit worthiness of the borrower, such as their bond rating, and the demand for municipal bonds as the time they are issued will also influence the cost of using this source of funds.
- State of Colorado Loans: Locally, the Colorado Water Conservation Board (CWCB) may have funds available for constructing stormwater and other flood-related facilities under their Water Project Loan Program. These types of loans are usually backed by stormwater utility revenues, similar to a revenue bond. The CWCB program is funded at a rate of about $50 million annually. The maximum loan amount is $10 million, but loans in multiple years are possible. Also, it may be possible to increase funding by combining CWCB funds with those from the Colorado Water Resources and Power Development Authority's Water Revenue Bond Program. The terms of repayment typically for these arrangements typically range from 20 to 30 years and municipal interest rates are in the range of 3% to 3.5%.

13 Summary and Recommendations

This document summarizes the results of a master planning effort related to stormwater management within the Town of Frederick and City of Dacono Planning areas. This report and the associated technical analyses provide an update to the previous master planning efforts within the study area. This Outfall System Plan (OSP) includes the following major watersheds: (1) Tri-Town; (2) Godding Hollow; (3) Idaho Creek; (4) Sump; (5) Little Dry Creek, and (6) Boulder Creek. The focus of this planning effort was to update the hydrologic modeling and hydraulic analysis for each watershed to assess existing flooding problems, identify long-term capital improvement projects, and provide an implementation and funding evaluation for the construction of the identified projects. The identification of recommended improvements for each basin are provided in Chapters 6 through 11. Holistic implementation and funding evaluations for Frederick and Dacono are provided in Chapter 12.

Following the approval and adoption of this OSP study, it is recommended that the Frederick and Dacono continue to diligently pursue the implementation of the identified drainage improvements. The following general recommendation are also offered.

- This OSP study did not reevaluate existing regulatory floodplains, nor did it develop any new flood hazard mapping within the study area. It is recommended that additional studies be conducted to update, or identify currently unmapped flood hazards, within the study area utilizing the updated hydrologic analysis associated with this report. These studies should first focus on the main drainageways and tributaries within the watersheds experiencing the most development pressure. These studies can then be expanded and revised as development occurs. It is further recommended that these studies be conducted in the near future and that they be submitted to FEMA for review and approval to establish a consistent regulation tool for future development along the drainageways.
- Until the future floodplain studies are completed, or if development is being proposed in a location where floodplains are not mapped, it is recommended that future developments be required to evaluate the potential for unmapped flood hazards on undeveloped sites. For developments where flood hazards are identified, the FEMA floodplain development process should be followed to ensure future developments are constructed such that they are not susceptible to flooding.
- Based on the 2020 census, it is anticipated that the Town of Frederick's population will surpass the threshold criteria for the Town to be designated into the MS4 Phase II Stormwater Management Program. In preparation for this designation, it is recommended that the Town seek out advice from Weld County and adjacent jurisdictions to begin planning their MS4 program. The information provided as part of this study can be utilized to help Frederick identify, monitor, and manage the existing MS4 systems within their jurisdiction. In addition, the design and construction of the capital improvement projects identified as part of this study can further provide an opportunity for the Town to achieve its goals with respect to the Minimum Control Measures that are part of the MS4 program.
- With the recent completion of the Town of Erie OSP, this OSP effort, and the on-going Town of Firestone OSP, the Tri-Town Region will soon have updated and consistent studies across the communities that can be utilized to solve drainage issues at a regional level. As a result, it is recommended that all communities within the Tri-Town Region work together to fund and implement those projects that benefit the region as a whole.
- As the projects associated with this OSP are implemented, it is recommended that the communities use these projects to supplement current public outreach and education program efforts with respect to stormwater drainage and water quality.
- Water quality treatment facilities should continue to be provided by future development, within proposed regional detention facilities, as well as by other methods, as needed to reach water quality treatment goals.
- Regular and proper maintenance of stormwater facilities are required for them to work as designed. It is recommended that adequate annual budgets be allocated for stormwater operation and maintenance efforts throughout the communities.
- This planning effort is meant to provide a flexible living document that is intended to guide the decision-making process with respect to future development and the management of stormwater within the studied areas. As the community planning areas buildout and drainage improvements are implemented, revisions and modifications to analyses and recommended plans identified in this report may be necessary. However, these future revisions should not change the underlying goals of this document to reduce flood risk to the communities and to provide more resilient stormwater facilities.

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Appendix A. General Project Correspondence

FREDERICK-DACONO OUTFALL SYSTEM PLAN

KICKOFF MEETING

AGENDA
September 14, 2020

1. **Introductions with Roles and Responsibilities**

   Meeting attendees were:
   Town of Frederick – Kevin Ash, Sarah Watson, and Amanda DeBord (Angela Wilson was unable to attend)
   City of Dacono – Gary Odehnal, Jon Rabas and Jordan Eichem
   Anderson Consulting Engineers – Brian Smith and Greg Koch
   ICON Engineering – Jackie Michaelson and Craig Jacobsen

   Project roles were discussed and are summarized in the attached project contact list. Primary points of contact for the project are:
   Sarah Watson – Town of Frederick
   Gary Odehnal – City of Dacono
   Brian Smith – ACE Project Team
   Jackie Michaelson – ICON (will primarily coordinate through Brian)

2. **Initial Data Collection**

   a. **Dacono**
   The data collection effort is nearly complete. A map and spreadsheet have been developed to identify the existing detention ponds that will be included in the hydrologic model. Final confirmation of the ponds to be modeled is expected in a few days.

   b. **Frederick**
   ACE is finishing up identifying the ponds to be included in the hydrologic model. A draft map and spreadsheet should be available in the next few days for Sarah to review.

   c. **Other Items**
   It was agreed that Erie's Master Plan model and plan of improvements should be utilized to the extent possible, without revision. If items are identified in Erie's model that should be modified, changes are not to be made until these issues are vetted through Sarah/Kevin and Gary.

3. **Current Drainage Criteria**
   Current drainage criteria are in the process of being summarized. Both Sarah and Gary confirmed that there have not been any recent changes to criteria. A summary memo will be prepared and submitted.

4. **Field Inventory/Survey**
   ACE staff will be in the field later this week to confirm drainage crossing structures, existing drainage facilities ponds, and confirm survey requirements. ICON staff will also be conducting their field inventory soon. We will coordinate all fieldwork with Sarah and Angela (Frederick), and Gary and Jon (Dacono) to inform the community and/or stakeholders, as necessary. If future site visits require entry onto HOA property or private property, these will be coordinated beforehand, with Sarah/Angela and Gary/Jon obtaining right of entry for the work. The roster of field survey needs will be finalized once the initial field inventory is complete.

5. **Baseline Hydrology**
   ACE is currently creating base maps to support baseline hydrologic modeling. This includes confirming major basin boundaries with the 2013 Lidar data. ACE and ICON will use these basin boundaries to ensure no overlap or holes between adjacent basins. ACE is also incorporating parcel boundaries and will eventually need the latest zoning maps from the communities.

6. **Schedule / Critical Deadlines**
   An overall project schedule was provided; in general, the schedule met everyone's expectations. Kevin confirmed that all work needs to be completed by the end of 2021; the schedule will be modified to show a final report date of December 1st to allow time for project close-out. Progress meetings will be added to the schedule; these will be not more often than monthly until both existing and future hydrologic modeling are complete. These meetings will be more frequent as alternatives are formulated and the plan is finalized. Ad hoc coordination will occur on an as-needed basis throughout the project.

   Kevin would like to get in front of the Town Board perhaps in about the mid-April time frame and/or perhaps once alternatives have been formulated. Kevin would like to identify potential dates to meet with the Board in the near future, as the Board's agenda can fill up well in advance of the meetings. The Frederick Town Board hold regular meetings twice a month and work sessions twice a month. The Dacono City Council holds to regular meetings per month; work sessions could be scheduled if needed, but Jon thought presentations to Council could occur during regular meetings.

7. **Invoicing**
   Invoices are to be sent via email (pdf format) to Sarah, with both Kevin and Gary copied. Invoices will be broken down by task. Each invoice total will be separated into portions for Frederick and Dacono. The cost to date and remaining budget for Frederick and Dacono will be identified. A summary of activities for the billing period will be provided in the invoice cover letter; this letter will also be provided in Word format.

FREDERICK-DACONO OUTFALL SYSTEM PLAN

CITY OF DACONO MEETING MINUTES

April 22, 2021

Topic	Notes	To-do
Meeting Start	<u>Meeting Attendees</u> City of Dacono: Gary Odehnal Anderson Consulting Engineers: Brian Smith and Ethan Kondo ICON Engineering: Jackie Michaelson Meeting Start Time: 8:30 AM Meeting End Time: 10:30 PM <u>Meeting Agenda</u> 1.0 General Notes 2.0 Little Dry Creek Basin 2.1 General Notes 2.2 Summit Blvd. and York St. 2.3 Colorado Blvd. 2.4 County Rd. 19 and Hwy 52 3.0 Tri-Town Basin 3.1 General Notes 4.0 Godding Hollow Basin 4.1 General Notes 4.2 York St. and Hwy 52 4.3 Grandview Blvd. and York St. 4.4 Speedway Blvd. Meeting minutes created by Ethan Kondo on 4/22/2021.	
1.0 General Notes	City of Dacono wants the 10-year discharge to pass through the crossings but will allow 100-year discharge to overtop. They want less than 6-inches of overtopping for the 100-year event. City of Dacono would like to focus on culvert capacities over detention ponds, especially in Little Dry Creek and Tri-Town basins. ACE detention pond maps do not have a developer's level of detail and are not a definitive showing of a pond overtopping. Gary Odehnal will meet with City of Dacono staff and update them next week (week of 4/26/2021). Gary would prefer the flow data and crossing maps.	ACE and ICON will give more detailed information on the overtopping depth in the 100-year event. ACE will check if they received preliminary designs and models from City of Dacono.
		ACE and ICON will provide the necessary data.
2.1 Little Dry Creek General Notes **2.1 Little Dry Creek General Notes**	Existing condition discharge is like the future condition discharge because of the subbasin detention ponds. LDC basin is underdeveloped due to no sewer service. A sewer main will be developed in about 1 year. Most culverts do not pass the 10-year discharge. City of Dacono will make developers model how their development impacts Little Dry Creek. City of Dacono will make estate lots match existing flow even if no conceptual ponds were modeled. No regional detention ponds in basin.	ICON will ensure there are conceptual ponds on known future developments. ICON will check how the Erie plan meets their the LDC model.
2.2 Summit Blvd. and York St.	Detention pond outflows parallel to Summit Blvd. on the north side. There is about 2288 cfs at the location, which falls between the 10- and 50-year events. Existing crossing is (3) 60" CMPs. The capacity of the culverts is about 670 cfs.	ICON will update their model to fit existing conditions.
2.3 Colorado Blvd.	Some of this crossing has been preliminarily designed by the city. The crossing has about 3500 cfs discharge. The city thinks that there are (4) 48" CMPS at the crossing. Current preliminary designs are (3) 3'x10' concrete boxes.	ACE and ICON will check surveying data to confirm size.
2.4 County Rd. 19 and HWY 52	There is a 72" CMP existing for the crossing, which passes between a 10- and 5-year event.	ICON will increase the size of the crossing for proposed conditions. ICON will analyze the bridge crossing capacity.
3.1 Tri-Town General Notes	No existing detention ponds are missing. Future developers will develop 100-2. Ridgeway Blvd./Hwy 52 subbasin is not developed, so it can detain 100-2.	ACE will provide a zoomed-in picture of the crossing map.

Topic	Notes	To-do
	Glenn Creighton Dr. crossing overtops, but the city owns a piece of the land and can decrease flows with a detention pond.	
4.1 Godding Hollow General Notes	Erie OSP proposed condition model shows that there is a large increase in flows in some areas coming into Dacono. It is assumed that these flows will be brought back to existing condition, but it is not modeled. Proposed condition cannot happen until confirmation of Erie's plans. Crossing 6 (WCR 12) is a problem, and the city confirms this.	ACE will send the Erie OSP exhibit to the city of Dacono. City of Dacono will confirm what Erie's plans are.
4.2 York St. and Hwy 52.	This crossing is passing the discharge just above the 10-year event. The detention pond at the location could be increased if needed. Further investigate the area to look at possible pond locations. The Sullivan Ditch (owned by Boulder) will not move from its current location.	
4.3 Grandview Blvd. and York St.	Crossing is undersized. The city thinks that it is an 18" CMP at the largest diameter. The current plan is to have flows go west across York St. and then flow north across Grandview Blvd. in a box culvert. Current estimate/plan from the city is 150 cfs going west. There are two plans for a potential detention pond. 1) On northwest corner of the intersection. This will not decrease any flow going into the crossings. 2) Southeast corner of the intersection. The land is currently owned by St. Vrain Block Company. This option reduces the flow going into the crossing. If it does not reduce the flows significantly, option 1 is better.	ACE will analyze both detention pond scenarios and propose the best result.
4.4 Speedway Blvd.	The current crossing is a small pipe that flows north into the detention pond. When the pond overtops, water flows into the existing tributary. Sweetgrass development is responsible for the Speedway Blvd. crossing updates.	

FREDERICK-DACONO OUTFALL SYSTEM PLAN

TOWN OF FREDERICK MEETING MINUTES

April 27, 2021

Topic	Notes	To-do
Meeting Start	Meeting Attendees Town of Frederick: Kevin Ash and Sarah Watson Anderson Consulting Engineers: Brian Smith and Ethan Kondo ICON Engineering: Jackie Michaelson and Jeremy Deischer Meeting Start Time: 9:00 AM Meeting End Time: 11:10 PM Next Meeting: Monday, May 3rd at 10:00 AM. Meeting Agenda 1.0 General Notes 2.0 Boulder Creek Basin 3.0 Little Dry Creek Basin 4.0 Sump basin 5.0 Tri-Town Basin 6.0 Godding Hollow Basin Meeting minutes created by Ethan Kondo on 4/27/2021.	
1.0 General Notes	For any road that is CDOT controlled, the crossing criteria should be in line with CDOT specs. Future condition land use for agriculture and large estates will be looked at again to potentially increase percent imperviousness values and include future condition conceptual ponds in these areas. ACE will potentially update the Town of Frederick Board in the month of May or June. Board meetings occur on 1st and 3rd Tuesdays each month at 530 pm. Any info packages need to be submitted by the Thursday before. The info should be at a high level with some highlighted problem areas. Highway 52 may become the focus of the meeting.	Town of Frederick will give ACE and ICON more specific standards that are to be met. ACE/ICON will look at percent imperviousness use for agriculture/large estates. ACE will provide a map package to the town.
2.0 Boulder Creek Basin	Road overtops on the far west side of Boulder Creek and Hwy 52.	
3.0 Little Dry Creek Basin	Planning area extends to Yosemite, which is county road 19.	
3.0 Little Dry Creek Basin	There are no significant crossings in the basin, except for CR 19 and HWY 52, and CR 14. The modeling is more focused on what developers would need. Little change in percent imperviousness values, so there may be no conceptual ponds for some of the subbasins. These areas will have their percent imperviousness values reviewed.	
4.0 Sump Basin	Model was made to fit similar information as the previous Master Plan Study. Hidden Creek development ends @ Firestone/Frederick. No future crossings are predicted for Firestone.	ACE will give Town of Frederick and Firestone the flow data.
5.0 Tri-Town Basin	Overall, Town of Frederick likes the detention pond map. Countryside pond (#644) is an identified problem with the city. Aspen Drive pond (#647) is not designed as a 100-year pond. Village East Pond B (#649) or Coal Ridge Pond B (#648) is an identified problem with the city. The Town of Frederick thinks that HWY 52 responsibility is most likely split between CDOT and developers. Area around crossing 2 (WCR 20) is a known problem, and the town wanted the info from this master plan before confirming their plans. Crossing 14 (Colorado Blvd) is a known problem, but more towards the northern intersection. This fits the topological data that ACE found for the area. Firestone manages crossing 20 (McClure Ave Storm Sewer). Crossing 13 (northmost WCR 13) is Firestone's responsibility. Crossing 15 (WCR 13, north of Tipple Pkwy) has some complaints about the drainage and overtopping. Residential area north of crossing 15 and 21 has some drainage issues.	ACE will provide some information about the ponds in their master plan report. ACE will include crossings 2 and 14 in their proposed improvement plan. ACE will look at the future 100-year condition for crossings 24 and 23 (Ridgeway Blvd. area). ACE will look at crossing 20 as a potential improvement. ACE will investigate the drainage problems at crossing 15 and find potential solutions.

Topic	Notes	To-do
5.0 Tri-Town Basin		ACE will acknowledge the residential area drainage problem but not necessarily address it in the master plan.
6.0 Godding Hollow Basin	Pond 641 (WCR 18 Regional Pond) is a CDOT pond and not much is known about it. Crossing 1 (Bella Rosa Pkwy) was blown out during the 2013 flood. The Tipple Pkwy and Godding Hollow Pkwy crossings were designed to an unknown capacity. It currently has good storm capacity, but it is a major road. The town agrees with Gary/City of Dacono with respect to talking to Erie about their future flows. Crossing 12 (Hwy 52) is very undersized. The land east of crossing 9 (E I-25 Frontage Road) is planned as commercial development north and south of the ditch. Area near crossing 11 (W I-25 Frontage Road) is a planned commercial development.	ACE will look at Crossing 1 as a potential improvement. Town of Frederick will reach out to Civil Resources about the design. Frederick will give ACE info about the commercial development near crossing 9. ACE will still investigate a pond at the location.

FREDERICK-DACONO OUTFALL SYSTEM PLAN

TOWN OF FREDERICK MEETING MINUTES

May 3, 2021

Topic	Notes	To-do
Meeting Start	<u>Meeting Attendees</u> Town of Frederick: Kevin Ash and Sarah Watson Anderson Consulting Engineers: Brian Smith and Ethan Kondo Meeting Start Time: 10:00 AM Meeting End Time: 11:30 PM <u>Meeting Agenda</u> 1.0 General Notes 2.0 Tri-Town Basin 3.0 Godding Hollow Basin 4.0 Idaho Creek Basin Meeting minutes created by Ethan Kondo on 5/3/2021.	
1.0 General Notes	<u>Future Condition Agriculture/Estate Lots</u> - Use 12% Percent Imperviousness values for future condition. - Hwy 52 area in Little Dry Creek basin will most likely not be developed with commercial due to the road curve. - The park and open space areas will likely be developed into playgrounds and ball fields. - These parks are more focused on the western side of Milavec Reservoir. Martin and Martin have started the design for the improvements at the intersection of Colorado Blvd and Tipple Pkwy. This improvement will consist of widening the road and adding another lane. There are some drainage issues on the northwestern, undeveloped side of the intersection. Town of Frederick's current criteria is for no overtopping of arterial streets in a 100-Year flood. This is pretty restrictive. They are open to revisiting this if recommended.	ACE will investigate different drainage criteria and give their recommendation which includes MHFD. ACE will investigate percent imperviousness values on potential development on North side of Bella Rosa Golf Course. Ace will add conceptual ponds on the west side of the park space in case the Floodplain gets developed.
2.0 Tri-Town Basin	<u>Hurts street crossing (north of crossing 15 to 4)</u> - No flooding complaints. There might be some flooding due to poor grading.	ACE will add this crossing to the crossing map.
3.0 Godding Hollow Basin	For the area near Tipple Pkwy and in the fields just SW of Crossing 3, there might be some potential to build a regional detention pond near the floodplain. Gary is planning to talk to Erie about the increased flows. The plan is still to wait for their response. For now, use the existing condition flows for hydrograph inputs.	For the proposed condition model, ACE will look at how the detention ponds in Dacono affects the basin downstream.
4.0 Idaho Creek Basin	ACE will use the Erie Future Conditions for the basin. <u>WCR 20 ½ and Bulrush Blvd</u> - This crossing should be around 600 cfs. - The Hawk Meadows (original report: Hawk Preserve) development is going to start building soon. There are about 24 estate lots. There are not many problems for CR 20 and 7. ACE will still evaluate and give recommendations for this crossing. WCR 7 and 20 ½ crossing is a 5 to 10-year crossing, so there could be improvements there. In the past, there were some improvements on the north part of WCR 7 (just south of Hwy 119). Sarah was unsure if Hwy 119 was overtopped in the 2013 flood. Town of Frederick are unsure if there is any information for the Hwy 52 and WCR 7 crossing.	ACE will update the crossings on the crossing map and investigate the Hwy 52 culverts. ACE will investigate a crossing near WCR 20 ½ and Bulrush Blvd, near the old railroad tracks. ACE will identify if WCR 18 needs improvements.

FREDERICK-DACONO OUTFALL SYSTEM PLAN

CITY OF DACONO MEETING MINUTES

August 9, 2021

Topic	Notes	To-do
Meeting Start	Meeting Attendees City of Dacono: Gary Odehnal Anderson Consulting Engineers: Brian Smith and Ethan Kondo ICON Engineering: Jackie Michaelson, Jeremy Deischer Meeting Start: 2:30 PM Meeting End: 3:36 PM	
1.0 ACE Notes	Speedway Pond Gary thinks that this pond is a good idea. It will most likely be funded by a mix of commercial developers and the city. SE York St. and Grandview Blvd. Gary thinks that this pond does not have enough volume to make a detention pond. However, there is an area upstream of this to potentially make a pond. York St. Tributary This tributary includes the York St. and Grandview Blvd. crossing. Gary thinks this is also a good idea to investigate further. Hwy 52 Pond Gary thinks that the 3.5-foot increase to the road elevation is a not a good idea. He would prefer to keep it below a 2.5-foot increase. Any increase would have to ensure that the slope of the medical center driveway would be within standards. Hwy 52 did overtop at this location during the 2013 flood. The eastern part of the tributary has a restrictor plate on it because of an agreement with the Sullivan Ditch company. The area could be cut out to increase the size of the pond, but it would have to end at the half parcel line.	ACE will investigate the development of the detention ponds.
2. ICON Notes	If Erie does not develop their future condition master plan, then there is a large amount of flow coming into the Little Dry Creek Basin. This makes the crossings large and expensive. The I-25 expansion might include a set of large box culverts. However, CDOT may consider detention ponds to prevent the large culverts.	ICON will investigate different overtopping elevations to reduce the size of the crossings.

FREDERICK-DACONO OUTFALL SYSTEM PLAN

CITY OF DACONO MEETING MINUTES

September 7th, 2021

Topic	Notes	To-do
Meeting Start	<u>Meeting Attendees</u> City of Dacono: Gary Odehnal Anderson Consulting Engineers: Brian Smith and Ethan Kondo ICON Engineering: Jackie Michaelson Meeting Start: 8:30 AM Meeting End: 10:00 AM	
1.0 ACE Notes	<u>Godding Hollow</u> The US York St. Tributary, DS York St. Tributary, and Speedway ponds were approved by Gary to use for future improvements. The US York St. Tributary ponds are stock ponds currently. Gary is okay with the ponds becoming jurisdictional dams. The railroad ditch is an outfall for an irrigation ditch. No pond is pursued here. Gary wants a 12" max depth for overtopping and have the culverts pass at least the 10-year event. Gary would like to know if the Lamp-Rynearson design for York St. and Grandview Blvd. crossing follows the criteria above. Gary thinks that the current Speedway Pond is used for dust mitigation. He wants ACE to assume this pond stays for proposed improvements. Gary would like 100-year protection for the Hwy 52 crossings. <u>Tri-Town</u> Gary confirms the drainage pathways that ACE found during their site visit. ACE will go ahead with future improvements for the Forest Ave and Carbondale St. area. Same for the main Hwy 52 crossings in this basin. The city owns the parcel east of the USPS building. He would like ACE to investigate a pond here to detain flows.	Gary will talk to John about the Glen neighborhood drainage. Gary will talk to John about their plans for public outreach.
2. ICON Notes	Gary would like to go ahead with the assumption of future condition flows with the existing condition Erie OSP flows. He would like ICON to size the future condition with the future condition flows of the Erie OSP but not to go forward with the costs associated with it.	

FREDERICK-DACONO OUTFALL SYSTEM PLAN

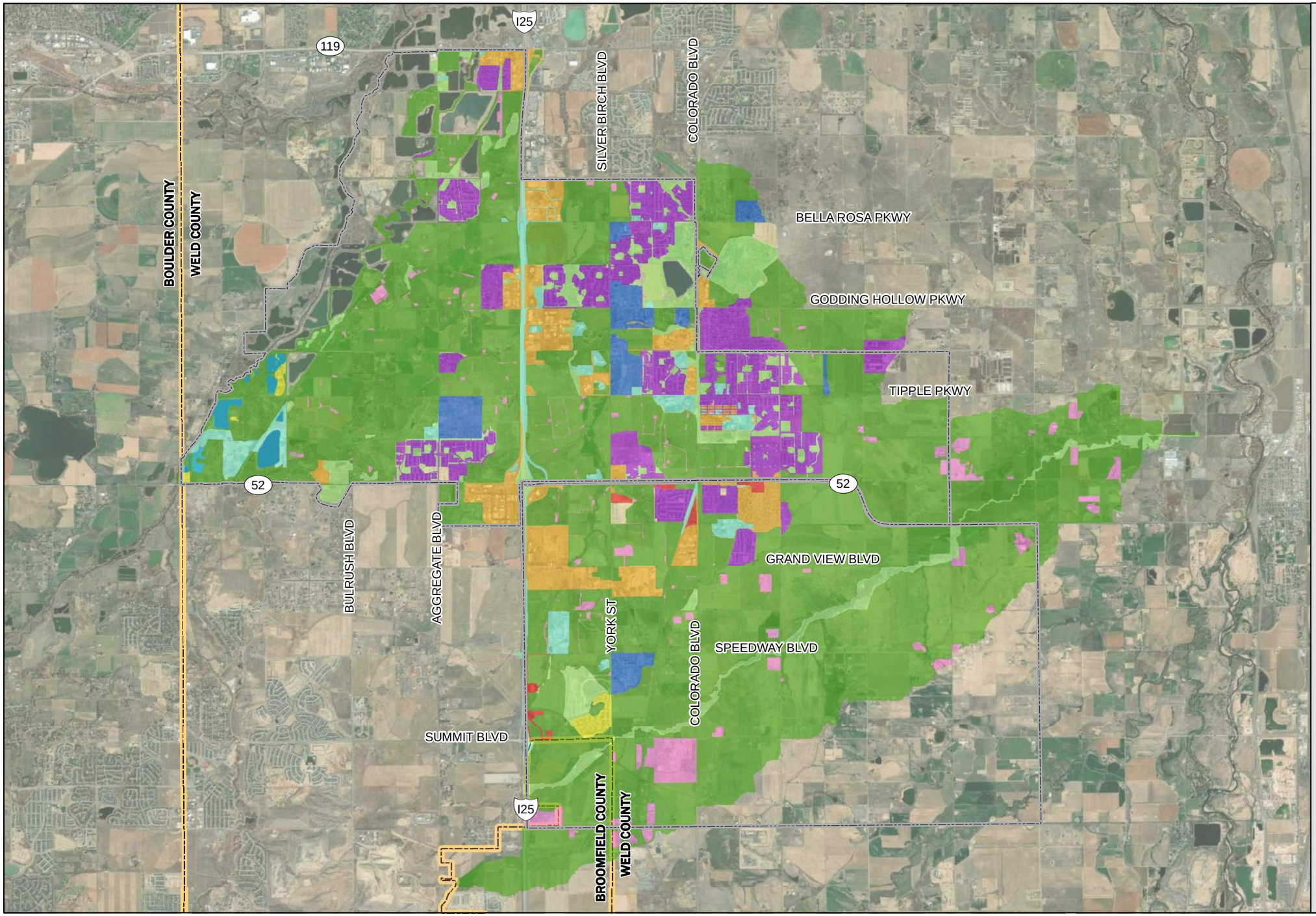
TOWN OF FREDERICK MEETING MINUTES

November 24, 2021, 2021

Topic	Notes	To-do
Meeting Start	Meeting Attendees Town of Frederick: Kevin Ash and Sarah Watson Anderson Consulting Engineers: Brian Smith and Ethan Kondo Meeting Start: 2:00 PM Meeting End: 4:15 PM Meeting at Town of Frederick	
1.0 General Notes	ACE will investigate using development cost for land instead of assessed values.	
2.0 Sump Basin	There is a new development south of the ditch. Frederick may have the developers pave Tipple Pkwy and Wheatland Blvd. Create a roadside channel that connects the Tipple Pkwy crossing and the possible McClure Ave connection. - Include a note "collaborate with Firestone"	
3.0 Tri-Town Basin	Civil Resources did a crossing design for Bella Rosa. CO Blvd seems to be a high priority for the city. Make a pipe alternative to the small Hurt St Improvements The town says to keep TT C-24 (McClure Ave Storm Sewer) in the study, but it is not a priority. May need to add more contingency to TT C-24 (Ridgway Blvd and Leyden Creek Blvd). The intersection is being redesigned due to new development. TT C-27 (5th St Storm Sewer) is designed to the max capacity possible for the area restrictions. Add an alternative to cross CO Blvd at the Hurt St Intersection for the 100 year.	
4.0 Godding Hollow Basin	There is some concern from the ditch company at the Hwy 52 crossing. - Frederick has already pledged $100,000 for ditch improvements.	
4.0 Godding Hollow Basin	Keep Tipple and Godding Hollow Pkwy improvements in the study. The town will talk about designing for the existing 100-year condition for some of the major crossings.	
5.0 Idaho Creek Basin	Confirm that IC C-19 flow matches the developers flow (WCR 16.5 railroad crossing). The town wants to keep 100-year protection for the basin. Design a stormwater channel starting north of WCR 20 (Bella Rosa Pkwy) to WCR 16.5. Avoid the gravel pond for IC C-14/15 (WCR 7/20 intersection). Include costs for IC C-7. Keep Firestone in mind for IC C-2. Check the new floodway for Boulder Creek.	
6.0 Boulder Creek	There seems to be some improvement talks about the actual creek and the WCR 16.5 and SH 119 crossings.	

Appendix B. General Hydrologic, Hydraulic, and Cost Estimate Documentation

Appendix B.1. Land Use and Soil Maps



Legend

- Planning Boundary
- County Boundary

Land Use Type (% Impervious)

- Agriculture/Estate Residential (2-12%)
- Business Park/Light Industrial/Commercial Residential/Corridor (75-80%)
- Commercial (85%)
- Medium Residential (55%)
- Multi Family Residential (75%)
- Multi-Use Zone Type (40-50%)
- Parks/Open Space (10%)
- Pond (90%)
- Public/Semi-Public (50%)
- Rural Residential (20%)
- Single Family Residential (30-45%)

N

0 3,050 6,100 12,200
Feet

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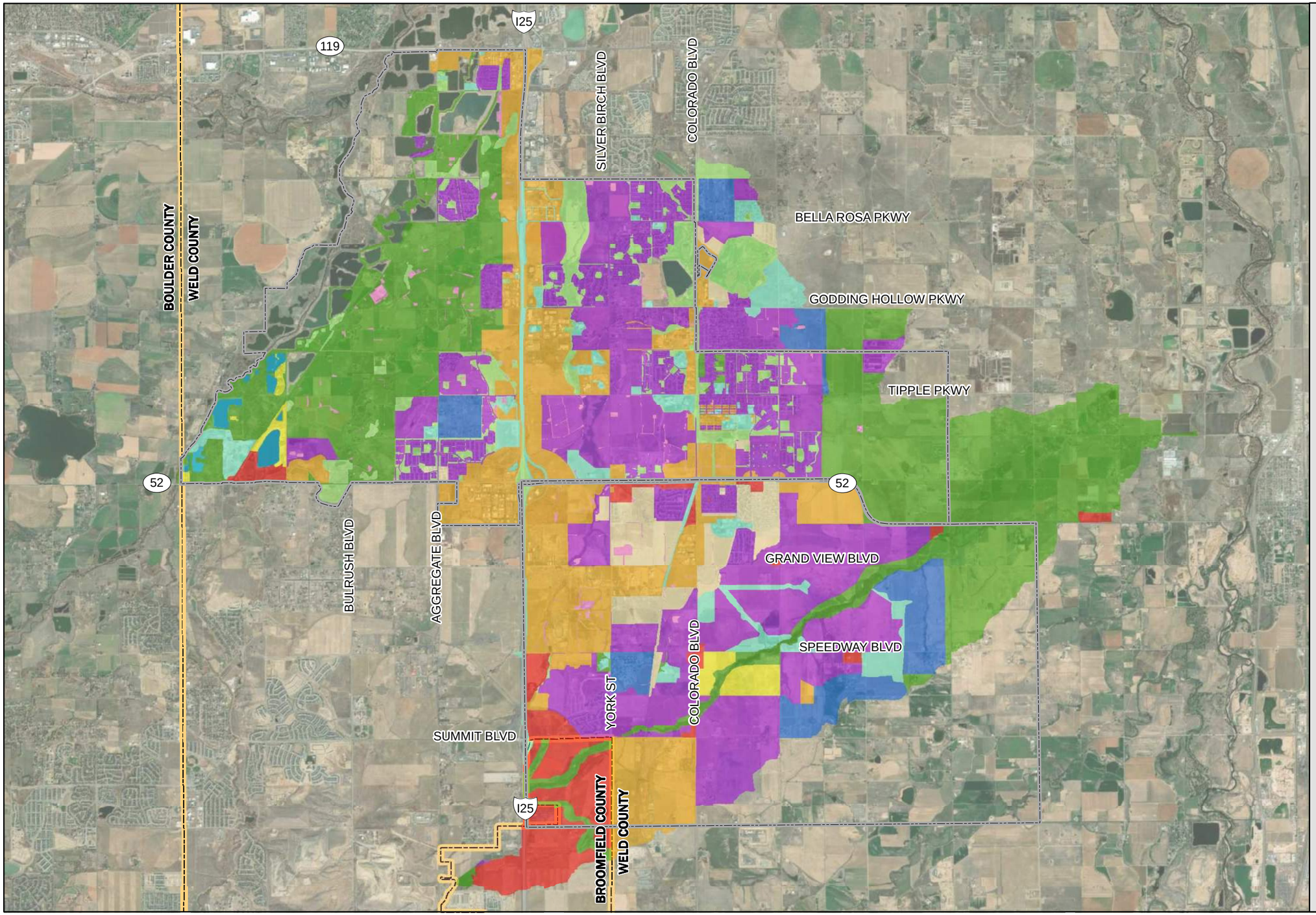
Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

EXSITING LAND USE MAP

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/06/2021	
SHEET: B.1.1	INDEX: B



Legend

- Planning Boundary
- County Boundary

Land Use Type (% Impervious)

- Agriculture/Estate Residential (2-12%)
- Business Park/Light Industrial/Commercial Residential/Corridor (75-80%)
- Commercial (85%)
- Medium Residential (55%)
- Multi Family Residential (75%)
- Multi-Use Zone Type (40-50%)
- Parks/Open Space (10%)
- Pond (90%)
- Public/Semi-Public (50%)
- Rural Residential (20%)
- Single Family Residential (30-45%)

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Feet

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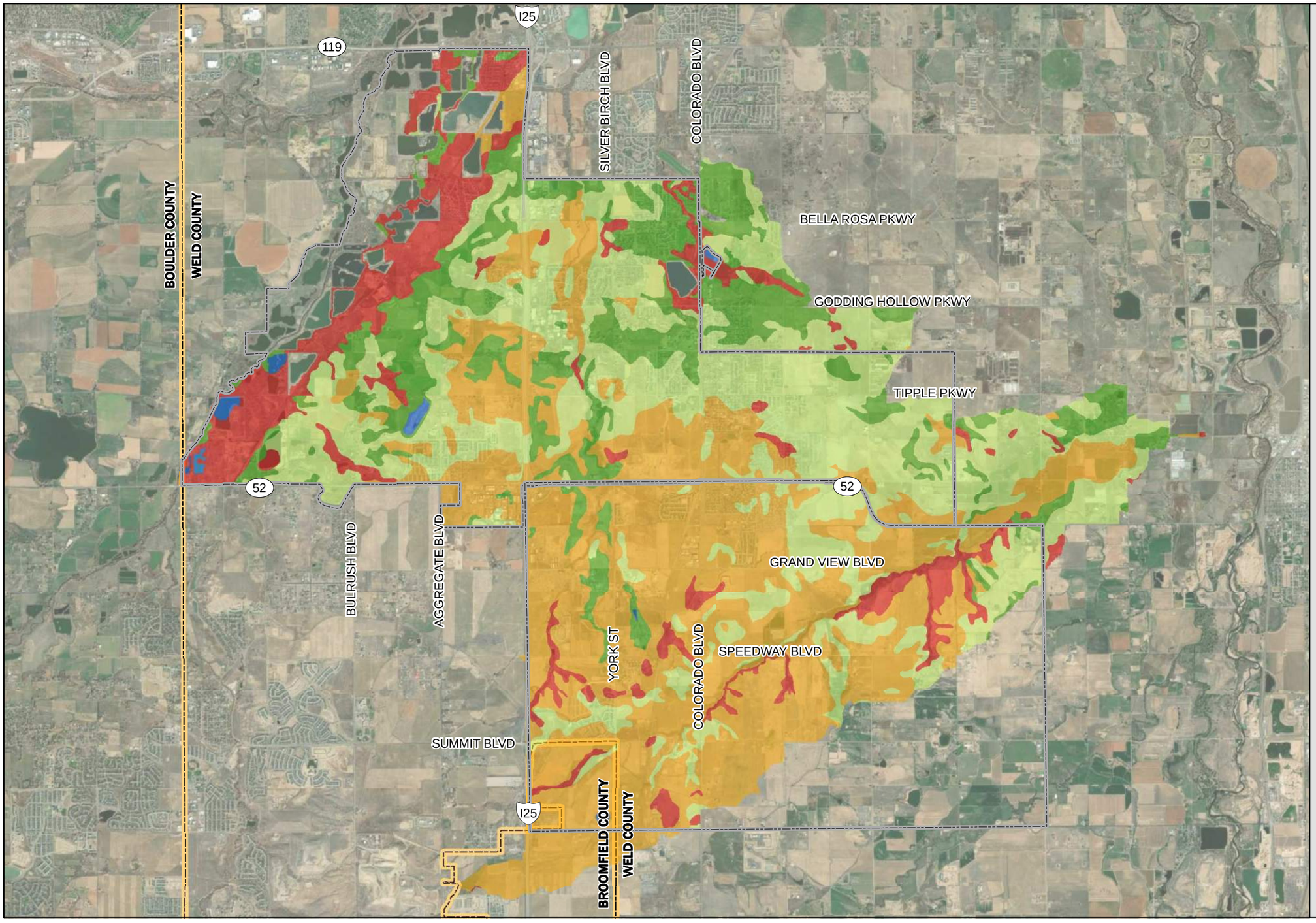
FUTURE LAND USE MAP

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/06/2021	
SHEET: B.1.2	INDEX: B



Legend

- Planning Boundary
- County Boundary

NRCS Hydrologic Soil Group

- A
- B
- C
- D
- WATER

N

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Feet

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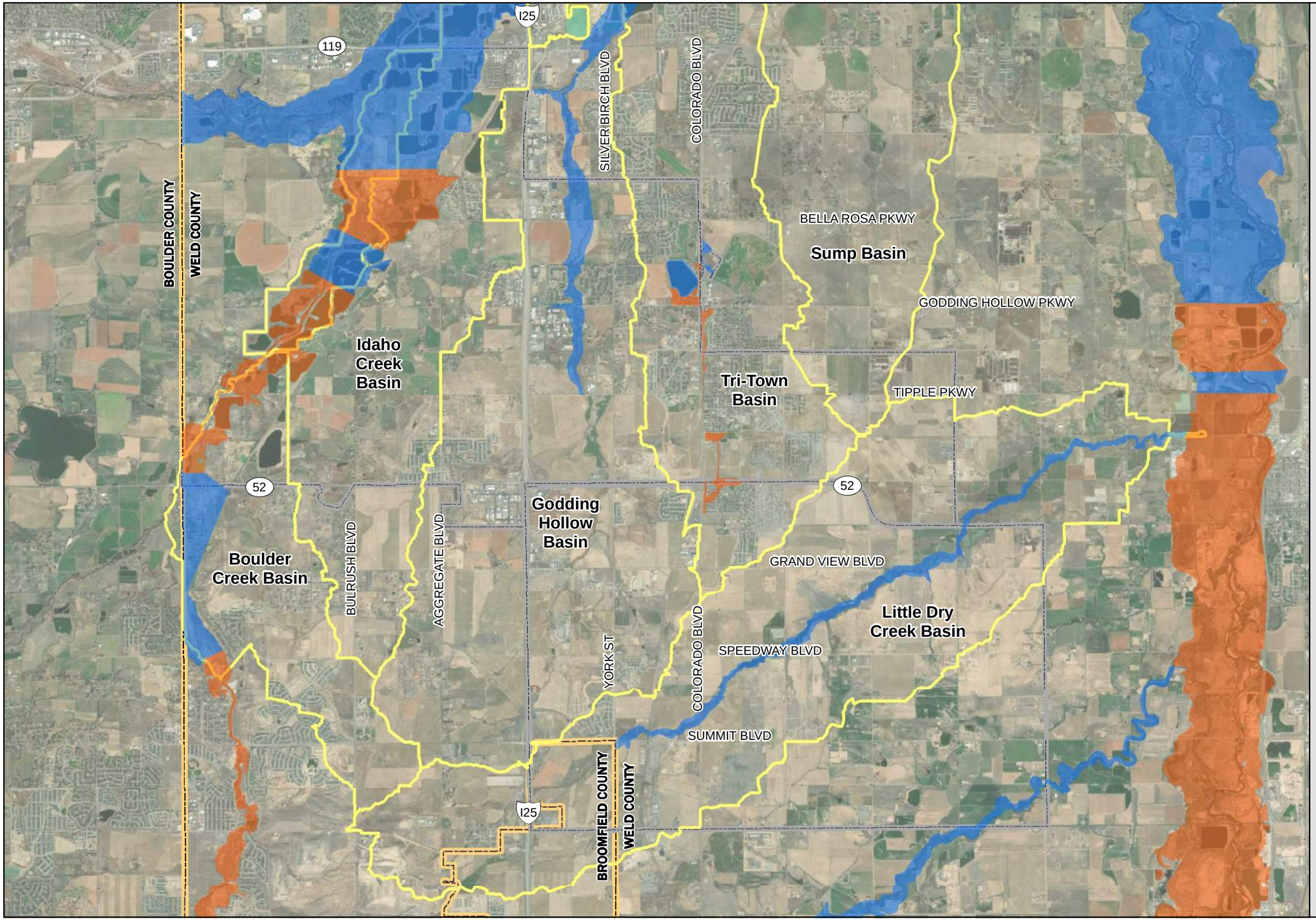
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

HYDROLOGIC SOILS
MAP

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/17/2021	
SHEET: B.1.3	INDEX: B

Appendix B.2. Floodplain Maps



Legend

- Planning Boundary
- County Boundary
- Major Drainage Basins
- Approximate 100 Year Floodplain
- Detailed 100 Year Floodplain

N

0 2,950 5,900 11,800
Feet

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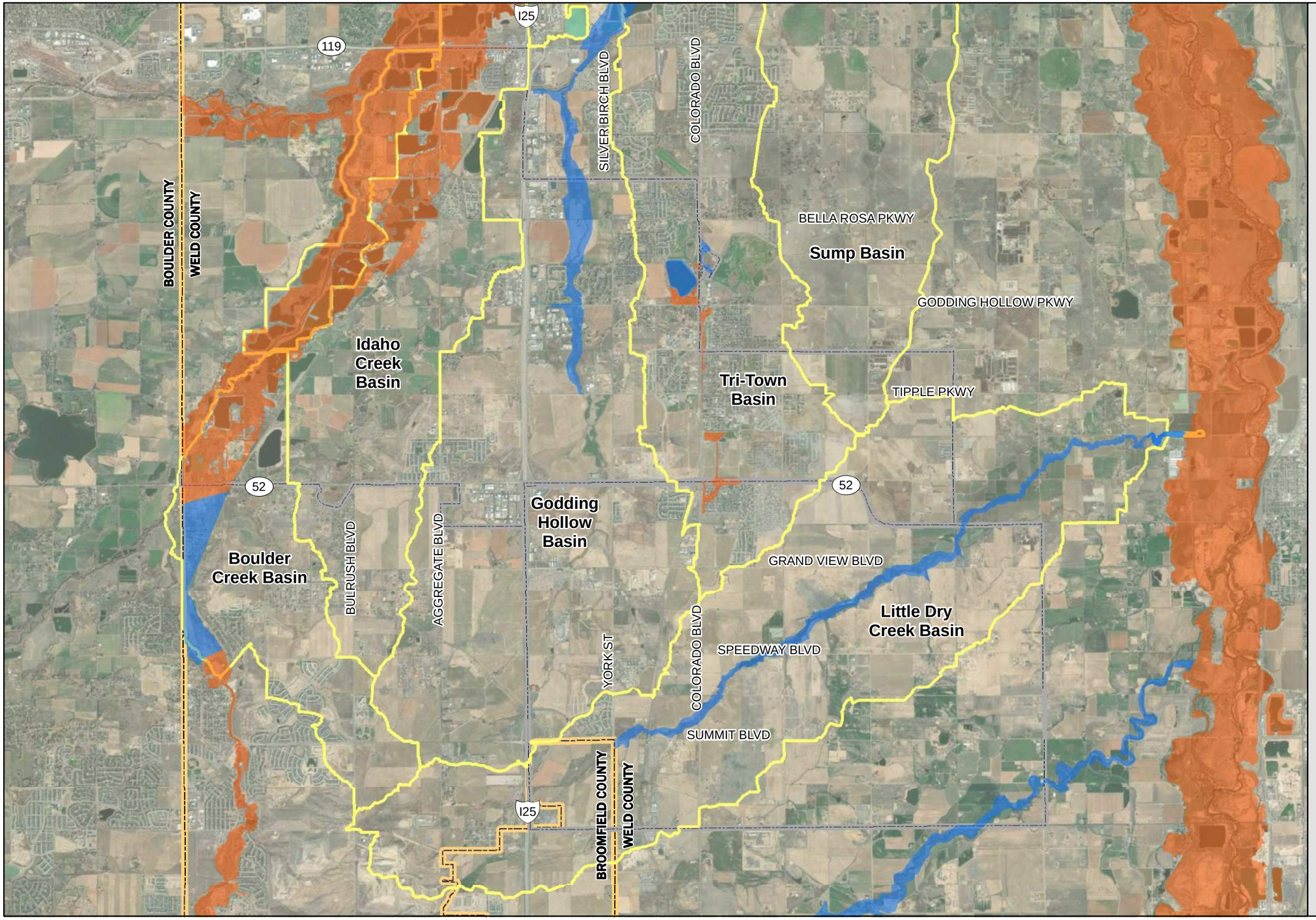
OUTFALL SYSTEM PLAN

EFFECTIVE FEMA
FLOODPLAINS

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/17/2021	
SHEET: B.2.1	INDEX: B



Legend

- Planning Boundary
- County Boundary
- Major Drainage Basins
- Approximate 100 Year Floodplain
- Detailed 100 Year Floodplain

N

0 3,000 6,000 12,000
Feet

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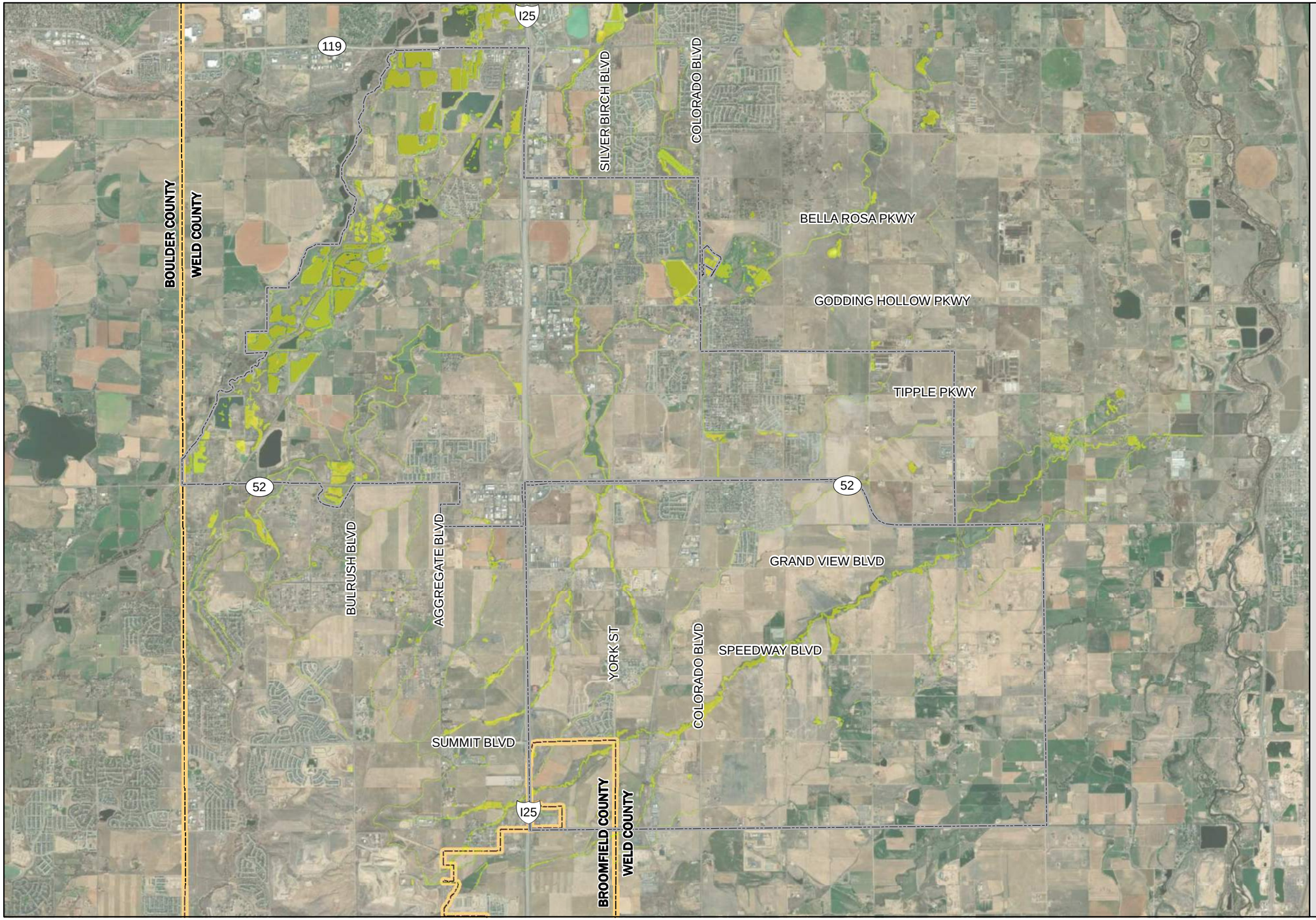
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

PRELIMINARY FEMA
FLOODPLAINS

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/17/2021	
SHEET: B.2.2	INDEX: B

Appendix B.3. Wetland Map



Legend

- Planning Boundary
- County Boundary
- Wetland Areas

N

0 3,000 6,000 12,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

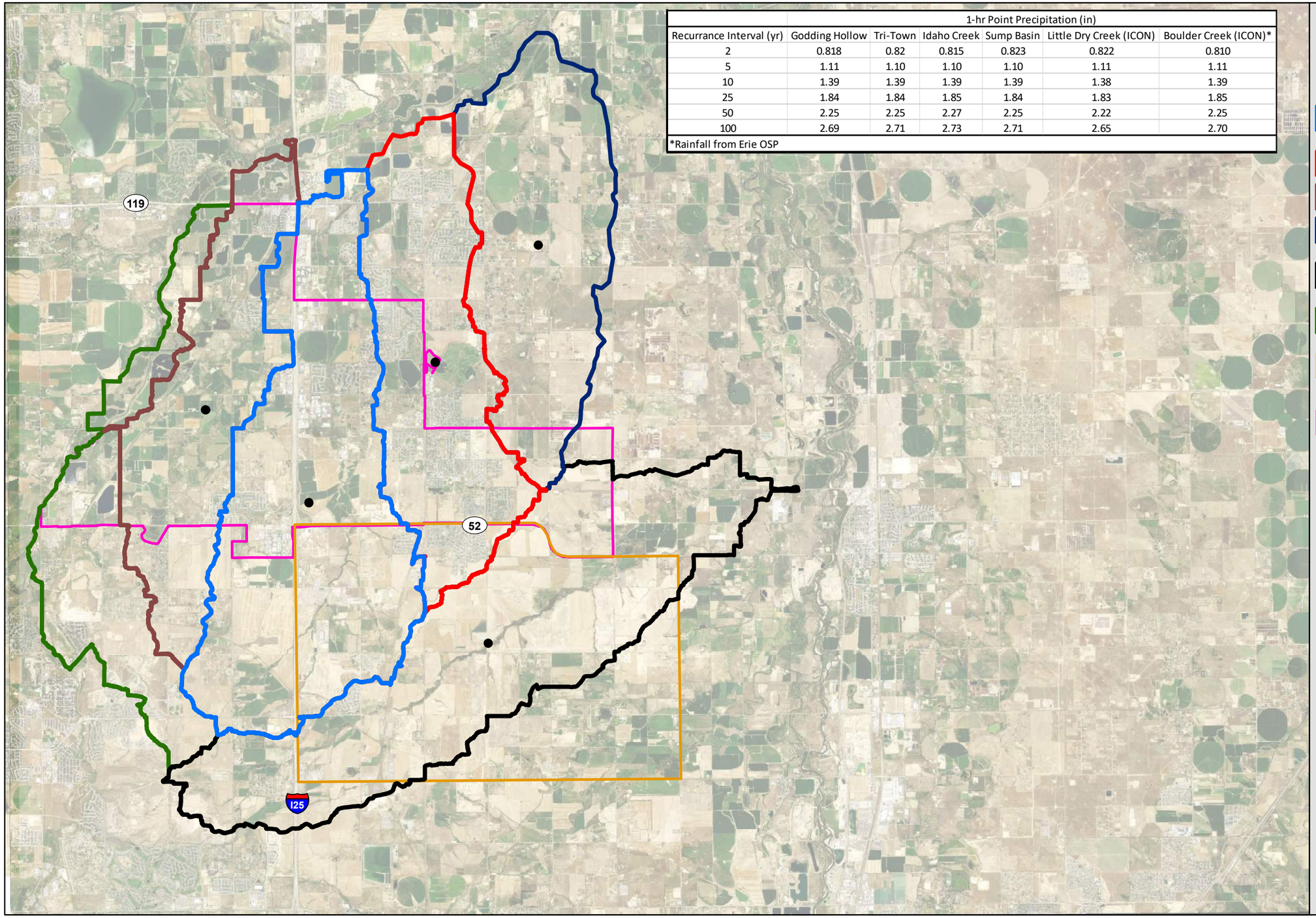
WETLAND/RIPARIAN AREAS

DRAWN BY:	BNA
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 2/23/2022	
SHEET: B.3.1	INDEX: B

Appendix B.4. Rainfall Documentation

	1-hr Point Precipitation (in)					
Recurrance Interval (yr)	Godding Hollow	Tri-Town	Idaho Creek	Sump Basin	Little Dry Creek (ICON)	Boulder Creek (ICON)*
2	0.818	0.82	0.815	0.823	0.822	0.810
5	1.11	1.10	1.10	1.10	1.11	1.11
10	1.39	1.39	1.39	1.39	1.38	1.39
25	1.84	1.84	1.85	1.84	1.83	1.85
50	2.25	2.25	2.27	2.25	2.22	2.25
100	2.69	2.71	2.73	2.71	2.65	2.70

*Rainfall from Erie OSP



Legend

- Centroid
- Godding Hollow Basin
- Tri-Town Basin
- Idaho Creek Basin
- Sump Basin
- Little Dry Creek Basin
- Boulder Creek Basin
- Dacono Planning Boundary
- Frederick Planning Boundary

N

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dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

BASIN CENTROIDS
MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 1/5/2022	
SHEET: B.4.1	INDEX: B

NOAA Atlas 14, Volume 8, Version 2
Location name: Frederick, Colorado, USA*
Latitude: 40.1242°, Longitude: -104.9387°
Elevation: 4927.56 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.229** (0.176-0.297)	**0.278** (0.213-0.361)	**0.374** (0.287-0.488)	**0.469** (0.358-0.615)	**0.623** (0.471-0.877)	**0.759** (0.556-1.08)	**0.911** (0.645-1.32)	**1.08** (0.735-1.61)	**1.33** (0.871-2.04)	**1.54** (0.973-2.36)
10-min	**0.335** (0.258-0.435)	**0.406** (0.313-0.528)	**0.547** (0.420-0.714)	**0.687** (0.524-0.900)	**0.912** (0.689-1.28)	**1.11** (0.814-1.57)	**1.33** (0.945-1.94)	**1.58** (1.08-2.36)	**1.95** (1.27-2.99)	**2.25** (1.43-3.46)
15-min	**0.408** (0.314-0.530)	**0.496** (0.381-0.644)	**0.668** (0.512-0.871)	**0.838** (0.639-1.10)	**1.11** (0.841-1.57)	**1.36** (0.993-1.92)	**1.63** (1.15-2.36)	**1.93** (1.31-2.88)	**2.38** (1.56-3.64)	**2.75** (1.74-4.22)
30-min	**0.554** (0.427-0.720)	**0.671** (0.516-0.872)	**0.901** (0.691-1.18)	**1.13** (0.861-1.48)	**1.50** (1.13-2.11)	**1.83** (1.34-2.59)	**2.19** (1.55-3.18)	**2.60** (1.77-3.88)	**3.20** (2.10-4.91)	**3.70** (2.34-5.69)
60-min	**0.677** (0.521-0.880)	**0.820** (0.631-1.07)	**1.10** (0.846-1.44)	**1.39** (1.06-1.82)	**1.84** (1.40-2.60)	**2.25** (1.65-3.19)	**2.71** (1.92-3.93)	**3.22** (2.19-4.80)	**3.97** (2.60-6.08)	**4.59** (2.91-7.05)
2-hr	**0.800** (0.623-1.03)	**0.970** (0.754-1.25)	**1.31** (1.01-1.68)	**1.64** (1.27-2.13)	**2.19** (1.67-3.05)	**2.67** (1.98-3.74)	**3.22** (2.31-4.61)	**3.83** (2.63-5.64)	**4.73** (3.13-7.15)	**5.48** (3.50-8.29)
3-hr	**0.868** (0.681-1.11)	**1.05** (0.823-1.34)	**1.41** (1.10-1.81)	**1.77** (1.38-2.28)	**2.36** (1.82-3.26)	**2.88** (2.15-4.00)	**3.47** (2.50-4.93)	**4.13** (2.86-6.02)	**5.09** (3.39-7.63)	**5.90** (3.79-8.85)
6-hr	**1.03** (0.817-1.30)	**1.23** (0.977-1.55)	**1.64** (1.29-2.06)	**2.03** (1.60-2.58)	**2.67** (2.08-3.63)	**3.24** (2.45-4.43)	**3.88** (2.83-5.43)	**4.59** (3.21-6.60)	**5.64** (3.79-8.32)	**6.50** (4.23-9.61)
12-hr	**1.27** (1.01-1.57)	**1.50** (1.20-1.86)	**1.94** (1.55-2.41)	**2.37** (1.88-2.96)	**3.05** (2.39-4.06)	**3.64** (2.77-4.89)	**4.30** (3.16-5.92)	**5.03** (3.55-7.11)	**6.10** (4.14-8.84)	**6.98** (4.59-10.2)
24-hr	**1.51** (1.23-1.85)	**1.80** (1.46-2.21)	**2.33** (1.88-2.86)	**2.81** (2.26-3.47)	**3.54** (2.78-4.60)	**4.15** (3.18-5.45)	**4.81** (3.57-6.48)	**5.53** (3.93-7.65)	**6.55** (4.49-9.32)	**7.38** (4.90-10.6)
2-day	**1.72** (1.42-2.08)	**2.10** (1.72-2.54)	**2.74** (2.24-3.33)	**3.30** (2.68-4.01)	**4.09** (3.23-5.19)	**4.73** (3.64-6.07)	**5.39** (4.02-7.09)	**6.08** (4.35-8.23)	**7.02** (4.85-9.78)	**7.77** (5.22-11.0)
3-day	**1.88** (1.55-2.25)	**2.27** (1.87-2.72)	**2.92** (2.40-3.51)	**3.48** (2.85-4.21)	**4.29** (3.41-5.39)	**4.93** (3.83-6.28)	**5.60** (4.20-7.31)	**6.30** (4.54-8.45)	**7.25** (5.03-10.0)	**8.00** (5.41-11.2)
4-day	**2.01** (1.67-2.39)	**2.39** (1.98-2.85)	**3.04** (2.52-3.64)	**3.61** (2.97-4.33)	**4.41** (3.53-5.51)	**5.06** (3.95-6.40)	**5.74** (4.33-7.44)	**6.44** (4.67-8.59)	**7.41** (5.17-10.2)	**8.17** (5.55-11.3)
7-day	**2.31** (1.93-2.71)	**2.70** (2.27-3.19)	**3.38** (2.82-3.99)	**3.96** (3.28-4.70)	**4.78** (3.85-5.89)	**5.44** (4.28-6.79)	**6.12** (4.66-7.83)	**6.83** (5.00-8.98)	**7.80** (5.49-10.6)	**8.56** (5.87-11.7)
10-day	**2.56** (2.16-2.99)	**2.98** (2.51-3.49)	**3.68** (3.09-4.32)	**4.28** (3.58-5.04)	**5.12** (4.15-6.25)	**5.79** (4.59-7.17)	**6.48** (4.96-8.22)	**7.19** (5.29-9.37)	**8.16** (5.77-10.9)	**8.90** (6.14-12.1)
20-day	**3.28** (2.80-3.78)	**3.76** (3.21-4.34)	**4.55** (3.87-5.26)	**5.21** (4.41-6.05)	**6.13** (5.01-7.34)	**6.84** (5.47-8.31)	**7.55** (5.85-9.40)	**8.29** (6.16-10.6)	**9.26** (6.62-12.2)	**10.0** (6.98-13.4)
30-day	**3.85** (3.31-4.40)	**4.40** (3.78-5.03)	**5.29** (4.53-6.07)	**6.02** (5.13-6.94)	**7.03** (5.79-8.33)	**7.80** (6.28-9.37)	**8.56** (6.67-10.5)	**9.33** (6.98-11.8)	**10.3** (7.44-13.5)	**11.1** (7.80-14.7)
45-day	**4.53** (3.93-5.14)	**5.19** (4.50-5.89)	**6.25** (5.39-7.11)	**7.11** (6.10-8.12)	**8.26** (6.84-9.68)	**9.13** (7.39-10.9)	**9.98** (7.81-12.2)	**10.8** (8.13-13.5)	**11.9** (8.61-15.3)	**12.7** (8.97-16.6)
60-day	**5.09** (4.44-5.74)	**5.86** (5.10-6.61)	**7.09** (6.15-8.02)	**8.07** (6.96-9.16)	**9.38** (7.79-10.9)	**10.3** (8.41-12.2)	**11.3** (8.87-13.6)	**12.2** (9.20-15.1)	**13.3** (9.70-17.0)	**14.2** (10.1-18.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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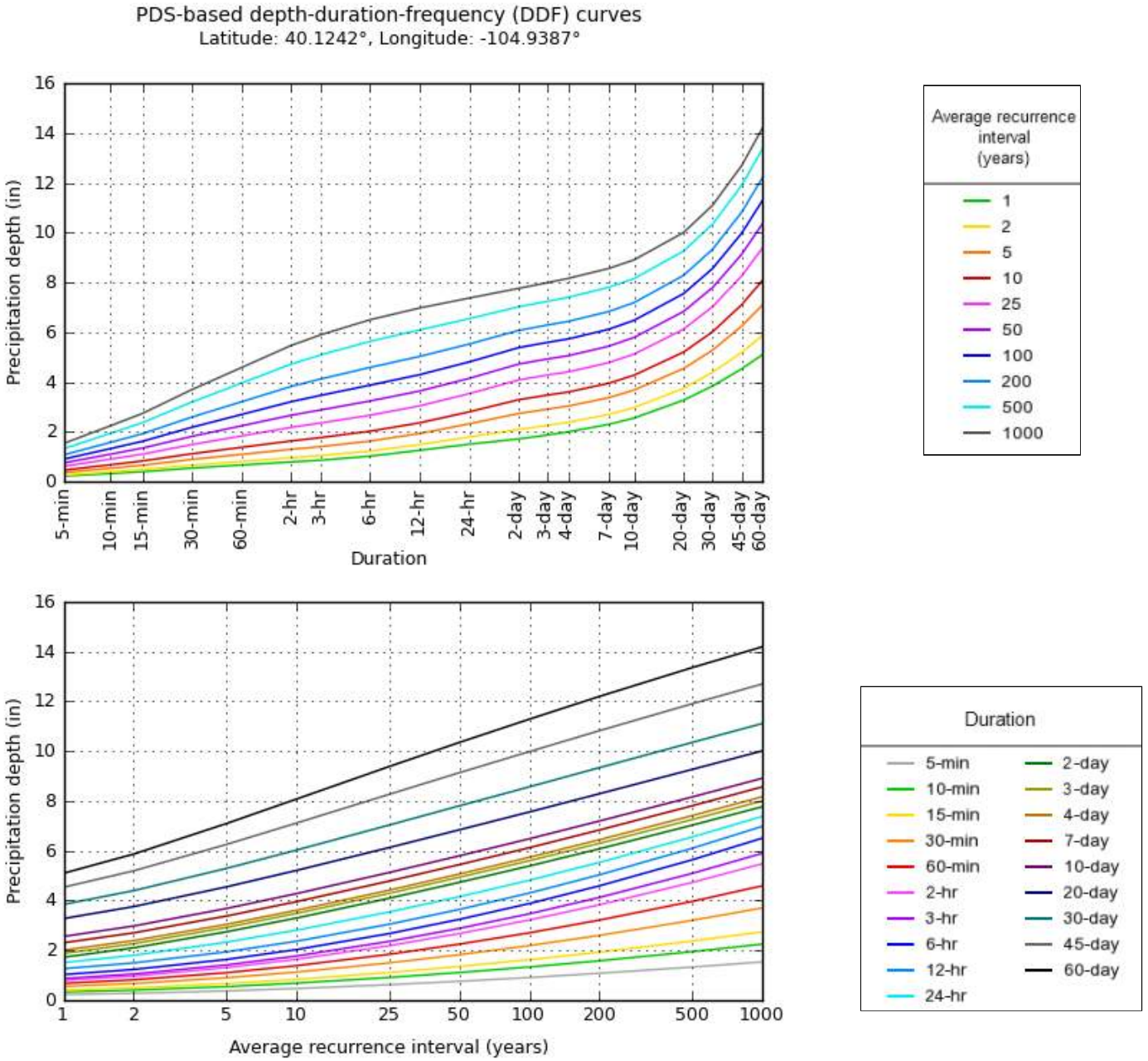
PF graphical



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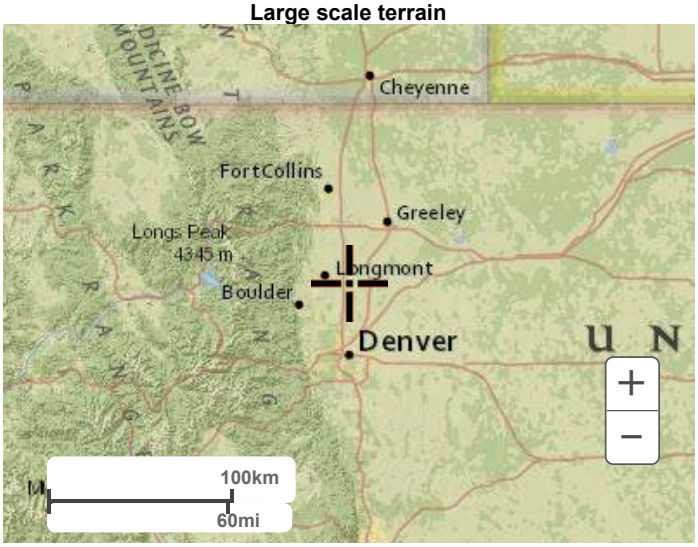
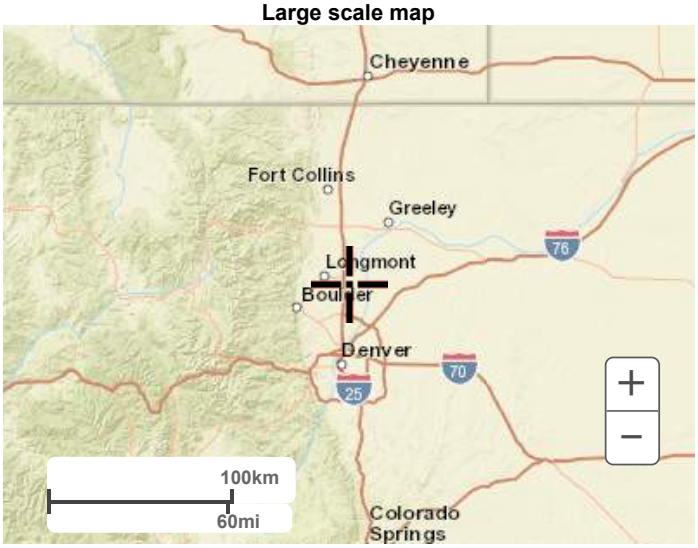
Small scale terrain

Large scale terrain



Large scale map



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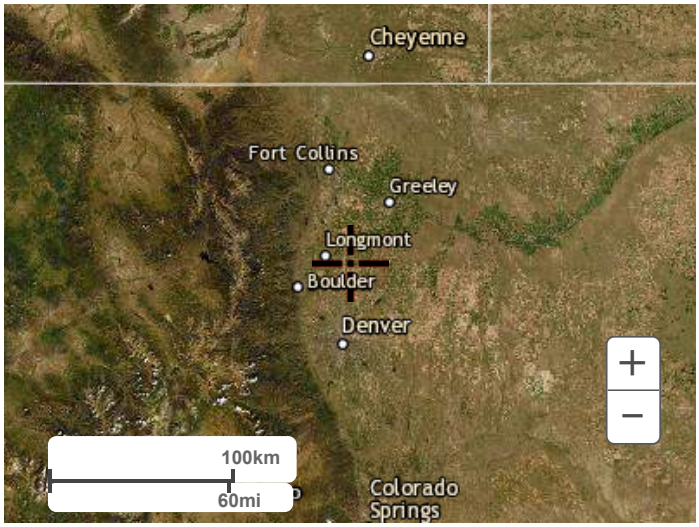

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National Weather Service
National Water Center
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Silver Spring, MD 20910
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NOAA Atlas 14, Volume 8, Version 2
Location name: Frederick, Colorado, USA*
Latitude: 40.0924°, Longitude: -104.9763°
Elevation: 4972.63 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.226** (0.174-0.293)	**0.275** (0.211-0.358)	**0.371** (0.284-0.484)	**0.466** (0.355-0.611)	**0.619** (0.467-0.872)	**0.754** (0.552-1.07)	**0.904** (0.640-1.32)	**1.07** (0.729-1.60)	**1.32** (0.863-2.03)	**1.52** (0.964-2.35)
10-min	**0.331** (0.254-0.430)	**0.403** (0.309-0.524)	**0.543** (0.416-0.709)	**0.682** (0.520-0.895)	**0.906** (0.684-1.28)	**1.10** (0.808-1.57)	**1.32** (0.937-1.93)	**1.57** (1.07-2.35)	**1.93** (1.26-2.97)	**2.23** (1.41-3.44)
15-min	**0.403** (0.310-0.524)	**0.491** (0.377-0.639)	**0.663** (0.508-0.865)	**0.832** (0.634-1.09)	**1.11** (0.834-1.56)	**1.35** (0.986-1.91)	**1.62** (1.14-2.35)	**1.92** (1.30-2.87)	**2.36** (1.54-3.62)	**2.72** (1.72-4.19)
30-min	**0.550** (0.423-0.715)	**0.668** (0.513-0.869)	**0.899** (0.689-1.17)	**1.13** (0.859-1.48)	**1.50** (1.13-2.11)	**1.82** (1.33-2.58)	**2.18** (1.55-3.18)	**2.59** (1.76-3.88)	**3.19** (2.09-4.90)	**3.68** (2.33-5.67)
60-min	**0.671** (0.516-0.873)	**0.818** (0.629-1.06)	**1.11** (0.847-1.44)	**1.39** (1.06-1.82)	**1.84** (1.39-2.60)	**2.25** (1.64-3.19)	**2.69** (1.91-3.92)	**3.20** (2.17-4.78)	**3.93** (2.57-6.04)	**4.54** (2.87-7.00)
2-hr	**0.793** (0.617-1.02)	**0.968** (0.753-1.24)	**1.31** (1.02-1.69)	**1.65** (1.27-2.13)	**2.19** (1.67-3.05)	**2.67** (1.98-3.74)	**3.21** (2.29-4.60)	**3.80** (2.61-5.61)	**4.68** (3.09-7.08)	**5.40** (3.45-8.20)
3-hr	**0.858** (0.673-1.09)	**1.05** (0.821-1.34)	**1.42** (1.11-1.82)	**1.78** (1.38-2.29)	**2.37** (1.82-3.26)	**2.88** (2.15-4.00)	**3.45** (2.48-4.91)	**4.09** (2.83-5.98)	**5.02** (3.34-7.54)	**5.80** (3.73-8.73)
6-hr	**1.02** (0.809-1.28)	**1.23** (0.977-1.55)	**1.65** (1.30-2.08)	**2.05** (1.61-2.59)	**2.68** (2.08-3.64)	**3.25** (2.44-4.43)	**3.87** (2.81-5.41)	**4.55** (3.18-6.55)	**5.56** (3.74-8.22)	**6.39** (4.16-9.48)
12-hr	**1.26** (1.01-1.56)	**1.50** (1.20-1.86)	**1.96** (1.56-2.43)	**2.39** (1.90-2.99)	**3.07** (2.40-4.08)	**3.66** (2.78-4.91)	**4.31** (3.16-5.92)	**5.02** (3.54-7.10)	**6.06** (4.11-8.81)	**6.91** (4.55-10.1)
24-hr	**1.51** (1.23-1.85)	**1.81** (1.47-2.22)	**2.35** (1.90-2.88)	**2.84** (2.28-3.50)	**3.57** (2.81-4.64)	**4.19** (3.20-5.50)	**4.84** (3.59-6.53)	**5.56** (3.95-7.70)	**6.57** (4.49-9.36)	**7.38** (4.91-10.6)
2-day	**1.73** (1.42-2.09)	**2.12** (1.74-2.56)	**2.77** (2.27-3.35)	**3.33** (2.71-4.05)	**4.13** (3.26-5.24)	**4.78** (3.68-6.13)	**5.44** (4.05-7.17)	**6.13** (4.39-8.31)	**7.08** (4.88-9.88)	**7.82** (5.25-11.1)
3-day	**1.89** (1.56-2.26)	**2.28** (1.88-2.73)	**2.95** (2.43-3.54)	**3.52** (2.88-4.24)	**4.33** (3.44-5.44)	**4.98** (3.87-6.34)	**5.65** (4.24-7.38)	**6.35** (4.58-8.54)	**7.31** (5.07-10.1)	**8.05** (5.44-11.3)
4-day	**2.01** (1.67-2.40)	**2.40** (2.00-2.86)	**3.07** (2.54-3.66)	**3.64** (2.99-4.36)	**4.45** (3.56-5.56)	**5.11** (3.98-6.46)	**5.78** (4.36-7.51)	**6.49** (4.70-8.67)	**7.46** (5.20-10.3)	**8.22** (5.58-11.5)
7-day	**2.31** (1.94-2.72)	**2.71** (2.28-3.19)	**3.39** (2.83-4.00)	**3.97** (3.30-4.71)	**4.80** (3.87-5.91)	**5.46** (4.30-6.82)	**6.14** (4.68-7.87)	**6.86** (5.01-9.04)	**7.83** (5.51-10.6)	**8.59** (5.89-11.8)
10-day	**2.57** (2.17-3.00)	**2.99** (2.52-3.49)	**3.69** (3.10-4.32)	**4.28** (3.58-5.04)	**5.13** (4.16-6.26)	**5.80** (4.60-7.18)	**6.49** (4.97-8.24)	**7.20** (5.30-9.41)	**8.17** (5.78-11.0)	**8.93** (6.15-12.2)
20-day	**3.29** (2.82-3.79)	**3.77** (3.22-4.34)	**4.56** (3.88-5.27)	**5.22** (4.42-6.05)	**6.13** (5.03-7.34)	**6.85** (5.48-8.32)	**7.57** (5.86-9.43)	**8.30** (6.17-10.6)	**9.28** (6.64-12.2)	**10.0** (6.99-13.5)
30-day	**3.87** (3.34-4.42)	**4.42** (3.80-5.05)	**5.31** (4.56-6.08)	**6.05** (5.16-6.95)	**7.05** (5.81-8.35)	**7.82** (6.31-9.40)	**8.59** (6.69-10.6)	**9.36** (7.00-11.9)	**10.4** (7.47-13.5)	**11.1** (7.82-14.8)
45-day	**4.56** (3.96-5.16)	**5.22** (4.53-5.92)	**6.28** (5.43-7.13)	**7.15** (6.14-8.15)	**8.30** (6.88-9.72)	**9.17** (7.44-10.9)	**10.0** (7.86-12.2)	**10.9** (8.18-13.6)	**12.0** (8.65-15.4)	**12.8** (9.02-16.8)
60-day	**5.13** (4.48-5.77)	**5.90** (5.15-6.64)	**7.13** (6.20-8.05)	**8.12** (7.02-9.20)	**9.43** (7.85-11.0)	**10.4** (8.47-12.3)	**11.3** (8.93-13.7)	**12.3** (9.27-15.3)	**13.4** (9.76-17.2)	**14.3** (10.1-18.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
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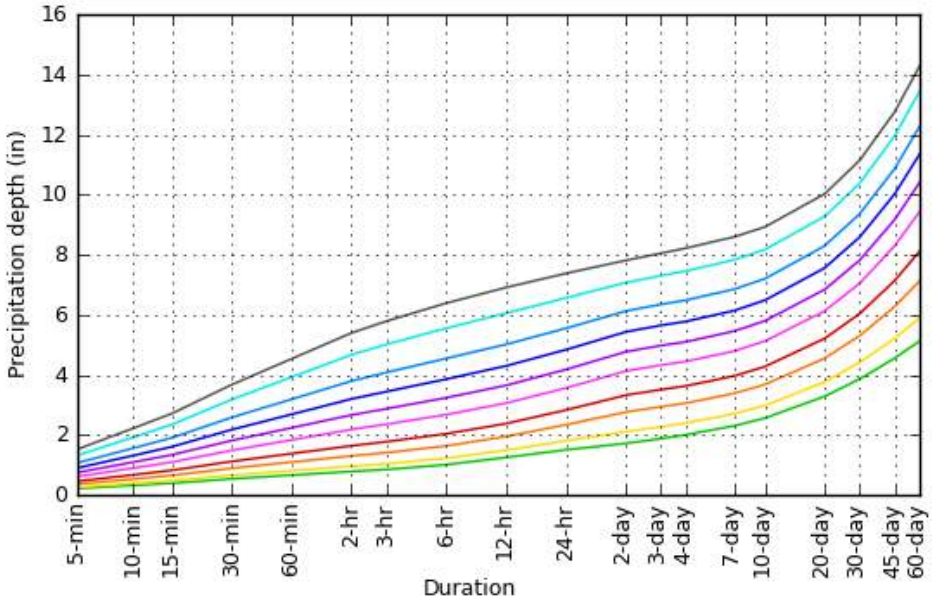

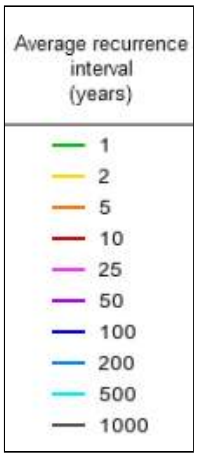

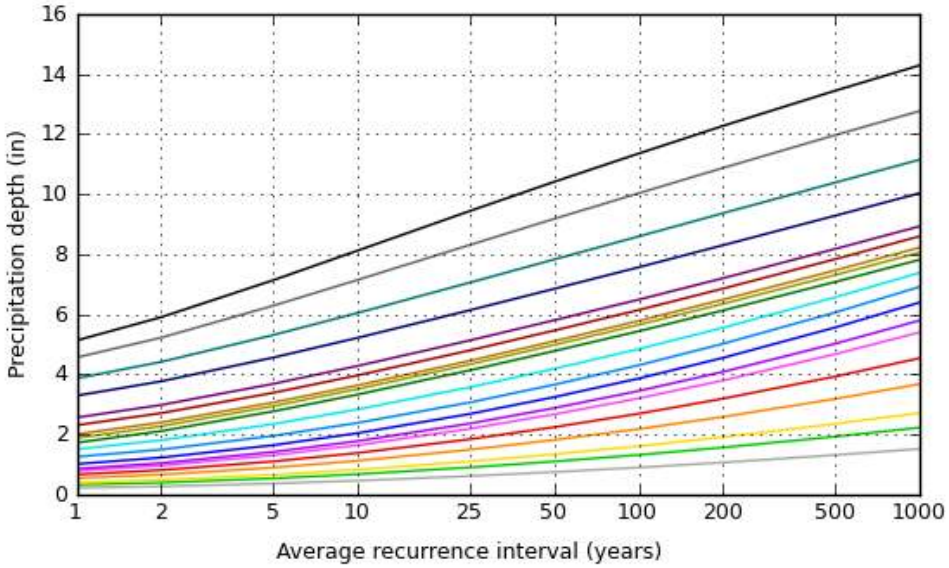

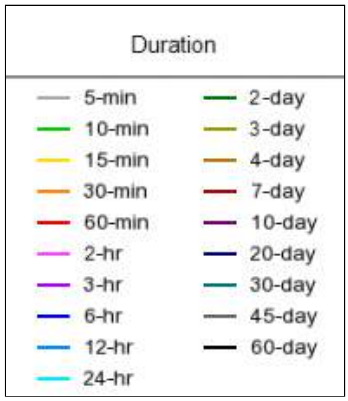

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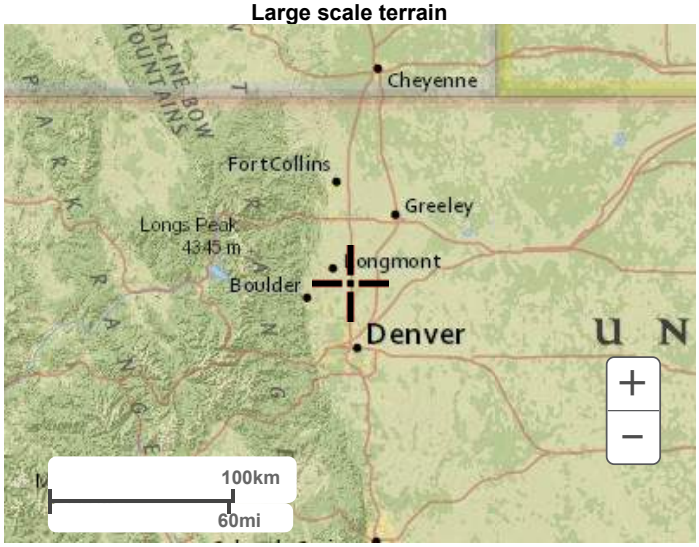

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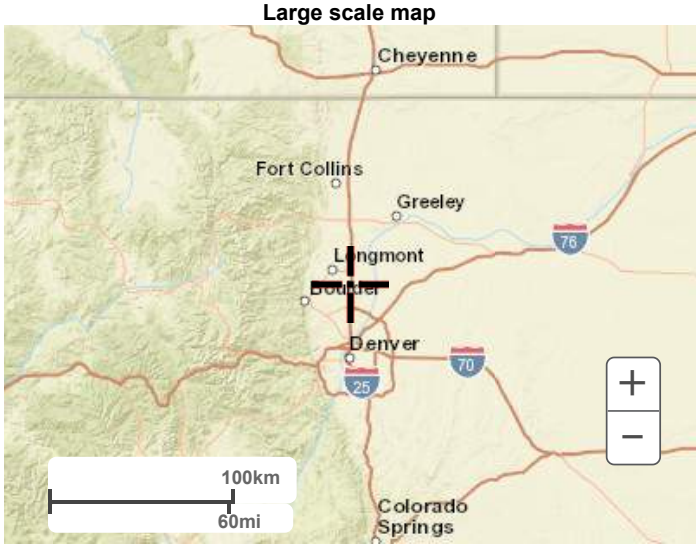

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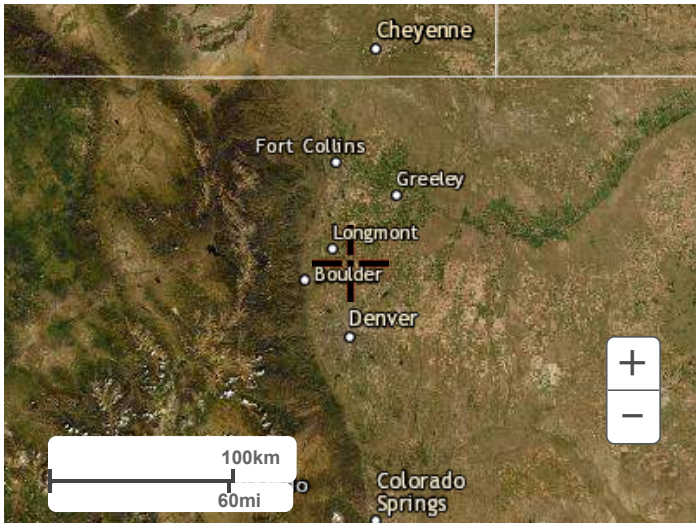

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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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NOAA Atlas 14, Volume 8, Version 2
Location name: Erie, Colorado, USA*
Latitude: 40.1137°, Longitude: -105.0067°
Elevation: 4937 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.225** (0.173-0.293)	**0.274** (0.211-0.357)	**0.370** (0.284-0.484)	**0.466** (0.355-0.612)	**0.622** (0.470-0.879)	**0.760** (0.557-1.08)	**0.915** (0.648-1.34)	**1.09** (0.740-1.63)	**1.34** (0.879-2.07)	**1.55** (0.984-2.41)
10-min	**0.330** (0.254-0.429)	**0.401** (0.308-0.522)	**0.542** (0.416-0.708)	**0.683** (0.520-0.896)	**0.910** (0.688-1.29)	**1.11** (0.816-1.58)	**1.34** (0.948-1.96)	**1.59** (1.08-2.39)	**1.97** (1.29-3.04)	**2.28** (1.44-3.52)
15-min	**0.402** (0.310-0.523)	**0.489** (0.376-0.637)	**0.662** (0.507-0.863)	**0.833** (0.635-1.09)	**1.11** (0.840-1.57)	**1.36** (0.995-1.93)	**1.63** (1.16-2.38)	**1.94** (1.32-2.92)	**2.40** (1.57-3.70)	**2.78** (1.76-4.30)
30-min	**0.547** (0.421-0.712)	**0.664** (0.511-0.864)	**0.896** (0.686-1.17)	**1.13** (0.858-1.48)	**1.50** (1.13-2.12)	**1.83** (1.34-2.61)	**2.21** (1.56-3.22)	**2.62** (1.78-3.94)	**3.24** (2.12-5.00)	**3.75** (2.37-5.80)
60-min	**0.669** (0.515-0.870)	**0.815** (0.626-1.06)	**1.10** (0.845-1.44)	**1.39** (1.06-1.82)	**1.85** (1.40-2.62)	**2.27** (1.66-3.22)	**2.73** (1.93-3.98)	**3.24** (2.21-4.87)	**4.00** (2.62-6.18)	**4.63** (2.93-7.17)
2-hr	**0.791** (0.615-1.01)	**0.965** (0.750-1.24)	**1.31** (1.01-1.69)	**1.65** (1.27-2.14)	**2.20** (1.69-3.07)	**2.70** (2.00-3.78)	**3.25** (2.32-4.67)	**3.86** (2.66-5.72)	**4.76** (3.15-7.25)	**5.52** (3.53-8.41)
3-hr	**0.858** (0.673-1.09)	**1.05** (0.821-1.33)	**1.42** (1.11-1.82)	**1.79** (1.39-2.30)	**2.39** (1.84-3.30)	**2.91** (2.17-4.05)	**3.50** (2.52-5.00)	**4.16** (2.88-6.11)	**5.13** (3.41-7.73)	**5.93** (3.82-8.97)
6-hr	**1.02** (0.810-1.28)	**1.24** (0.980-1.55)	**1.66** (1.31-2.08)	**2.06** (1.62-2.61)	**2.72** (2.11-3.69)	**3.29** (2.48-4.51)	**3.93** (2.86-5.52)	**4.65** (3.25-6.71)	**5.69** (3.83-8.44)	**6.56** (4.26-9.75)
12-hr	**1.26** (1.01-1.56)	**1.51** (1.21-1.86)	**1.97** (1.57-2.45)	**2.41** (1.92-3.01)	**3.11** (2.44-4.14)	**3.72** (2.83-4.99)	**4.39** (3.22-6.04)	**5.12** (3.62-7.26)	**6.19** (4.20-9.03)	**7.07** (4.65-10.4)
24-hr	**1.51** (1.23-1.84)	**1.82** (1.48-2.22)	**2.36** (1.91-2.90)	**2.86** (2.30-3.52)	**3.61** (2.84-4.69)	**4.24** (3.25-5.57)	**4.92** (3.65-6.63)	**5.65** (4.02-7.84)	**6.69** (4.58-9.56)	**7.53** (5.00-10.9)
2-day	**1.73** (1.42-2.08)	**2.12** (1.74-2.55)	**2.78** (2.28-3.35)	**3.35** (2.73-4.06)	**4.17** (3.29-5.27)	**4.82** (3.72-6.19)	**5.50** (4.11-7.25)	**6.21** (4.45-8.43)	**7.19** (4.96-10.1)	**7.95** (5.34-11.3)
3-day	**1.88** (1.56-2.25)	**2.28** (1.89-2.72)	**2.95** (2.44-3.54)	**3.53** (2.90-4.25)	**4.36** (3.47-5.47)	**5.03** (3.91-6.39)	**5.71** (4.29-7.46)	**6.43** (4.64-8.65)	**7.42** (5.15-10.3)	**8.19** (5.53-11.5)
4-day	**2.01** (1.68-2.38)	**2.41** (2.00-2.85)	**3.08** (2.55-3.66)	**3.66** (3.02-4.37)	**4.49** (3.59-5.59)	**5.16** (4.03-6.51)	**5.85** (4.42-7.59)	**6.58** (4.77-8.79)	**7.57** (5.28-10.4)	**8.36** (5.68-11.7)
7-day	**2.31** (1.95-2.71)	**2.72** (2.29-3.19)	**3.41** (2.85-4.00)	**4.00** (3.33-4.72)	**4.84** (3.91-5.95)	**5.52** (4.36-6.88)	**6.22** (4.74-7.96)	**6.95** (5.09-9.16)	**7.95** (5.60-10.8)	**8.73** (5.98-12.0)
10-day	**2.57** (2.18-2.98)	**2.99** (2.53-3.48)	**3.71** (3.13-4.32)	**4.32** (3.62-5.06)	**5.18** (4.21-6.30)	**5.87** (4.65-7.24)	**6.57** (5.04-8.32)	**7.30** (5.37-9.52)	**8.29** (5.87-11.1)	**9.06** (6.24-12.4)
20-day	**3.30** (2.83-3.77)	**3.78** (3.24-4.33)	**4.58** (3.92-5.26)	**5.25** (4.46-6.06)	**6.18** (5.08-7.37)	**6.91** (5.54-8.37)	**7.64** (5.92-9.50)	**8.39** (6.24-10.7)	**9.38** (6.71-12.4)	**10.1** (7.07-13.6)
30-day	**3.87** (3.35-4.39)	**4.43** (3.83-5.03)	**5.33** (4.59-6.07)	**6.08** (5.21-6.95)	**7.10** (5.87-8.37)	**7.88** (6.37-9.44)	**8.66** (6.76-10.6)	**9.45** (7.07-12.0)	**10.5** (7.54-13.7)	**11.3** (7.89-15.0)
45-day	**4.57** (3.99-5.14)	**5.24** (4.57-5.90)	**6.32** (5.48-7.12)	**7.19** (6.20-8.14)	**8.36** (6.95-9.73)	**9.24** (7.51-10.9)	**10.1** (7.93-12.3)	**11.0** (8.25-13.7)	**12.1** (8.73-15.5)	**12.9** (9.09-16.9)
60-day	**5.15** (4.51-5.75)	**5.93** (5.19-6.63)	**7.18** (6.26-8.04)	**8.17** (7.09-9.20)	**9.50** (7.93-11.0)	**10.5** (8.56-12.3)	**11.4** (9.02-13.8)	**12.4** (9.34-15.3)	**13.5** (9.84-17.3)	**14.4** (10.2-18.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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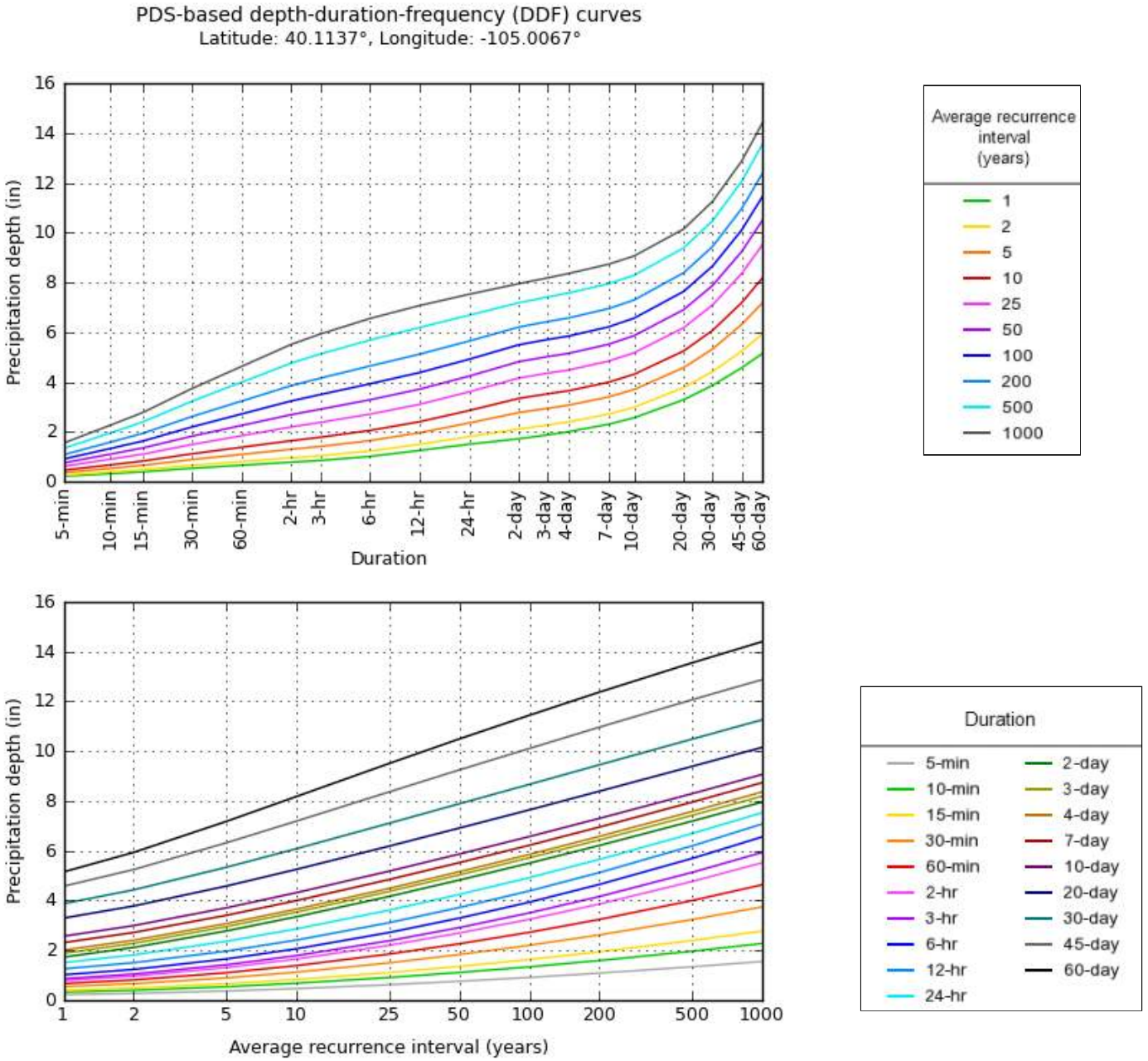
PF graphical



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Created (GMT): Mon Feb 8 18:55:13 2021

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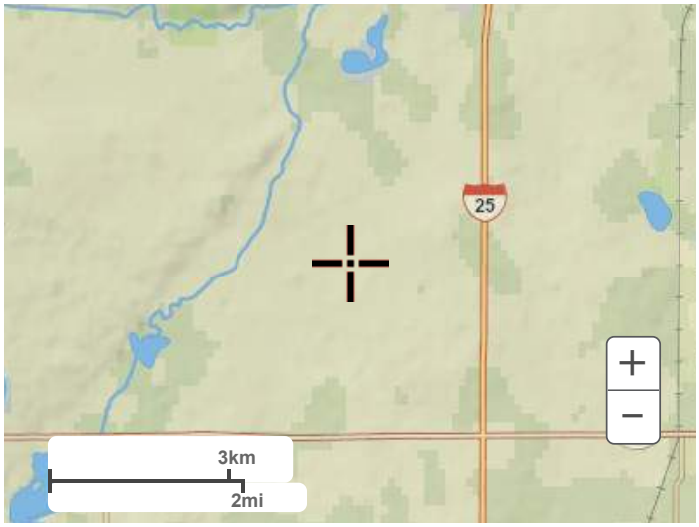
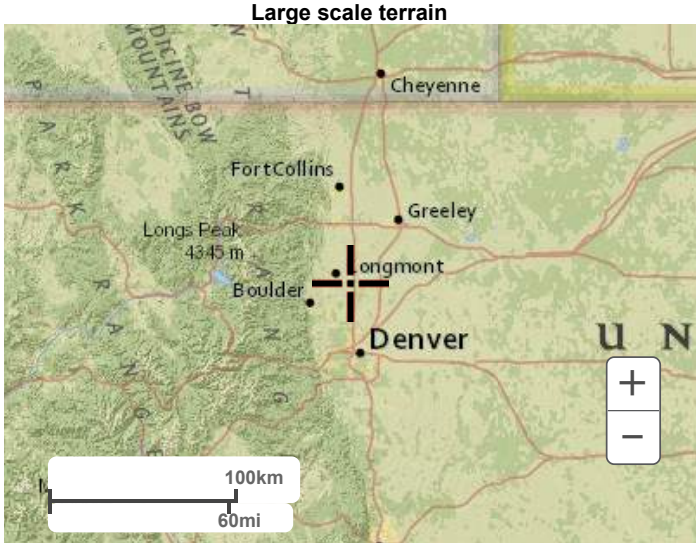
Maps & aerials

Small scale terrain



Large scale terrain



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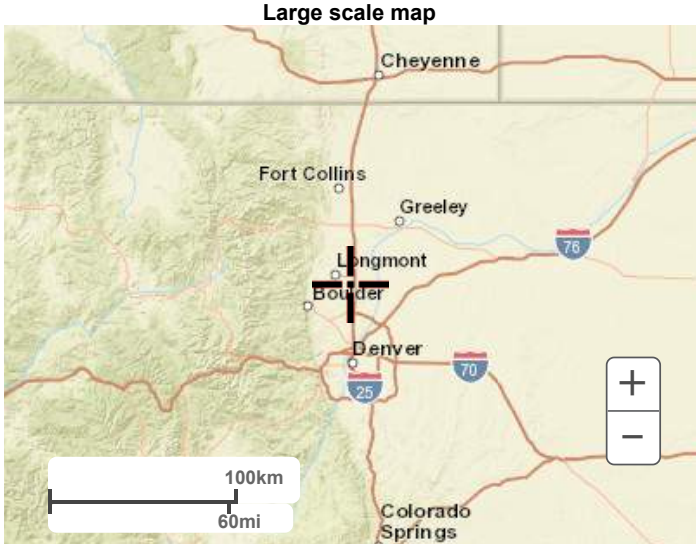
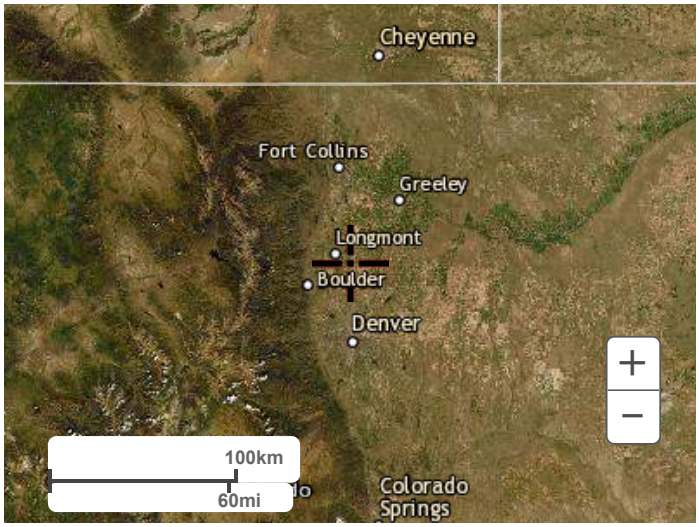


Large scale aerial



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NOAA Atlas 14, Volume 8, Version 2
Location name: Longmont, Colorado, USA*
Latitude: 40.1506°, Longitude: -104.9079°
Elevation: 4949.57 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.231** (0.178-0.299)	**0.280** (0.216-0.363)	**0.376** (0.290-0.490)	**0.472** (0.361-0.617)	**0.626** (0.474-0.878)	**0.763** (0.560-1.08)	**0.915** (0.649-1.32)	**1.09** (0.739-1.61)	**1.34** (0.874-2.04)	**1.54** (0.977-2.36)
10-min	**0.338** (0.261-0.437)	**0.410** (0.316-0.531)	**0.551** (0.424-0.717)	**0.691** (0.529-0.903)	**0.917** (0.695-1.29)	**1.12** (0.820-1.58)	**1.34** (0.950-1.94)	**1.59** (1.08-2.36)	**1.96** (1.28-2.98)	**2.26** (1.43-3.45)
15-min	**0.412** (0.318-0.533)	**0.500** (0.386-0.648)	**0.672** (0.517-0.874)	**0.843** (0.645-1.10)	**1.12** (0.847-1.57)	**1.36** (1.00-1.92)	**1.63** (1.16-2.36)	**1.94** (1.32-2.88)	**2.38** (1.56-3.63)	**2.76** (1.74-4.21)
30-min	**0.557** (0.431-0.722)	**0.674** (0.520-0.874)	**0.904** (0.696-1.18)	**1.13** (0.867-1.48)	**1.50** (1.14-2.11)	**1.83** (1.35-2.58)	**2.20** (1.56-3.18)	**2.61** (1.78-3.87)	**3.21** (2.10-4.89)	**3.71** (2.35-5.67)
60-min	**0.682** (0.527-0.883)	**0.823** (0.635-1.07)	**1.10** (0.849-1.44)	**1.39** (1.06-1.81)	**1.84** (1.40-2.59)	**2.25** (1.66-3.18)	**2.71** (1.92-3.92)	**3.23** (2.20-4.79)	**3.98** (2.61-6.07)	**4.61** (2.92-7.04)
2-hr	**0.806** (0.630-1.03)	**0.972** (0.758-1.24)	**1.30** (1.01-1.68)	**1.64** (1.27-2.11)	**2.19** (1.68-3.04)	**2.68** (1.99-3.73)	**3.23** (2.32-4.61)	**3.84** (2.65-5.64)	**4.76** (3.15-7.15)	**5.52** (3.53-8.30)
3-hr	**0.876** (0.688-1.11)	**1.05** (0.826-1.34)	**1.41** (1.10-1.80)	**1.77** (1.38-2.26)	**2.36** (1.82-3.25)	**2.88** (2.16-3.99)	**3.48** (2.51-4.93)	**4.14** (2.87-6.03)	**5.13** (3.42-7.65)	**5.95** (3.83-8.88)
6-hr	**1.04** (0.824-1.30)	**1.23** (0.979-1.55)	**1.63** (1.29-2.05)	**2.02** (1.59-2.56)	**2.66** (2.08-3.62)	**3.24** (2.45-4.42)	**3.88** (2.83-5.42)	**4.61** (3.23-6.60)	**5.68** (3.82-8.34)	**6.57** (4.27-9.65)
12-hr	**1.27** (1.02-1.57)	**1.49** (1.20-1.85)	**1.93** (1.54-2.40)	**2.35** (1.87-2.94)	**3.03** (2.38-4.03)	**3.63** (2.77-4.86)	**4.29** (3.16-5.88)	**5.03** (3.55-7.07)	**6.10** (4.15-8.81)	**6.99** (4.60-10.1)
24-hr	**1.51** (1.23-1.84)	**1.79** (1.46-2.19)	**2.31** (1.87-2.84)	**2.79** (2.24-3.43)	**3.51** (2.77-4.55)	**4.12** (3.16-5.40)	**4.78** (3.55-6.42)	**5.50** (3.92-7.59)	**6.52** (4.47-9.24)	**7.36** (4.89-10.5)
2-day	**1.72** (1.41-2.08)	**2.09** (1.72-2.53)	**2.72** (2.22-3.29)	**3.26** (2.66-3.97)	**4.05** (3.20-5.13)	**4.68** (3.61-6.00)	**5.34** (3.99-7.02)	**6.03** (4.32-8.14)	**6.98** (4.82-9.69)	**7.73** (5.19-10.9)
3-day	**1.88** (1.55-2.25)	**2.25** (1.86-2.70)	**2.89** (2.38-3.48)	**3.45** (2.82-4.16)	**4.24** (3.38-5.33)	**4.89** (3.80-6.21)	**5.55** (4.17-7.23)	**6.25** (4.51-8.36)	**7.20** (5.01-9.91)	**7.96** (5.38-11.1)
4-day	**2.01** (1.67-2.39)	**2.38** (1.98-2.84)	**3.02** (2.50-3.61)	**3.57** (2.94-4.29)	**4.37** (3.50-5.46)	**5.02** (3.92-6.34)	**5.69** (4.30-7.36)	**6.39** (4.64-8.50)	**7.36** (5.14-10.1)	**8.13** (5.52-11.2)
7-day	**2.30** (1.93-2.71)	**2.70** (2.26-3.18)	**3.37** (2.81-3.98)	**3.94** (3.27-4.68)	**4.76** (3.84-5.86)	**5.42** (4.26-6.75)	**6.09** (4.64-7.78)	**6.80** (4.97-8.92)	**7.77** (5.47-10.5)	**8.52** (5.85-11.6)
10-day	**2.55** (2.15-2.99)	**2.97** (2.51-3.48)	**3.68** (3.09-4.32)	**4.27** (3.57-5.04)	**5.11** (4.14-6.24)	**5.78** (4.58-7.14)	**6.46** (4.95-8.18)	**7.17** (5.27-9.32)	**8.13** (5.75-10.9)	**8.87** (6.12-12.0)
20-day	**3.27** (2.79-3.77)	**3.75** (3.20-4.33)	**4.54** (3.86-5.26)	**5.20** (4.40-6.05)	**6.12** (5.01-7.33)	**6.83** (5.46-8.29)	**7.54** (5.84-9.38)	**8.27** (6.14-10.6)	**9.23** (6.60-12.1)	**9.96** (6.95-13.3)
30-day	**3.83** (3.29-4.39)	**4.38** (3.76-5.02)	**5.28** (4.52-6.06)	**6.01** (5.12-6.94)	**7.01** (5.77-8.31)	**7.78** (6.26-9.35)	**8.54** (6.65-10.5)	**9.30** (6.95-11.7)	**10.3** (7.42-13.4)	**11.1** (7.77-14.6)
45-day	**4.51** (3.91-5.12)	**5.17** (4.47-5.88)	**6.23** (5.37-7.10)	**7.08** (6.07-8.10)	**8.23** (6.81-9.65)	**9.09** (7.36-10.8)	**9.93** (7.78-12.1)	**10.8** (8.09-13.4)	**11.8** (8.57-15.2)	**12.6** (8.92-16.5)
60-day	**5.06** (4.41-5.72)	**5.83** (5.07-6.59)	**7.05** (6.11-7.99)	**8.03** (6.92-9.14)	**9.33** (7.74-10.9)	**10.3** (8.36-12.1)	**11.2** (8.82-13.5)	**12.1** (9.15-15.0)	**13.3** (9.64-16.9)	**14.1** (10.0-18.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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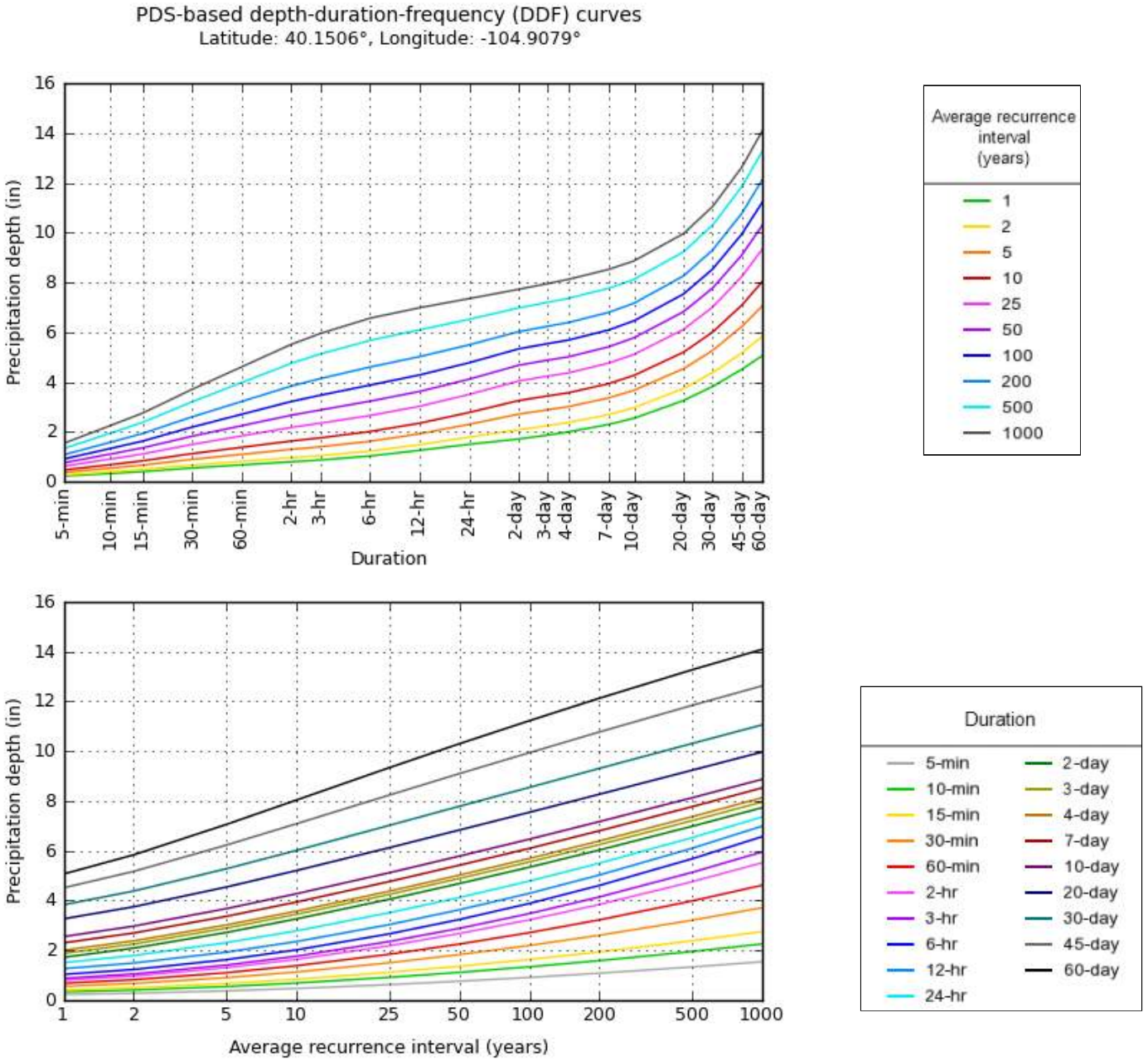
PF graphical



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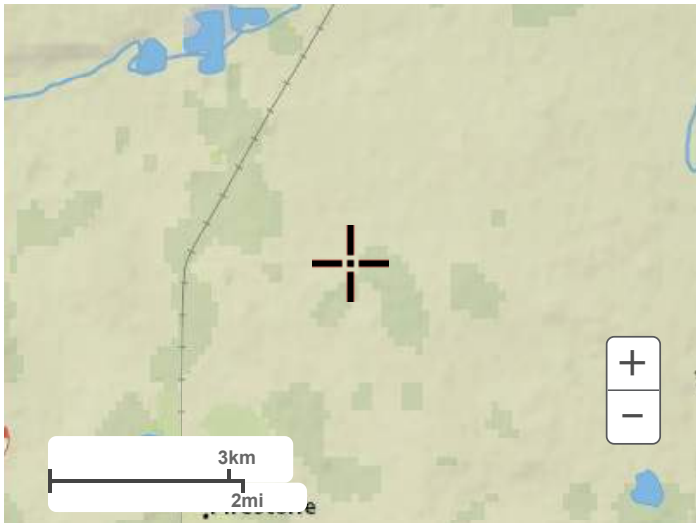

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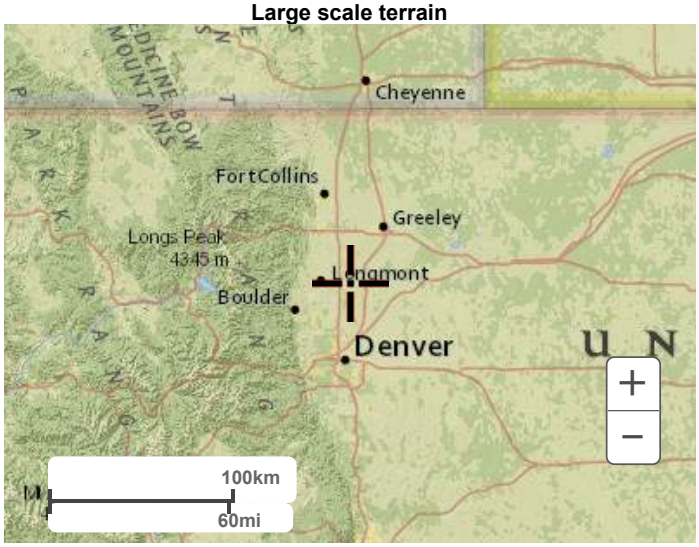

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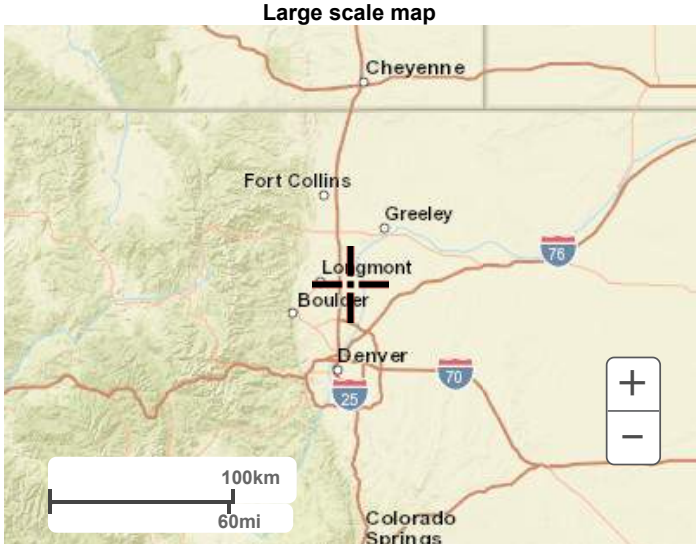

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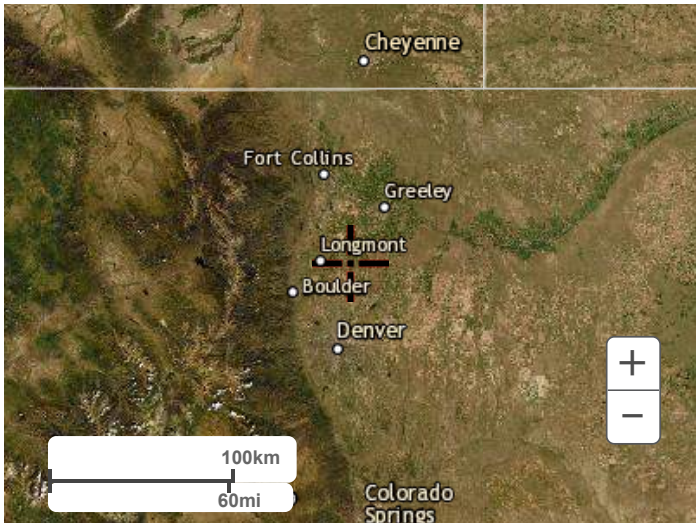

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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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NOAA Atlas 14, Volume 8, Version 2
Location name: Fort Lupton, Colorado, USA*
Latitude: 40.0603°, Longitude: -104.9235°
Elevation: 5024.52 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.226** (0.174-0.294)	**0.276** (0.212-0.359)	**0.372** (0.285-0.486)	**0.466** (0.355-0.611)	**0.615** (0.463-0.863)	**0.746** (0.545-1.06)	**0.891** (0.630-1.29)	**1.05** (0.715-1.57)	**1.29** (0.843-1.97)	**1.48** (0.939-2.28)
10-min	**0.331** (0.255-0.431)	**0.404** (0.311-0.526)	**0.545** (0.417-0.711)	**0.682** (0.519-0.894)	**0.900** (0.678-1.26)	**1.09** (0.798-1.54)	**1.30** (0.922-1.89)	**1.54** (1.05-2.30)	**1.89** (1.23-2.89)	**2.17** (1.38-3.33)
15-min	**0.404** (0.311-0.526)	**0.493** (0.379-0.642)	**0.664** (0.509-0.867)	**0.831** (0.633-1.09)	**1.10** (0.827-1.54)	**1.33** (0.974-1.88)	**1.59** (1.13-2.31)	**1.88** (1.28-2.80)	**2.30** (1.51-3.52)	**2.65** (1.68-4.07)
30-min	**0.554** (0.426-0.720)	**0.672** (0.516-0.875)	**0.902** (0.691-1.18)	**1.13** (0.858-1.48)	**1.49** (1.12-2.09)	**1.80** (1.32-2.55)	**2.15** (1.52-3.13)	**2.55** (1.73-3.80)	**3.12** (2.04-4.77)	**3.59** (2.28-5.52)
60-min	**0.675** (0.519-0.878)	**0.822** (0.631-1.07)	**1.11** (0.847-1.44)	**1.38** (1.05-1.82)	**1.83** (1.38-2.57)	**2.22** (1.62-3.14)	**2.65** (1.88-3.85)	**3.14** (2.13-4.67)	**3.84** (2.51-5.88)	**4.43** (2.80-6.79)
2-hr	**0.797** (0.619-1.02)	**0.972** (0.755-1.25)	**1.31** (1.01-1.69)	**1.64** (1.26-2.13)	**2.17** (1.65-3.01)	**2.64** (1.95-3.68)	**3.15** (2.25-4.51)	**3.73** (2.56-5.48)	**4.56** (3.02-6.89)	**5.26** (3.36-7.96)
3-hr	**0.861** (0.674-1.10)	**1.05** (0.821-1.34)	**1.42** (1.10-1.81)	**1.77** (1.37-2.28)	**2.34** (1.79-3.22)	**2.83** (2.11-3.93)	**3.38** (2.43-4.80)	**4.00** (2.76-5.83)	**4.89** (3.25-7.32)	**5.63** (3.62-8.45)
6-hr	**1.02** (0.809-1.29)	**1.23** (0.974-1.55)	**1.63** (1.29-2.07)	**2.02** (1.59-2.57)	**2.64** (2.04-3.58)	**3.18** (2.39-4.34)	**3.78** (2.74-5.28)	**4.44** (3.10-6.38)	**5.41** (3.63-7.97)	**6.20** (4.03-9.17)
12-hr	**1.26** (1.01-1.57)	**1.50** (1.20-1.87)	**1.94** (1.54-2.42)	**2.36** (1.87-2.95)	**3.01** (2.35-4.01)	**3.58** (2.72-4.81)	**4.21** (3.09-5.79)	**4.90** (3.45-6.92)	**5.90** (4.00-8.56)	**6.72** (4.42-9.79)
24-hr	**1.52** (1.23-1.86)	**1.81** (1.46-2.23)	**2.33** (1.88-2.87)	**2.80** (2.25-3.47)	**3.51** (2.76-4.57)	**4.11** (3.14-5.41)	**4.75** (3.51-6.40)	**5.43** (3.86-7.53)	**6.41** (4.39-9.13)	**7.20** (4.78-10.3)
2-day	**1.73** (1.42-2.10)	**2.11** (1.73-2.57)	**2.76** (2.25-3.36)	**3.31** (2.68-4.05)	**4.09** (3.22-5.20)	**4.71** (3.62-6.07)	**5.35** (3.98-7.07)	**6.02** (4.31-8.17)	**6.93** (4.78-9.67)	**7.64** (5.13-10.8)
3-day	**1.89** (1.56-2.27)	**2.28** (1.88-2.75)	**2.93** (2.41-3.54)	**3.49** (2.85-4.24)	**4.29** (3.40-5.40)	**4.92** (3.81-6.28)	**5.57** (4.17-7.28)	**6.24** (4.50-8.39)	**7.16** (4.97-9.90)	**7.87** (5.33-11.0)
4-day	**2.02** (1.67-2.41)	**2.40** (1.99-2.88)	**3.05** (2.52-3.67)	**3.61** (2.96-4.36)	**4.41** (3.51-5.52)	**5.04** (3.92-6.40)	**5.70** (4.29-7.41)	**6.38** (4.62-8.53)	**7.31** (5.10-10.1)	**8.04** (5.47-11.2)
7-day	**2.31** (1.93-2.74)	**2.71** (2.26-3.21)	**3.37** (2.81-4.01)	**3.94** (3.26-4.70)	**4.75** (3.82-5.88)	**5.39** (4.24-6.76)	**6.06** (4.60-7.78)	**6.75** (4.93-8.91)	**7.69** (5.41-10.4)	**8.43** (5.78-11.6)
10-day	**2.57** (2.16-3.02)	**2.98** (2.50-3.51)	**3.67** (3.07-4.33)	**4.25** (3.54-5.04)	**5.08** (4.10-6.23)	**5.73** (4.53-7.13)	**6.41** (4.89-8.16)	**7.10** (5.22-9.29)	**8.04** (5.69-10.8)	**8.77** (6.05-12.0)
20-day	**3.29** (2.80-3.82)	**3.76** (3.20-4.37)	**4.54** (3.84-5.29)	**5.18** (4.37-6.07)	**6.08** (4.96-7.33)	**6.78** (5.41-8.29)	**7.49** (5.78-9.37)	**8.20** (6.09-10.5)	**9.16** (6.55-12.1)	**9.89** (6.90-13.3)
30-day	**3.86** (3.31-4.45)	**4.40** (3.77-5.08)	**5.28** (4.51-6.11)	**6.01** (5.10-6.97)	**7.00** (5.74-8.35)	**7.76** (6.23-9.38)	**8.51** (6.61-10.5)	**9.27** (6.92-11.8)	**10.3** (7.38-13.4)	**11.0** (7.73-14.7)
45-day	**4.55** (3.93-5.20)	**5.20** (4.49-5.95)	**6.25** (5.37-7.17)	**7.10** (6.07-8.17)	**8.24** (6.80-9.72)	**9.10** (7.35-10.9)	**9.94** (7.77-12.2)	**10.8** (8.09-13.6)	**11.8** (8.57-15.3)	**12.6** (8.93-16.6)
60-day	**5.11** (4.44-5.81)	**5.88** (5.09-6.68)	**7.09** (6.12-8.08)	**8.06** (6.93-9.23)	**9.36** (7.75-11.0)	**10.3** (8.37-12.3)	**11.2** (8.83-13.7)	**12.2** (9.17-15.2)	**13.3** (9.67-17.1)	**14.1** (10.1-18.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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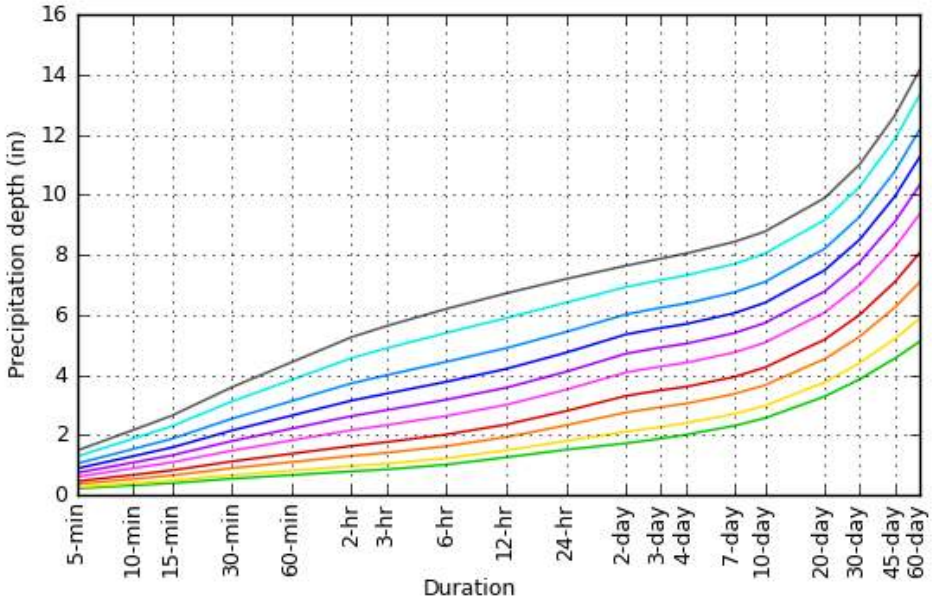
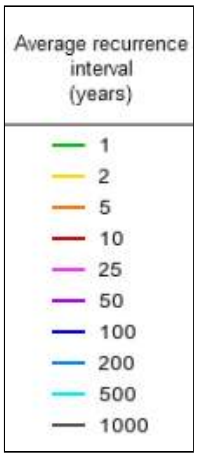
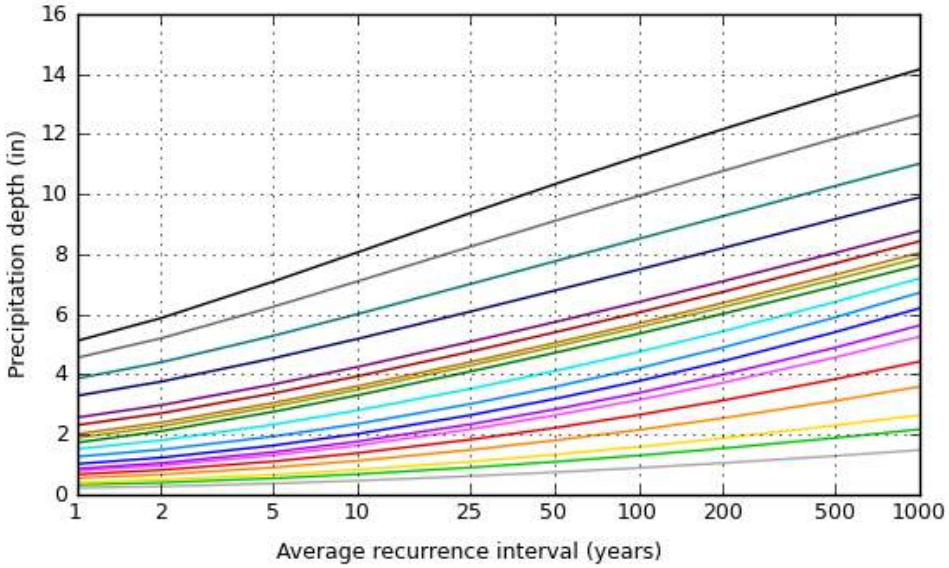
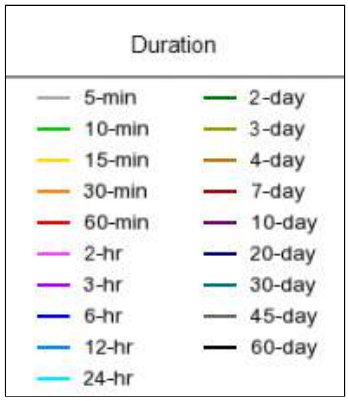
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.0603°, Longitude: -104.9235°









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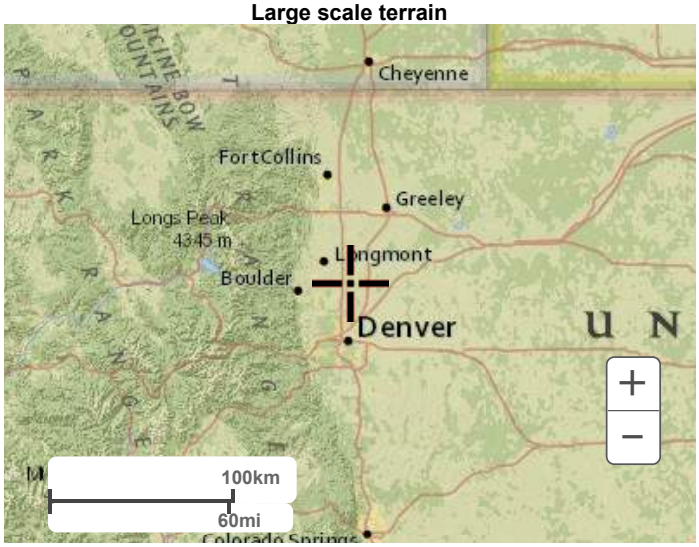
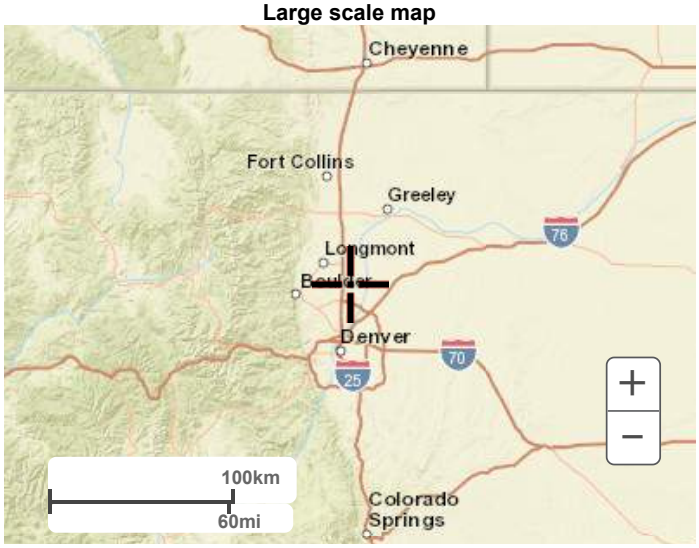
Maps & aerials

Small scale terrain

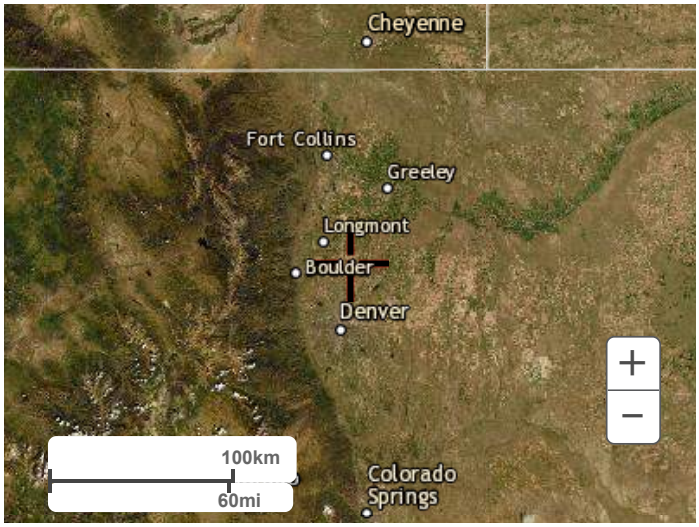
Large scale terrain



Large scale map



Large scale aerial



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Appendix B.5. Unit Cost Documentation

Cost Data

Item	Unit	Unit Cost 2012 Q1	Adjusted Unit Cost 2021 Q2
Circular Pipes			
12-inch	L.F.	$36.00	$49.00
18-inch	L.F.	$54.00	$73.00
24-inch	L.F.	$72.00	$98.00
30-inch	L.F.	$90.00	$122.00
36-inch	L.F.	$108.00	$146.00
42-inch	L.F.	$126.00	$171.00
48-inch	L.F.	$144.00	$195.00
54-inch	L.F.	$216.00	$293.00
60-inch	L.F.	$240.00	$325.00
66-inch	L.F.	$264.00	$358.00
72-inch	L.F.	$360.00	$488.00
78-inch	L.F.	$390.00	$528.00
84-inch	L.F.	$420.00	$569.00
90-inch	L.F.	$450.00	$610.00
96-inch	L.F.	$480.00	$650.00
102-inch	L.F.	$714.00	$967.00
108-inch	L.F.	$756.00	$1,024.00
120-inch	L.F.	$840.00	$1,138.00
Flared End Sections			
12-inch	EA	$710.00	$962.00
18-inch	EA	$920.00	$1,247.00
24-inch	EA	$970.00	$1,314.00
30-inch	EA	$1,570.00	$2,127.00
36-inch	EA	$1,610.00	$2,182.00
42-inch	EA	$1,700.00	$2,304.00
48-inch	EA	$2,060.00	$2,791.00
Manholes and Inlets			
Manhole, 4' Dia. (Pipe Dia. < 36"), Depth > 15-feet)	EA	$2,900.00	$3,930.00
Manhole, 5' Dia. (Pipe Dia. 36" - 42"), Depth > 15-feet)	EA	$3,900.00	$5,285.00
Manhole, 6' Dia. (Pipe Dia. , Depth > 15-feet)	EA	$4,300.00	$5,827.00
Type B Manhole (Pipe Dia. 48" and larger, deflection < 10 degrees)	EA	$12,000.00	$16,260.00
Type P Manhole (Pipe Dia. 48" and larger, deflection > 10 degrees)	EA	$15,000.00	$20,325.00
Storm Inlet, Type R/Type 14, 5-foot, 10-foot deep avg.	EA	$4,600.00	$6,233.00
Headwalls for Circular Pipes			
See Headwall Table			See Headwall Table
Wingwalls for Circular Pipes			
See Wingwall Table			See Wingwall Table
Box Culverts			
See Box Culvert Table			See Box Culvert Table
Hydraulic Structures			
Grouted Boulders, 36-inch	C.Y.	$190.00	$257.00
Soil Riprap, Type M	C.Y.	$70.00	$95.00
Excavation, Complete-in-Place	C.Y.	$11.00	$15.00
Bedding, Granular Type II	C.Y.	$58.00	$79.00
Grout	C.Y.	$240.00	$325.00
Check Structure, Concrete	L.F.	$270.00	$366.00
Channel Improvements			
Boulder Edging, 12" High	L.F.	$60.00	$81.00
Boulder Edging, 24" High	L.F.	$75.00	$102.00
Boulder Edging, 36" High	L.F.	$90.00	$122.00
Concrete Low Flow Channel	L.F.	$40.00	$54.00
Grouted Boulders, 12"	S.Y.	$130.00	$176.00
Grouted Boulders, 18"	S.Y.	$150.00	$203.00
Grouted Boulders, 24"	S.Y.	$170.00	$230.00
Grouted Boulders, 36"	S.Y.	$190.00	$257.00
Grouted Boulders, 48"	S.Y.	$200.00	$271.00
6-inch Riprap, Type VL	C.Y.	$45.00	$61.00
9-inch Riprap, Type L	C.Y.	$55.00	$75.00
12-inch Riprap, Type M	C.Y.	$60.00	$81.00
18-inch Riprap, Type H	C.Y.	$80.00	$108.00
24-inch Riprap, Type VH	C.Y.	$85.00	$115.00
Soil Riprap, Type VL	C.Y.	$50.00	$68.00
Soil Riprap, Type L	C.Y.	$60.00	$81.00
Soil Riprap, Type M	C.Y.	$70.00	$95.00
Soil Riprap, Type H	C.Y.	$80.00	$108.00
Soil Riprap, Type VH	C.Y.	$90.00	$122.00
Excavation, Low Range	C.Y.	$11.00	$15.00
Excavation, Mid Range	C.Y.	$24.00	$33.00
Excavation, High Range	C.Y.	$31.00	$42.00
Detention/Water Quality Facilities			
Excavation, Low Range	C.Y.	$11.00	$15.00
Excavation, Mid Range	C.Y.	$24.00	$33.00
Excavation, High Range	C.Y.	$31.00	$42.00
Outlet Works	EA	User Defined	User Defined
Water Quality Appurtenances	EA	User Defined	User Defined
Detention (Complete-in-Place)	AC-FT	$45,600.00	$61,788.00
Landscaping and Recreation Improvements			
Wetlands Plantings	ACRE	$25,000.00	$33,875.00
Reclamation & seeding (native grasses)	ACRE	$1,000.00	$1,355.00
Trail/Path, Concrete (10' Width)	L.F.	$44.00	$60.00
Trail/Path, Crusher Fines (10' Width)	L.F.	$11.00	$15.00
Removals			
Removal of culvert pipe (D<48")	L.F.	$20.00	$27.00
Removal of culvert pipe (48"<D<84")	L.F.	$50.00	$68.00
Removal of culvert pipe (D>84")	L.F.	$75.00	$102.00
Concrete Box Culvert	L.F./CELL	$100.00	$136.00
Land Acquisition			
Temporary Easements	EA	User Defined	User Defined
Easement/ROW Acquisition	ACRE	User Defined	User Defined
Concrete and Steel			
Concrete	C.Y.	$600.00	$813.00
Steel	LB.	$0.90	$1.00
Operation and Maintenance			
Culvert Maintenance	L.F.	$1.00	$1.00
Manhole and Inlet Maintenance	EA	$50.00	$68.00
Hydraulic Structure Maintenance	EA	$500.00	$678.00
Channel Maintenance	L.F.	$2.00	$3.00
Detention/WQ Maintenance	ACRE	$1,500.00	$2,033.00
Mowing	ACRE	$50.00	$68.00
Trail Maintenance	L.F.	$5.00	$7.00

***Asphalt Removal/Replacement (Assumes 6" Asphalt over 6" Road Base) = $100 per S.Y.**
***Additional Road Base for Road Fill = $80 per C.Y.**

Headwalls for Pipe Culverts (CDOT M-601-10)

Diameter (in)	Single Pipe Concrete (cy)	Single Pipe Steel (lbs)	Single Unit Cost	Double Pipe Concrete (cy)	Double Pipe Steel (lbs)	Double Unit Cost
54-inch	2.12	209	$1,932.56	3.55	364	$3,250.15
60-inch	2.35	236	$2,146.55	3.99	414	$3,657.87
66-inch	2.60	249	$2,362.80	4.44	453	$4,062.72
72-inch	2.85	270	$2,587.05	4.91	476	$4,467.83
78-inch	3.11	306	$2,834.43	5.29	527	$4,827.77
84-inch	3.38	333	$3,080.94	5.68	572	$5,189.84
90-inch	3.66	335	$3,310.58	6.08	593	$5,536.04
96-inch	3.94	379	$3,582.22	6.48	649	$5,917.24
102-inch	4.24	400	$3,847.12	6.89	664	$6,265.57
108-inch	4.54	424	$4,115.02	7.30	707	$6,641.90
120-inch	4.84	448	$4,382.92	7.71	750	$7,018.2

Concrete Cost ($/cy) =	$813.00
Steel Cost ($/lb) =	$1.00

Notes :

1. 120-inch is an estimate based on ratio of concrete and steel increases with pipe size. CDOT does not have a standard detail for a 120-inch diameter pipe headwall.
2. For layouts with more than one pipe section (barrel) a multiple has been used of 0.67 for concrete and 0.73 for steel. See example below:

Example : 3 x 60 inch RCP

Headwall Concrete for Single Pipe = 2.35 cy

Headwall Steel for Single Pipe = 236 lbs

Headwall Concrete for Triple Pipes = 2.35 cy + 2.35 cy x (0.67 x 2) = 5.50 cy

Concrete = Single Headwall Concrete + Single Headwall Concrete x (0.67 x Number of Barrels in Excess of 1)

Headwall Steel for Triple Pipes = 236 lbs + 236 lbs x (0.73 x 2) =580.56 lbs

Steel = Single Headwall Steel + Single Headwall Steel x (0.73 x Number of Barrels in Excess of 1)

Cost = 5.50 cy x $684/cy + 580.56 lbs x $0.80/lb = $4,226.52

Wingwalls (CDOT M-601-20)

Wingwall Height (ft)	Concrete (cy/lf)	Steel (lbs/lf)
2.00	0.161	8.00
3.00	0.210	9.30
4.00	0.259	10.70
5.00	0.308	12.10
6.00	0.358	14.30
7.00	0.407	16.40
8.00	0.457	23.00
9.00	0.506	28.60
10.00	0.556	41.80
11.00	0.604	54.60

Concrete Cost ($/cy) =	$813.00
Steel Cost ($/lb) =	$1.00

Box Culvert (CDOT M-601-1)

Span (feet)	Cost $/LF Rise (feet)								
	2	3	4	5	6	7	8	9	10
4	$479.55	$489.83	$552.36	$666.95	$729.36	$791.77	$855.17	$916.77	$979.17
5	$541.96	$604.36	$666.95	$729.36	$791.77	$855.17	$906.57	$998.66	$1,091.16
6	$604.36	$666.95	$729.36	$791.77	$811.40	$831.04	$957.98	$1,080.56	$1,203.15
7	$666.95	$729.36	$791.77	$855.17	$892.44	$929.71	$1,028.38	$1,146.52	$1,264.65
8	$729.36	$791.77	$855.17	$906.57	$957.98	$1,028.38	$1,098.79	$1,169.39	$1,239.98
9	ERROR	$855.17	$916.77	$998.66	$1,080.56	$1,146.52	$1,212.47	$1,277.43	$1,342.38
10	ERROR	$916.77	$979.17	$1,091.16	$1,203.15	$1,264.65	$1,326.15	$1,385.47	$1,444.79
11	ERROR	$979.17	$1,042.58	$1,171.14	$1,299.69	$1,366.69	$1,433.69	$1,499.34	$1,564.99
12	ERROR	ERROR	$1,104.98	$1,250.61	$1,396.23	$1,468.73	$1,541.23	$1,613.21	$1,685.19
13	ERROR	ERROR	ERROR	ERROR	$1,552.90	$1,620.15	$1,687.40	$1,760.72	$1,834.04
14	ERROR	ERROR	ERROR	ERROR	$1,709.56	$1,771.56	$1,833.56	$1,908.23	$1,982.89
15	ERROR	ERROR	ERROR	ERROR	$1,922.45	$1,995.03	$2,067.61	$2,146.28	$2,224.95
16	ERROR	ERROR	ERROR	ERROR	$2,135.34	$2,218.50	$2,301.66	$2,384.34	$2,467.01
17	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,475.19	$2,560.10	$2,645.00
18	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,648.72	$2,735.86	$2,822.99
19	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$2,977.68	$3,054.98	$3,132.28
20	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	$3,306.65	$3,374.11	$3,441.57

Headwall/Toewall (CDOT M-601-2)

Span (feet)	Steel (lbs/lf)
4	18.9
6	22.1
8	22.5
10	28.2
12	27.6
14	34
16	32.3
18	39
20	38.6

Notes: Concrete quantity estimated as 0.085 CY/LF per standard detail.
Weight of steel for span of 4 feet was linearly extrapolated.

Expanded Table

Span (feet)	RISE																									
	concrete	steel	2'	concrete	steel	3'	concrete	steel	4'	concrete	steel	5'	concrete	steel	6'	concrete	steel	7'	concrete	steel	8'	concrete	steel	9'	concrete	steel	10'
4	0.473	95	$480	0.484	97	$490	0.545	109	$552																	
5	0.535	107	$542	0.597	119	$604	0.658	132	$667	0.720	144	$729														
6	0.597	119	$604	0.658	132	$667	0.720	144	$729	0.782	156	$792	0.808	155	$811	0.834	153	$831								
7	0.658	132	$667	0.720	144	$729	0.782	156	$792	0.844	169	$855	0.884	174	$892	0.924	179	$930								
8	0.720	144	$729	0.782	156	$792	0.844	169	$855	0.898	177	$907	0.952	184	$958	1.014	204	$1,028	1.076	224	$1,099	1.145	239	$1,169	1.214	253	$1,240
9				0.844	169	$855	0.905	181	$917	0.986	197	$999	1.067	214	$1,081	1.128	229	$1,147	1.190	245	$1,212	1.260	253	$1,277	1.330	262	$1,342
10				0.905	181	$917	0.967	193	$979	1.074	218	$1,091	1.181	243	$1,203	1.243	255	$1,265	1.304	266	$1,326	1.375	268	$1,385	1.445	270	$1,445
11				0.967	193	$979	1.029	206	$1,043	1.145	240	$1,171	1.261	275	$1,300	1.323	292	$1,367	1.384	309	$1,434	1.461	312	$1,499	1.538	315	$1,565
12							1.091	218	$1,105	1.216	262	$1,251	1.341	306	$1,396	1.403	329	$1,469	1.464	351	$1,541	1.547	356	$1,613	1.630	360	$1,685
13													1.485	346	$1,553	1.546	363	$1,620	1.608	381	$1,687	1.686	390	$1,761	1.765	400	$1,834
14													1.628	386	$1,710	1.690	398	$1,772	1.751	410	$1,834	1.825	425	$1,908	1.899	439	$1,983
15													1.843	425	$1,922	1.906	445	$1,995	1.970	466	$2,068	2.060	472	$2,146	2.150	477	$2,225
16													2.057	463	$2,135	2.123	493	$2,218	2.189	522	$2,302	2.295	519	$2,384	2.401	515	$2,467
17																			2.376	544	$2,475	2.473	550	$2,560	2.570	556	$2,645
18																			2.563	565	$2,649	2.651	581	$2,736	2.738	597	$2,823
19																			2.868	646	$2,978	2.933	670	$3,055	2.999	695	$3,132
20																			3.173	727	$3,307	3.216	760	$3,374	3.259	792	$3,442

Concrete Cost ($/cy) =	$813.00
Steel Cost ($/lb) =	$1.00

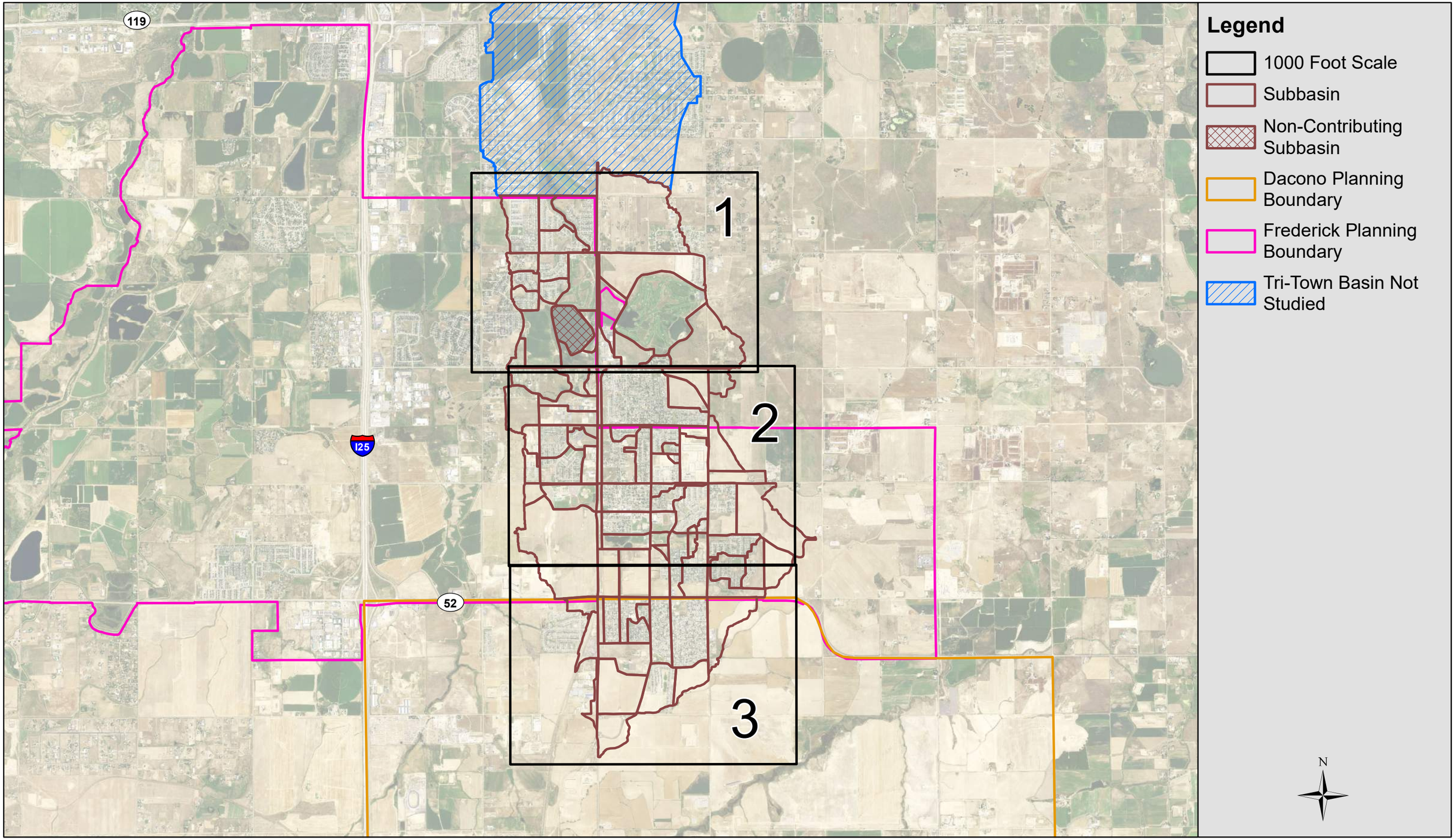
Uses CDOT M-601-1 Single Concrete Box Culvert
Assumes 8 feet of cover
Assumes 10" wall thickness and 200 lb steel per cubic yard for small box culverts

Available Box Sizes - For Data Validation

Span	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Rise	2	2	2	2	2												
		3	3	3	3	3	3	3									
		4	4	4	4	4	4	4	4								
		5	5	5	5	5	5	5	5								
		6	6	6	6	6	6	6	6	6	6	6	6				
		7	7	7	7	7	7	7	7	7	7	7	7				
		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Appendix C. Tri-Town Basin Documentation

Appendix C.1. Tri-Town Existing Condition Documentation



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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
SUBBASIN MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/12/2021	
SHEET: TT	INDEX: SB-INDEX

SILVER BIRCH BLVD

COLORADO BLVD

PINE CONE AVE

FRONTIER ST

GODDING HOLLOW PKWY

TT-01 | 37 | 26 / 26

TT-02 | 48 | 27 / 27

TT-03 | 77 | 23 / 23

TT-04 | 85 | 10 / 10

TT-05 | 19 | 10 / 10

TT-06 | 31 | 10 / 10

TT-18 | 91 | 27 / 27

TT-19 | 39 | 32 / 32

TT-20 | 28 | 29 / 29

TT-21 | 23 | 25 / 25

TT-22 | 28 | 25 / 25

TT-23 | 26 | 22 / 22

TT-24 | 100 | 13 / 27

TT-25 | 16 | 20 / 30

TT-26 | 296 | 5 / 23

TT-27 | 35 | 75 / 75

TT-28 | 143 | 23 / 59

TT-29 | 54 | 30 / 75

TT-30 | 243 | 10 / 10

TT-31 | 151 | 2 / 50

TT-33 | 42 | 2 / 66

TT-34 | 15 | 30 / 30

Legend

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

XX — Subcatchment ID
XX | X — % Impervousness (Existing Condition) / % Impervousness (Future Condition)
X — Acreage

Key Map

N

0 500 1,000 2,000
Feet

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TRI-TOWN
SUBBASIN MAPS

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CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/12/2021	
SHEET: TT	INDEX: SB-1

GODDING HOLLOW PKWY

FRONTIER ST

COLORADO BLVD

TT-95: 68 | 11 / 30
TT-94: 28 | 17 / 31
TT-07: 14 | 9 / 61
TT-35: 36 | 5 / 46
TT-32: 28 | 2 / 30
TT-08: 12 | 10 / 10
TT-36: 219 | 45 / 45
TT-37: 45 | 3 / 45
TT-38: 36 | 48 / 48
TT-93: 65 | 12 / 34
TT-39: 48 | 70 / 70
TT-40: 10 | 5 / 48
TT-92: 18 | 21 / 21
TT-49: 15 | 21 / 21
TT-48: 31 | 26 / 26
TT-42: 22 | 25 / 25
TT-41: 43 | 27 / 27
TT-43: 22 | 39 / 57
TT-51: 9 | 21 / 21
TT-46: 79 | 21 / 21
TT-47: 43 | 28 / 28
TT-50: 51 | 23 / 23
TT-54: 64 | 22 / 22
TT-45: 27 | 70 / 70
TT-44: 62 | 27 / 27
TT-09: 12 | 9 / 9
TT-53: 37 | 26 / 26
TT-52: 4 | 30 / 30
TT-55: 34 | 2 / 30
TT-57: 21 | 25 / 25
TT-58: 19 | 9 / 33
TT-60: 68 | 43 / 43
TT-61: 14 | 29 / 29
TT-91: 62 | 27 / 27
TT-56: 60 | 46 / 46
TT-10: 6 | 10 / 10
TT-96: 28 | 36 / 36
TT-70: 73 | 27 / 27
TT-71: 136 | 2 / 21
TT-90: 3 | 10 / 10
TT-62: 54 | 60 / 60
TT-63: 24 | 52 / 52
TT-89: 7 | 24 / 24
TT-11: 8 | 10 / 10
TT-73: 45 | 24 / 24
TT-59: 293 | 3 / 40
TT-64: 12 | 10 / 10
TT-65: 5 | 2 / 60
TT-68: 9 | 23 / 23
TT-88: 39 | 10 / 34
TT-72: 47 | 27 / 27
TT-12: 34 | 10 / 10
TT-67: 48 | 31 / 31
TT-76: 50 | 4 / 72
TT-13: 71 | 3 / 62
TT-66: 45 | 9 / 42
TT-69: 64 | 33 / 33
TT-74: 42 | 24 / 24
TT-75: 47 | 2 / 12

Legend

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

XX — Subcatchment ID
XX X — % Impervousness (Existing Condition)
X — % Impervousness (Future Condition)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
SUBBASIN MAPS

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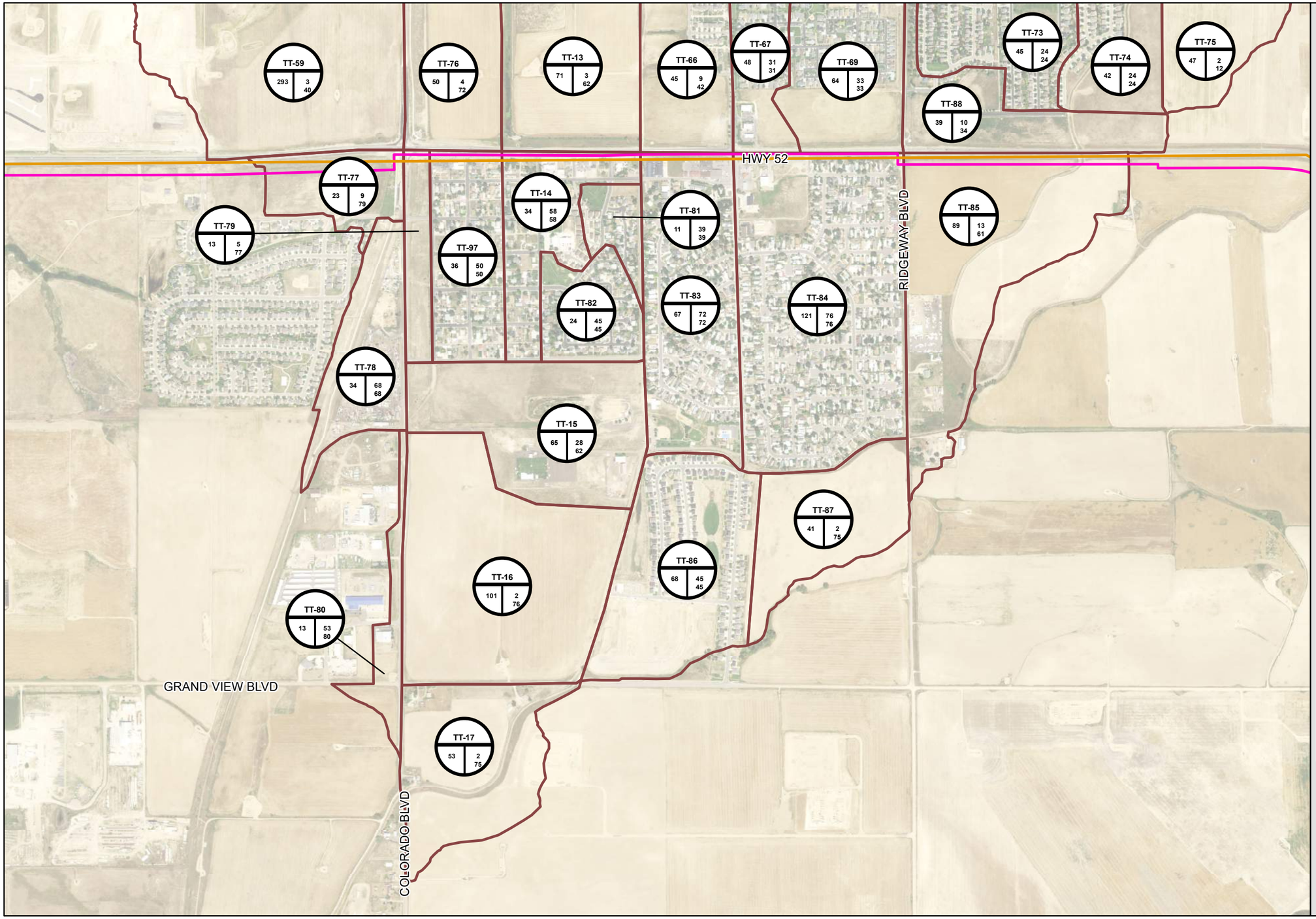
SHEET: TT	INDEX: SB-2

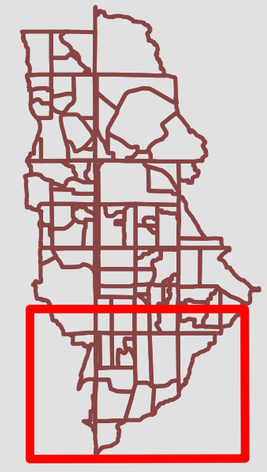


Legend

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

XX — Subcatchment ID
XX X — % Impervousness (Existing Condition)
X — % Impervousness (Future Condition)
Acreage

Key Map



N

0 500 1,000 2,000
Feet

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OUTFALL SYSTEM PLAN

TRI-TOWN
SUBBASIN MAPS

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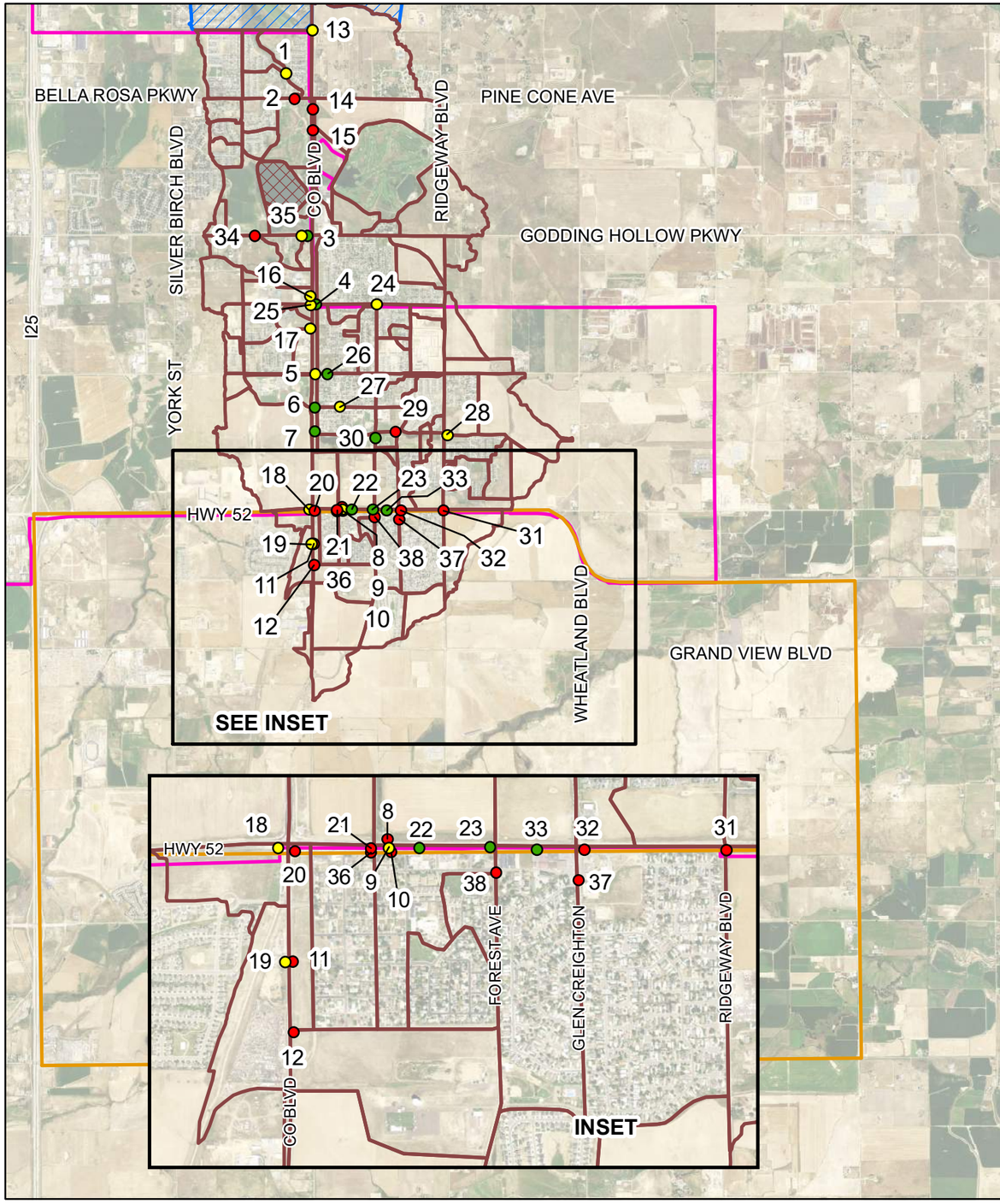
PROJECT NUMBER: COTOF.03	
DATE: 10/12/2021	
SHEET: TT	INDEX: SB-3

TABLE C.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
TRI-TOWN																				
TT-01	401	0.05718	36.6	0.19914	1051	0.30567	1614	0.0177	26	0.35	0.05	4.35	0.0012	0.78	55.97	1.53	39.77	9.87	6.99	4.32
TT-02	402	0.07495	48.0	0.17565	927	0.36422	1923	0.0155	27	0.35	0.05	4.66	0.0010	0.87	71.32	1.49	49.05	13.06	9.17	5.51
TT-03	403	0.11961	76.6	0.28971	1530	0.54337	2869	0.0092	23	0.35	0.05	4.29	0.0011	0.80	90.42	1.18	61.54	13.99	9.68	5.81
TT-04	404	0.13322	85.3	0.34224	1807	0.51613	2725	0.0124	10	0.40	0.05	3.90	0.0013	0.72	94.75	1.11	62.92	6.82	4.19	1.76
TT-05	405	0.02972	19.0	0.32308	1706	0.37270	1968	0.0082	10	0.40	0.05	3.36	0.0016	0.59	14.82	0.78	9.98	1.96	0.72	0.35
TT-06	406	0.04863	31.1	0.12946	684	0.28033	1480	0.0030	10	0.40	0.05	3.21	0.0017	0.55	38.31	1.23	27.01	6.26	2.00	1.06
TT-07	407	0.02180	14.0	0.14741	778	0.22043	1164	0.0028	9	0.40	0.05	4.30	0.0014	0.71	11.53	0.83	7.61	0.80	0.45	0.20
TT-08	408	0.01895	12.1	0.18237	963	0.45081	2380	0.0048	10	0.40	0.05	4.44	0.0018	0.60	8.33	0.69	5.57	1.05	0.39	0.19
TT-09	409	0.01901	12.2	0.26122	1379	0.50052	2643	0.0042	9	0.40	0.05	4.50	0.0018	0.60	6.64	0.55	4.41	0.78	0.28	0.13
TT-10	410	0.01003	6.4	0.13281	701	0.24206	1278	0.0055	10	0.40	0.05	4.45	0.0018	0.60	5.12	0.80	3.47	0.66	0.25	0.12
TT-11	411	0.01322	8.5	0.16394	866	0.32457	1714	0.0182	10	0.40	0.05	3.04	0.0018	0.50	8.25	0.97	5.83	1.52	0.50	0.24
TT-12	612	0.05387	34.5	0.25080	1324	0.41861	2210	0.0044	10	0.40	0.05	3.34	0.0018	0.52	32.65	0.95	22.82	5.54	1.69	0.89
TT-13	413	0.11157	71.4	0.32593	1721	0.41567	2195	0.0039	3	0.40	0.05	3.23	0.0018	0.52	74.93	1.05	52.23	10.94	1.46	0.64
TT-14	414	0.05266	33.7	0.18583	981	0.39108	2065	0.0164	58	0.35	0.05	3.00	0.0018	0.50	98.34	2.92	77.17	37.83	26.89	18.16
TT-15	415	0.10112	64.7	0.37529	1982	0.52751	2785	0.0174	28	0.40	0.05	3.00	0.0018	0.50	98.63	1.52	72.68	25.23	13.72	8.56
TT-16	416	0.15757	100.8	0.34554	1824	0.57676	3045	0.0197	2	0.40	0.05	3.32	0.0018	0.52	138.41	1.37	96.93	19.86	1.54	0.81
TT-17	417	0.08289	53.0	0.19611	1035	0.33007	1743	0.0146	2	0.40	0.05	2.99	0.0018	0.50	83.39	1.57	59.17	13.60	2.07	0.53
TT-18	618	0.14237	91.1	0.33999	1795	0.59165	3124	0.0172	27	0.40	0.05	4.72	0.0013	0.77	124.52	1.37	86.64	22.11	15.52	9.55
TT-19	619	0.06094	39.0	0.11751	620	0.27865	1471	0.0279	32	0.35	0.05	5.00	0.0007	1.00	74.25	1.90	49.19	16.66	11.56	7.71
TT-20	420	0.04320	27.6	0.15072	796	0.25546	1349	0.0155	29	0.35	0.05	4.98	0.0007	0.99	36.82	1.33	24.24	7.29	5.04	3.19
TT-21	621	0.03609	23.1	0.13681	722	0.24604	1299	0.0222	25	0.35	0.05	5.00	0.0007	1.00	28.35	1.23	18.13	5.17	3.45	2.02
TT-22	422	0.04334	27.7	0.17365	917	0.26361	1392	0.0252	25	0.35	0.05	4.91	0.0008	0.98	34.63	1.25	22.65	6.17	4.18	2.37
TT-23	423	0.04107	26.3	0.15921	841	0.27376	1445	0.0126	22	0.35	0.05	4.78	0.0012	0.82	34.61	1.32	23.44	5.21	3.58	2.10
TT-24	424	0.15636	100.1	0.24003	1267	0.40015	2113	0.0120	13	0.40	0.05	4.54	0.0015	0.72	150.31	1.50	101.73	14.25	9.30	4.67
TT-25	425	0.02473	15.8	0.10149	536	0.17849	942	0.0140	20	0.40	0.05	4.37	0.0017	0.64	26.65	1.68	19.22	4.76	2.69	1.59
TT-26	426	0.46181	295.6	0.40181	2122	0.73615	3887	0.0158	5	0.40	0.05	4.91	0.0009	0.93	267.78	0.91	144.89	9.03	4.23	0.91
TT-27	427	0.05392	34.5	0.31233	1649	0.57310	3026	0.0109	75	0.40	0.10	4.39	0.0011	0.84	78.22	2.27	61.38	30.11	23.29	16.91
TT-28	428	0.22366	143.1	0.46804	2471	0.91655	4839	0.0156	23	0.40	0.05	4.66	0.0013	0.78	155.28	1.08	105.77	23.85	16.33	9.64
TT-29	429	0.08365	53.5	0.29500	1558	0.63817	3370	0.0126	30	0.40	0.05	3.73	0.0015	0.65	71.82	1.34	51.68	15.31	9.78	6.08
TT-30	430	0.37932	242.8	0.42563	2247	0.78642	4152	0.0161	10	0.40	0.05	4.25	0.0015	0.67	311.94	1.28	212.60	30.87	14.56	6.77
TT-31	431	0.23533	150.6	0.20945	1106	0.53156	2807	0.0135	2	0.40	0.05	4.69	0.0010	0.89	168.14	1.12	92.63	2.41	1.16	0.09
TT-32	432	0.04313	27.6	0.11716	619	0.20899	1103	0.0094	2	0.40	0.05	5.00	0.0007	1.00	20.26	0.73	9.14	0.28	0.08	0.01
TT-33	433	0.06515	41.7	0.25265	1334	0.36218	1912	0.0146	2	0.40	0.05	4.98	0.0007	1.00	23.48	0.56	10.44	0.32	0.10	0.02
TT-34	434	0.02312	14.8	0.14795	781	0.18825	994	0.0226	30	0.35	0.05	5.00	0.0007	1.00	19.35	1.31	12.70	3.97	2.74	1.80
TT-35	435	0.05650	36.2	0.12625	667	0.36887	1948	0.0170	5	0.40	0.05	4.93	0.0008	0.95	32.21	0.89	17.62	1.11	0.50	0.12
TT-36	436	0.34202	218.9	0.44891	2370	1.02863	5431	0.0153	45	0.35	0.05	4.74	0.0013	0.79	441.78	2.02	325.18	119.68	89.52	60.77
TT-37	437	0.07041	45.1	0.18222	962	0.41848	2210	0.0162	3	0.40	0.05	4.83	0.0011	0.86	43.24	0.96	24.65	0.90	0.47	0.06
TT-38	638	0.05689	36.4	0.23176	1224	0.34051	1798	0.0214	48	0.35	0.05	4.94	0.0008	0.95	76.45	2.10	56.11	23.62	17.59	13.06
TT-39	639	0.07456	47.7	0.36281	1916	0.52203	2756	0.0121	70	0.40	0.05	4.97	0.0008	0.98	108.46	2.27	83.67	41.70	32.87	24.96
TT-40	440	0.01580	10.1	0.13973	738	0.25226	1332	0.0092	5	0.40	0.05	4.80	0.0011	0.84	7.30	0.72	4.32	0.25	0.13	0.03
TT-41	641	0.06719	43.0	0.17752	937	0.35787	1890	0.0136	27	0.35	0.05	4.71	0.0013	0.77	67.34	1.57	47.85	12.43	8.64	5.41
TT-42	642	0.03516	22.5	0.16064	848	0.36100	1906	0.0070	25	0.35	0.05	4.78	0.0012	0.83	23.81	1.06	16.15	3.91	2.71	1.65
TT-43	443	0.03389	21.7	0.16138	852	0.22425	1184	0.0123	39	0.40	0.10	4.85	0.0010	0.88	39.54	1.82	28.08	9.64	6.89	4.77
TT-44	644	0.09710	62.1	0.25304	1336	0.46344	2447	0.0141	27	0.35	0.05	4.53	0.0017	0.63	99.18	1.60	72.14	22.84	12.77	8.22
TT-45	445	0.04196	26.9	0.19439	1026	0.34493	1821	0.0142	70	0.40	0.05	4.72	0.0013	0.78	77.59	2.89	60.47	30.07	23.41	17.01
TT-46	446	0.12297	78.7	0.33234	1755	0.55303	2920	0.0059	21	0.40	0.05	4.50	0.0018	0.60	90.85	1.15	64.70	17.10	9.26	5.63
TT-47	647	0.06774	43.4	0.20188	1066	0.43324	2288	0.0115	28	0.35	0.05	4.50	0.0018	0.60	68.40	1.58	50.11	16.36	8.97	5.82
TT-48	648	0.04840	31.0	0.18823	994	0.29774	1572	0.0076	26	0.35	0.05	4.50	0.0018	0.60	44.92	1.45	32.92	10.60	5.68	3.66
TT-49	649	0.02395	15.3	0.15219	804	0.25524	1348	0.0158	21	0.35	0.05	4.50	0.0018	0.60	21.35	1.39	15.46	4.59	2.23	1.40
TT-50	650	0.07948	50.9	0.16943	895	0.41075	2169	0.0140	23	0.35	0.05	4.50	0.0018	0.60	86.34	1.70	63.34	19.93	10.03	6.27
TT-51	451	0.01342	8.6	0.08013	423	0.17058	901	0.0133	21	0.35	0.05	4.50	0.0018	0.60	13.63	1.59	10.04	3.04	1.46	0.91
TT-52	452	0.00657	4.2	0.04816	254	0.10360	547	0.0240	30	0.35	0.05	4.50	0.0018	0.60	9.44	2.25	7.05	2.51	1.40	0.88
TT-53	653	0.05776	37.0	0.14500	766	0.25480	1345	0.0174	26	0.35	0.05	4.50	0.0018	0.60	75.41	2.04	56.34	18.59	9.78	6.26
TT-54	654	0.09979	63.9	0.17300	913	0.35086	1853	0.0209	22	0.35	0.05	4.50	0.0018	0.60	129.81	2.03	96.31	30.03	14.63	9.16
TT-55	455	0.05376	34.4	0.24610	1299	0.49331	2605	0.0111	2	0.40	0.05	4.50	0.0018	0.60	32.46	0.94	21.95	2.86	0.33	0.15
TT-56	656	0.09320	59.6	0.28640	1512	0.54963	2902	0.0108	46	0.40	0.10	4.24	0.0018	0.58	123.36	2.07	94.12	37.09	24.72	16.67
TT-57	657	0.03302	21.1	0.14885	786	0.31023	1638	0.0070	25	0.35	0.05	4.50	0.0018	0.60	28.04	1.33	20.47	6.46	3.41	2.18
TT-58	458	0.02917	18.7	0.59689	3152	0.69730	3682	0.0105	9	0.40	0.05	4.47	0.0018	0.60	8.98	0.48	5.97	1.08	0.39	0.18
TT-59	459	0.45848	293.4	0.60423	3190	0.81906	4325	0.0118	3	0.40	0.05	3.08	0.0018	0.51	352.34	1.20	247.13	54.69	8.94	3.11
TT-60	460	0.10635	68.1	0.21998	1162	0.41644	2199	0.0104	43	0.35	0.05	3.67	0.0018	0.54	171.91	2.53	131.93	55.04	35.97	23.50
TT-61	461	0.02262	14.5	0.17294	913	0.46312	2445	0.0190	29	0.35	0.05	4.50	0.0018	0.60	18.32	1.27	13.42	4.35	2.42	1.55
TT-62	462	0.08492	54.4	0.19670	1039	0.39653	2094	0.0053	60	0.35	0.05	3.04	0.0018	0.50	152.46	2.81	119.70	58.56	41.99	28.62
TT-63	463	0.03806	24.4	0.19139	1011	0.28670	1514	0.0100	52	0.40	0.10	3.04	0.0018	0.50	59.61	2.45	46.23	20.15	13.43	9.16
TT-64	464	0.01827	11.7	0.08370	442	0.17267	912	0.0105	10	0.40	0.05	3.00	0.0018	0.50	18.36	1.57	13.20	3.60	1.20	0.57
TT-65	465	0.00821	5.3	0.10306	544	0.20323	1073	0.0211	2	0.40	0.05	3.35	0.0018	0.52	5.85	1.11	4.09	0.81	0.06	0.03
TT-66	466	0.06966	44.6	0.25739	1359	0.47210	2493	0.0178	9	0.40	0.10	3.55	0.0018	0.54	55.45	1.24	39.09	8.96	2.50	1.32
TT-67	667	0.07448	47.7	0.32788	1731	0.59914	3163	0.0172	31	0.35	0.05	3.81	0.0018	0.55	70.13	1.47	51.89	18.42	10.80	6.63
TT-68	668	0.01408	9.0	0.08710	460	0.17967	949	0.0263	23	0.35	0.05	3.32	0.0018	0.52	16.69	1.85	12.53	4.36	2.40	1.29
TT-69	669	0.09974	63.8	0.31918	1685	0.52870	2792	0.0103	33	0.35	0.05	3.74	0.0018	0.55	105.44	1.65	78.78	28.94	17.41	10.79
TT-70	670	0.11356	72.7	0.24524	1295	0.46793	2471	0.0166	27	0.35	0.05	4.50	0.0018	0.60	128.05	1.76	93.82	31.14	16.86	10.74
TT-71	471	0.21215	135.8	0.32488	1715	0.65177	3441	0.0151	2	0.40	0.05	4.50	0.0018	0.60	177.11	1.30	121.18	16.46	1.84	0.86
TT-72	672	0.07282	46.6	0.22454	1186	0.40451	2136	0.0263	27	0.35	0.05	4.34	0.0018	0.59	82.97	1.78	61.79	20.68	11.06	7.09
TT-73	673	0.06968	44.6	0.17407	919	0.36406	1922	0.0210	24	0.35	0.05	4.10	0.0018	0.57	81.87	1.84	61.29	20.21	10.50	6.41
TT-74	674	0.06518	41.7	0.17672	933	0.36826	1944	0.0228	24	0.35	0.05	4.50	0.0018	0.60	74.32	1.78	55.33	17.68	9.04	5.70
TT-75	475	0.07280	46.6	0.15103	797	0.27042	1428	0.0181	2	0.40	0.05	4.42	0.0018	0.59	78.01	1.67	54.43	8.04	0.86	0.40
TT-76	476	0.07751	49.6	0.21629	1142	0.41828	2209	0.0126	4	0.40	0.05	3.34	0.0018	0.52	65.56	1.32	45.99	9.87	1.45	0.77
TT-77	477	0.03562	22.8	0.17641	931	0.28145	1486	0.0104	9	0.40	0.05	3.34	0.0018	0.52	28.41	1.25	20.16	4.89	1.36	0.74
TT-78	478	0.05282	33.8	0.29468	1556	0.53458	2823	0.0073	68	0.35	0.05	3.00	0.0018	0.50	75.50	2.23	60.11	30.18	22.47	15.77
TT-79	479	0.02061	13.2	0.23427	1237	0.41686	2201	0.0061	5	0.40	0.05	3.00	0.0018	0.50	9.54	0.72	6.51	1.48	0.35	0.13
TT-80	480	0.02001	12.8	0.39569	2089	0.60945	3218	0.0181	53	0.40	0.05	3.00	0.0018	0.50	17.54	1.37	13.49	5.88	4.04	2.80
TT-81	681	0.01714	11.0	0.11771	621	0.27218	1437	0.0249	39	0.35	0.05	3.02	0.0018	0.50	24.04	2.19	18.49	7.65	4.94	3.01
TT-82	682	0.03673	23.5	0.17084	902	0.27364	1445	0.0284	45	0.35	0.05	3.18	0.0018	0.51	64.82	2.76	49.88	22.34	14.79	9.48
TT-83	483	0.10501	67.2	0.34258	1809	0.56799	2999	0.0184	72	0.35	0.05	3.29	0.0018	0.52	203.22	3.02	162.74	85.25	63.94	45.33
TT-84	484	0.18923	121.1	0.42132	2225	0.70669	3731	0.0123	76	0.35	0.05	3.36	0.0018	0.52	377.99	3.12	301.18	158.02	120.66	87.28
TT-85	485	0.13972	89.4	0.33732	1781	0.64838	3423	0.0090	13	0.40	0.05	3.68	0.0018	0.54	104.15	1.16	73.51	18.17	6.93	3.94
TT-86	686	0.10651	68.2	0.34577	1826	0.42248	2231	0.0131	45	0.35	0.05	3.04	0.0018	0.50	162.90	2.39	126.05	55.09	36.84	23.44
TT-87	487	0.06404	41.0	0.15657	827	0.33573	1773	0.0113	2	0.40	0.05	2.99	0.0018	0.50	60.54	1.48	42.92	9.80	1.49	0.38
TT-88	488	0.06092	39.0	0.46237	2441	0.74704	3944	0.0155	10	0.40	0.05	4.01	0.0018	0.57	30.26	0.78	20.55	4.27	1.49	0.73
TT-89	489	0.01039	6.7	0.07540	398	0.10888	575	0.0118	24	0.35	0.05	4.50	0.0018	0.60	11.70	1.76	8.72	2.78	1.42	0.90
TT-90	490	0.00401	2.6	0.05027	265	0.07736	408	0.0051	10	0.35	0.05	4.50	0.0018	0.60	3.22	1.25	2.27	0.54	0.17	0.09
TT-91	491	0.09632	61.6	0.26608	1405	0.48227	2546	0.0166	27	0.35	0.05	4.34	0.0018	0.59	99.86	1.62	73.22	24.13	12.96	8.41
TT-92	492	0.02868	18.4	0.09054	478	0.18245	963	0.0055	21	0.40	0.05	4.50	0.0018	0.60	29.52	1.61	21.43	5.87	3.13	1.90
TT-93	493	0.10082	64.5	0.26096	1378	0.41290	2180	0.0139	12	0.40	0.05	4.88	0.0009	0.91	61.57	0.95	36.53	5.03	2.84	1.07
TT-94	494	0.04333	27.7	0.12533	662	0.21093	1114	0.0160	17	0.40	0.05	4.49	0.0012	0.80	42.93	1.55	29.02	5.21	3.43	1.82
TT-95	495	0.10549	67.5	0.15318	809	0.36458	1925	0.0106	11	0.40	0.05	4.55	0.0017	0.65	107.45	1.59	74.55	13.08	5.91	2.93
TT-96	496	0.04344	27.8	0.17147	905	0.34942	1845	0.0137	36	0.35	0.05	3.63	0.0018	0.54	55.73	2.00	42.43	16.41	10.20	6.35
TT-97	497	0.05625	36.0	0.19162	1012	0.38465	2031	0.0116	50	0.35	0.05	3.70	0.0022	0.62	90.74	2.52	70.39	31.51	21.55	14.34
Totals/Averages			**5030.1**						**24**						**79.22**	**1.53**	**56.55**	**17.46**	**10.59**	**6.90**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3



Tri-Town Basin Crossings

Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation	SWMM Node
TT-C1	Wetland Loop	(4) 4' H x 14' W RCBC	< 100-Year	4901.9	402
TT-C2	County Road 20/Bella Rosa Parkway	48" RCP	< 2-Year	4906.4	404
TT-C3	County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	(2) 8' H x 12' W RCBC	> 100-Year	4943.2	407
TT-C4	McClure Avenue	Bridge Crossing (Approximated as 3' H x 53.5' W RCBC)	> 100-Year	4953.7	409
TT-C5	County Road 16/Tipple Parkway/ First Street	6' H x 10' W RCBC	< 100-Year	4963.7	410
TT-C6	Fifth Street	6' H x 13' W RCBC	> 100-Year	4971.7	411
TT-C7	Eighth Street/Main Street (Outlet of Regional Detention Pond)	8' H x 6' W RCBC	> 100-Year	4982.9	412/612
TT-C8	Access Road Crossing North of Highway 52	4' H x 5' W RCBC	< 2-Year	5006.1	997
TT-C9	Highway 52	48" CMP (2) 30" H x 48" W CMP Pipe Arch	< 50-Year	5008.4 5007.8	999
TT-C10	Eighth Street	48" CMP 42" CMP	< 5-Year	5008.2 5008.8	414
TT-C11	Sixth Street, East of Colorado Blvd	(2) 24" H x 38" W HERCP	< 10-Year	5020.2	915
TT-C12	Second Street, East of Colorado Blvd	(2) 20" H x 30" W HERCP	< 10-Year	5030.2	415
TT-C13	Colorado Blvd, North of County Road 20/Bella Rosa Parkway	(2) 24" H x 38" W HERCP	< 50-Year	4900.6	426
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	Road Overtopping	< 2-Year	4917.9	428
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	(4) 36" RCP	< 10-Year	4916.4	427
TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	19" H x 30" W HERCP	< 50-Year	4956.1	940
TT-C17	Colorado Blvd, North of Hurt Street	(2) 27" PVC	< 50-Year	4956.7	443
TT-C18	Colorado Blvd, HWY 52 Intersection	36" RCP	< 50-Year	5018.5	477
TT-C19	Colorado Blvd, South of HWY 52	14" H x 23" W HERCP	< 50-Year	5026.4	980
TT-C20	HWY 52, East of Colorado Blvd Intersection	30" RCP	< 10-Year	5017.5	479
TT-C21	HWY 52, West of Birch Avenue	24" RCP	< 5-Year	5009.9	914
TT-C22	HWY 52, East of Cherry Street	24" RCP	> 100-Year	5011.7	983
TT-C23	HWY 52, West of Forest Avenue	36" CMP 24" CMP	> 100-Year	5020.6 5021.2	984
TT-C24	McClure Avenue Storm Sewer	24" & 36" RCP	< 50-Year	4973.6	448
TT-C25	Majestic Street, West of Colorado Blvd	14" H x 23" W HERCP	< 50-Year	4956.6	440
TT-C26	Tipple Parkway/First Street Storm Sewer	4' H x 10' W RCBC	> 100-Year	4965.0	460
TT-C27	Fifth Street Storm Sewer	24" RCP (2) 36" RCP	< 50-Year	4974.7 4972.6	462
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP	< 50-Year	5013.1	470
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate Ties into 24" RCP	< 10-Year	4995.1	467/667
TT-C30	Centennial Park Access Road	3' H x 10' W RCBC	> 100-Year	4988.7	464
TT-C31	County Road 15/Ridgeway Blvd, South of Highway 52	18" CMP	< 5-Year	5045.8	485
TT-C32	Glen Creighton Drive, South of Highway 52	18" CMP	< 5-Year	5037.2	985
TT-C33	Forest Avenue, South of Highway 52	(2) 18" CMP	> 100-Year	5022.1	985 (Link)
TT-C34	County Road 18/Godding Hollow Parkway, East of Frederick Skate Park	18" RCP	< 10-Year	4956.1	495
TT-C35	County Road 18/Godding Hollow Parkway, West of County Road 13/Colorado Blvd	18" RCP 24" RCP	< 100-Year	4949.6 4946.3	494
TT-C36	Eighth Street, West of Birch Ave	(2) 24" ADS (1) 24"CMP	< 5-Year	5010.2	497
TT-C37	Carbondale Drive Storm Sewer	30" RCP	< 2-Year	5030.2	484
TT-C38	Carbondale Drive, East of Forest Avenue	(2) 18" CMP	< 2-Year	5025.0	483

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN EXISTING CONDITION CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER:	COTOF.03
DATE:	10/18/2021
SHEET:	TT
INDEX:	EC-CROSS

Table C.1.2: Existing Tri-Town Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
TT-C1	Wetland Loop	402	(4) 4' H x 14' W RCBC	4901.9	2500	< 100-Year	> 100-Year	156	253	425	1714	2627	147	225	335	1156	1707	Good Condition - constructed circa 2001. Light vegetation and sediment build up.
TT-C2	County Road 20/Bella Rosa Parkway	404	48" RCP	4906.4	130	< 2-Year	< 2-Year	151	245	413	1682	2583	142	218	324	1121	1647	Good Condition - replaced after 2013 flood due to road being washed out. Heavy vegetation on both sides.
TT-C3	County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	407	(2) 8' H x 12' W RCBC	4943.2	1560	> 100-Year	> 100-Year	122	186	302	981	1464	118	176	255	701	1016	Good Condition - built in 2004/2005 Heavy vegetation on downstream side. Tree growing in channel on upstream side.
TT-C4	McClure Avenue	409	Bridge Crossing (Approximated as 3' H x 53.5' W RCBC)	4953.7	1070	> 100-Year	> 100-Year	78	121	214	691	987	74	112	167	417	569	Good Condition - built in 2018. Heavy vegetation on both sides of bridge in channel. Limited survey data and design drawings utilized to develop capacity calculation.
TT-C5	County Road 16/Tipple Parkway/ First Street	410	6' H x 10' W RCBC	4963.7	740	< 100-Year	> 100-Year	59	92	169	560	783	58	88	131	299	394	Good Condition - Minimal Vegetation.
TT-C6	Fifth Street	411	6' H x 13' W RCBC	4971.7	650	> 100-Year	> 100-Year	33	54	106	380	552	32	48	70	147	199	Good Condition - concrete trickle channel bottom. Vegetation is being maintained.
TT-C7	Eighth Street/Main Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	8' H x 6' W RCBC	4982.9	420	> 100-Year	> 100-Year	33	52	94	278	388	31	46	68	142	192	Good Condition.
TT-C8	Access Road Crossing North of Highway 52	997	4' H x 5' W RCBC	5006.1	60	< 2-Year	< 2-Year	138	214	314	871	1183	135	208	292	624	826	Fair Condition - appears to be a farm/local access crossing. Grouted riprap downstream of crossing for erosion protection. Due to low overtopping elevation, full capacity of culvert is not utilized and creates backwater for HWY 52 crossing (TT-C9).
TT-C9	Highway 52	999	48" CMP (2) 30" H x 48" W CMP Pipe Arch	5008.4 5007.8	280	< 50-Year	< 50-Year	107	173	249	776	1088	107	173	249	548	736	Fair Condition - three pipes crossing HWY 52 in this location. Grouted riprap at downstream side of crossing indicating previous erosion/road overtopping problems. Flows in excess of 10-year event anticipated to flood low lying properties south of Eighth Street.
TT-C10	Eighth Street	414	48" CMP 42" CMP	5008.2 5008.8	160	< 5-Year	< 5-Year	107	168	244	583	794	107	168	244	543	731	Fair Condition - two pipes crossing 8th Street in this location. Projecting edges of CMPs are starting to get bent.
TT-C11	Sixth Street, East of Colorado Blvd	915	(2) 24" H x 38" W HERCP	5020.2	55	< 10-Year	> 100-Year	12	19	58	229	344	5	7	8	14	19	Good Condition. Trash and tumble weeds blocking entrance.
TT-C12	Second Street, East of Colorado Blvd	415	(2) 20" H x 30" W HERCP	5030.2	50	< 10-Year	> 100-Year	9	15	52	216	308	4	5	6	12	16	Good Condition. Trash and tumble weeds blocking downstream side.
Other County Road 13/Colorado Blvd Crossings																		
TT-C13	Colorado Blvd, North of County Road 20/Bella Rosa Parkway	426	(2) 24" H x 38" W HERCP	4900.6	90	< 50-Year	< 50-Year	1	4	9	145	268	5	7	9	163	267	Good Condition - sump grate inlets.
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	428	Road Overtopping	4917.9	N/A	< 2-Year	< 2-Year	10	16	32	427	720	4	5	6	212	331	No existing crossing structure. Excess flow from TT-C15 crossing and Subbasin TT-20 overtop roadway.

Table C.1.2: Existing Tri-Town Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other County Road 13/Colorado Blvd Crossings (Continued)																		
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	427	(4) 36" RCP	4916.4	60	< 10-Year	< 50-Year	25	42	68	388	631	21	34	56	266	384	Good Condition. Due to low northern channel bank on upstream side, full capacity of culverts are not utilized. Excess flow will be conveyed north along roadside swale and then overtop Colorado Blvd at the low point (TT-C14 Crossing).
TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	940	19" H x 30" W HERCP	4956.1	15	< 50-Year	< 100-Year	2	2	3	18	50	2	2	3	14	35	Good Condition. Excess flow will overtop Colorado Blvd at low point.
TT-C17	Colorado Blvd, North of Hurt Street	443	(2) 27" PVC	4956.7	75	< 50-Year	< 100-Year	23	32	41	89	118	19	26	33	65	82	Good Condition. Excess flow will be conveyed north along roadside swale into Meadowlark Business Park South Detention Pond.
TT-C18	Colorado Blvd, HWY 52 Intersection	477	36" RCP	5018.5	50**	< 50-Year	< 50-Year	16	23	35	79	103	16	22	30	60	76	Good Condition - built in 2018 as part of intersection updates. Excess flow overtops Colorado Blvd, south of HWY 52.
TT-C19	Colorado Blvd, South of HWY 52	980	14" H x 23" W HERCP	5026.4	10**	< 50-Year	> 100-Year	3	4	6	13	17	1	2	2	2	3	Good Condition. Excess flow continues north along roadside swale to Hwy 52 intersection and TT-C18 crossing.
Other HWY 52 Crossings																		
TT-C20	HWY 52, East of Colorado Blvd Intersection	479	30" RCP	5017.5	30**	< 10-Year	> 100-Year	12	19	59	255	374	5	7	8	15	29	Good Condition - built in 2018 as part of intersection updates. Excess flow continues east along roadside swale to TT-21 crossing.
TT-C21	HWY 52, West of Birch Avenue	914	24" RCP	5009.9	15	< 5-Year	< 5-Year	14	20	47	245	367	14	20	20	20	20	Good Condition - built in 2018 as part of HWY 52 improvements. Serves as initial outfall for Basin TT-97. Flow reaching this crossing in future condition is limited by 8th Street culvert crossing (TT-C36 crossing). Excess flow reaching this area will continue east along roadside swale to TT-C9 crossing.
TT-C22	HWY 52, East of Cherry Street	983	24" RCP	5011.7	25**	> 100-Year	> 100-Year	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Fair Condition. Sediment build up at upstream end. Serves as initial outfall for area east of Cherry Street, between 8th and 7th Streets. This crossing picks up a small tributary area of localized flow that was not subdivided from Basin TT-14 in the SWMM model. Based on an area-weighted flow calculation, this crossing was determined to have sufficient capacity for the 100-year.
TT-C23	HWY 52, West of Forest Avenue	984	36" CMP 24" CMP	5020.6 5021.2	60	> 100-Year	> 100-Year	44	45	45	45	45	41	42	42	44	44	Good Condition. Serves as outfall for Carbondale Drive Storm Sewer (crossings TT-C37 and TT-C38). Capacity of existing crossing is adequate due to limited flow being conveyed to junction box.

Table C.1.2: Existing Tri-Town Basin Crossings

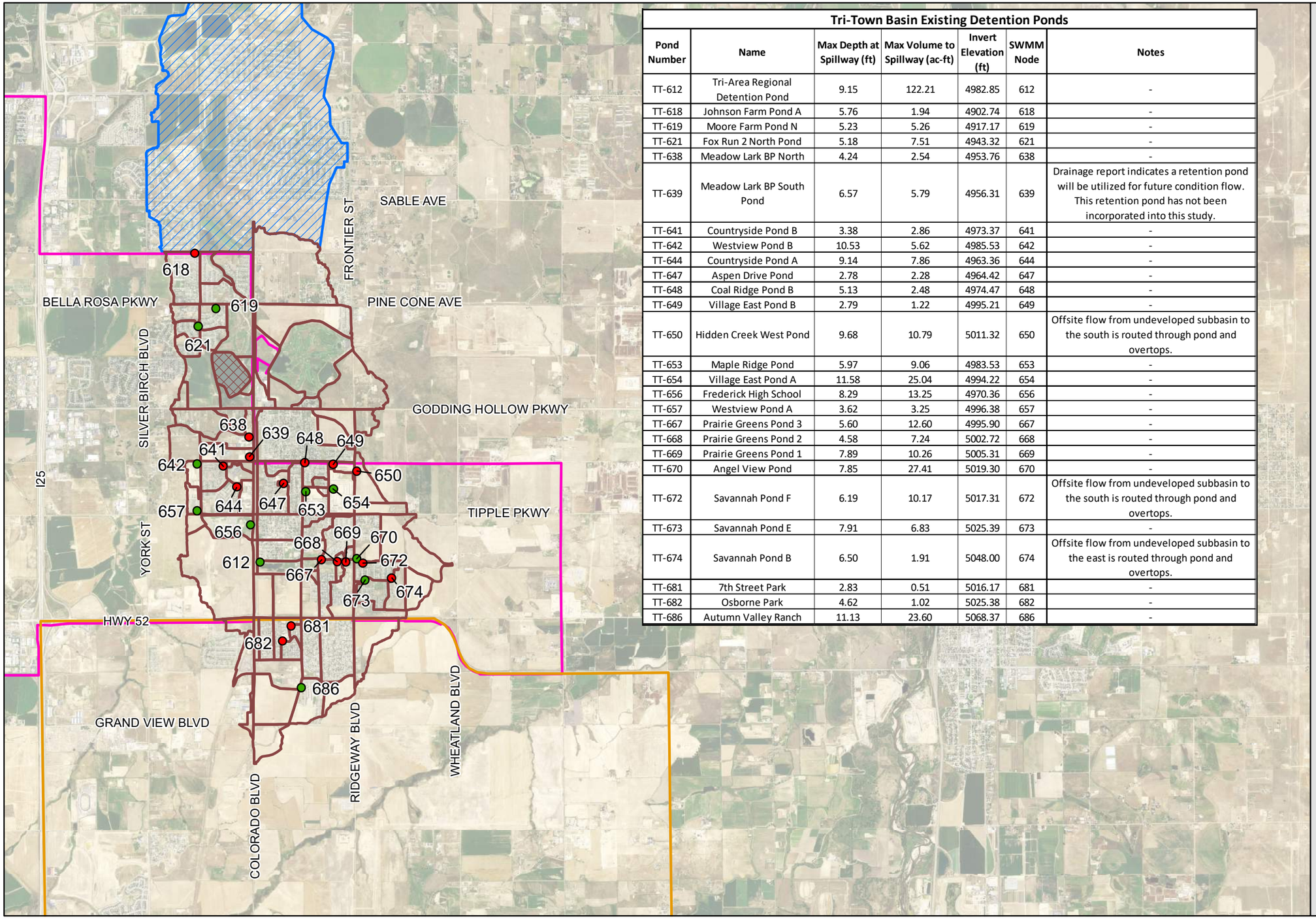
Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other Tributary & Storm Sewer Crossings																		
TT-C24	McClure Avenue Storm Sewer	448	24" & 36" RCP	4973.6	20**	< 50-Year	< 50-Year	2	5	10	34	65	2	5	10	33	65	Good Condition. Outfall for numerous detention ponds south of McClure and east of Maple Drive. Excess flow will continue west as street flow along McClure Street.
TT-C25	Majestic Street, West of Colorado Blvd	440	14" H x 23" W HERCP	4956.6	10**	< 50-Year	< 50-Year	2	2	3	19	50	2	2	3	14	35	Good Condition. Replaced in 2018 as part of the McClure Avenue Extension Project by Firestone. Erosion beginning to occur near asphalt at flared end sections. Excess flow overtops street and will continue north along roadside swale to TT-C16 crossing.
TT-C26	Tipple Parkway/First Street Storm Sewer	460	4' H x 10' W RCBC	4965.0	300	> 100-Year	> 100-Year	24	37	57	184	272	24	37	57	184	272	Good Condition. Drains large sump and inlet bank on southwest corner of 1st Street and Elm Street intersection. Outfalls to Tri-Town Channel upstream of 1st Street crossing.
TT-C27	Fifth Street Storm Sewer	462	24" RCP (2) 36" RCP	4974.7 4972.6	100	< 50-Year	< 50-Year	34	51	73	158	200	34	51	73	158	200	Good Condition. Three pipes comprise storm sewer at outfall, with new dual 36" pipes constructed in 2016. Excess flow heads north in streets to Tipple Parkway Storm Sewer (TT-C26).
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	470	24" RCP	5013.1	20**	< 50-Year	< 50-Year	9	12	17	70	189	9	12	15	25	61	Good Condition. Outfall for numerous detention ponds east of Ridgeway Blvd. Excess flow overtops Ridgeway Blvd to west into Prairie Greens Detention Pond.
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	467/667	36" RCP Pond 3 Outlet with Orifice Plate Ties into 24" RCP	4995.1	20**	< 10-Year	< 10-Year	13	17	21	29	139	13	17	21	29	47	Good Condition. Prairie Green Pond predicted to overtop during events in excess of 10-year. Excess flow overtops Frederick Way to west.
TT-C30	Centennial Park Access Road	464	3' H x 10' W RCBC	4988.7	250	> 100-Year	> 100-Year	1	1	4	17	121	1	1	4	13	28	Good Condition - built circa 2007 as part of access road construction.
TT-C31	County Road 15/Ridgeway Blvd, South of Highway 52	485	18" CMP	5045.8	5**	< 5-Year	> 100-Year	4	7	18	74	104	2	2	2	3	4	Poor Condition - west end of culvert is mostly crushed and plugged with sediment. Excess flow will overtop Ridgeway Blvd and be conveyed west along roadside swale to TT-C32 crossing.
TT-C32	Glen Creighton Drive, South of Highway 52	985	18" CMP	5037.2	5**	< 5-Year	> 100-Year	4	7	17	72	102	2	2	2	3	4	Fair Condition. Excess flow will be conveyed south along Glen Creighton Drive and into Carbondale Drive Storm Sewer (TT-C37 crossing).

Table C.1.2: Existing Tri-Town Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other Tributary & Storm Sewer Crossings (Continued)																		
TT-C33	Forest Avenue, South of Highway 52	985 (Link)	(2) 18" CMP	5022.1	20**	> 100-Year	> 100-Year	3	5	5	5	5	2	2	2	3	4	Fair Condition. Dual crossing pipes of Forest Ave drain into junction box associated with crossing TT-C23. Flow reaching this crossing is limited by the culvert upstream at Glen Creighton Drive (TT-C32 crossing). This crossing also picks up a small tributary area of localized flow that was not subdivided from Basin TT-14 in the SWMM model. Based on an area-weighted flow calculation, this crossing was determined to have sufficient capacity for the 100-year.
TT-C34	County Road 18/Godding Hollow Parkway, East of Frederick Skate Park	495	18" RCP	4956.1	10**	< 10-Year	> 100-Year	3	6	14	93	146	1	2	2	3	4	Good Condition. Crossing installed as part of 2016 road improvement project.
TT-C35	County Road 18/Godding Hollow Parkway, West of County Road 13/Colorado Blvd	494	18" RCP 24" RCP	4949.6 4946.3	35**	< 100-Year	> 100-Year	2	3	5	29	43	1	1	1	2	2	Good Condition. Crossings installed as part of 2016 road improvement project.
TT-C36	Eighth Street, West of Birch Ave	497	(2) 24" ADS (1) 24"CMP	5010.2	20	< 5-Year	< 5-Year	14	22	32	70	91	14	22	32	70	91	Good Condition. ADS pipes appear to have been recently installed. Capacity is limited by 24" RCP crossing of Highway 52 (TT-C21 crossing). Excess flow will overtop Birch Street and be conveyed east along roadside swale to TT-C10 crossing.
TT-C37	Carbondale Drive Storm Sewer	484	30" RCP	5030.2	30	< 2-Year	< 2-Year	87	121	159	344	455	87	121	158	301	378	Fair Condition. Pipes entering inlet box from drainage channel to east are clogged with debris on trash rack. Excess flow overtops Glen Creighton Drive and is conveyed west along Glen Ayre Street/drainage swale to TT-C38 crossing.
TT-C38	Carbondale Drive, East of Forest Avenue	483	(2) 18" CMP	5025.0	10	< 2-Year	< 2-Year	97	148	205	449	600	97	148	205	414	532	Poor Condition. Sediment clogging most of eastern pipe and half of western pipe. Excess flow overtops Forest Street and is conveyed west along 7th Street to TT-C10.

*HY-8 Program used to evaluate capacities unless otherwise noted

**Capacities evaluated in EPA-SWMM or StormCAD



Tri-Town Basin Existing Detention Ponds

Pond Number	Name	Max Depth at Spillway (ft)	Max Volume to Spillway (ac-ft)	Invert Elevation (ft)	SWMM Node	Notes
TT-612	Tri-Area Regional Detention Pond	9.15	122.21	4982.85	612	-
TT-618	Johnson Farm Pond A	5.76	1.94	4902.74	618	-
TT-619	Moore Farm Pond N	5.23	5.26	4917.17	619	-
TT-621	Fox Run 2 North Pond	5.18	7.51	4943.32	621	-
TT-638	Meadow Lark BP North	4.24	2.54	4953.76	638	-
TT-639	Meadow Lark BP South Pond	6.57	5.79	4956.31	639	Drainage report indicates a retention pond will be utilized for future condition flow. This retention pond has not been incorporated into this study.
TT-641	Countryside Pond B	3.38	2.86	4973.37	641	-
TT-642	Westview Pond B	10.53	5.62	4985.53	642	-
TT-644	Countryside Pond A	9.14	7.86	4963.36	644	-
TT-647	Aspen Drive Pond	2.78	2.28	4964.42	647	-
TT-648	Coal Ridge Pond B	5.13	2.48	4974.47	648	-
TT-649	Village East Pond B	2.79	1.22	4995.21	649	-
TT-650	Hidden Creek West Pond	9.68	10.79	5011.32	650	Offsite flow from undeveloped subbasin to the south is routed through pond and overtops.
TT-653	Maple Ridge Pond	5.97	9.06	4983.53	653	-
TT-654	Village East Pond A	11.58	25.04	4994.22	654	-
TT-656	Frederick High School	8.29	13.25	4970.36	656	-
TT-657	Westview Pond A	3.62	3.25	4996.38	657	-
TT-667	Prairie Greens Pond 3	5.60	12.60	4995.90	667	-
TT-668	Prairie Greens Pond 2	4.58	7.24	5002.72	668	-
TT-669	Prairie Greens Pond 1	7.89	10.26	5005.31	669	-
TT-670	Angel View Pond	7.85	27.41	5019.30	670	-
TT-672	Savannah Pond F	6.19	10.17	5017.31	672	Offsite flow from undeveloped subbasin to the south is routed through pond and overtops.
TT-673	Savannah Pond E	7.91	6.83	5025.39	673	-
TT-674	Savannah Pond B	6.50	1.91	5048.00	674	Offsite flow from undeveloped subbasin to the east is routed through pond and overtops.
TT-681	7th Street Park	2.83	0.51	5016.17	681	-
TT-682	Osborne Park	4.62	1.02	5025.38	682	-
TT-686	Autumn Valley Ranch	11.13	23.60	5068.37	686	-

Legend

- Detention Pond with Sufficient Volume for 100-Year Flow Event
- Detention Pond Anticipated to Overtop in 100-Year Flow Event
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN DETENTION POND MAP

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/18/2021	
SHEET: TT	INDEX: POND

TRI-TOWN EXISTING POND 612 - TRI-AREA REGIONAL POND

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4982.85	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4983.00	407115	9.35	0.15	20356	0.47	1.00	0.00	1.00	
4984.00	457316	10.50	1.15	452328	10.38	20.00	0.00	20.00	
4985.00	487004	11.18	2.15	924410	21.22	50.00	0.00	50.00	
4986.00	515981	11.85	3.15	1425833	32.73	90.00	0.00	90.00	
4987.00	544636	12.50	4.15	1956077	44.91	130.00	0.00	130.00	
4988.00	575257	13.21	5.15	2515953	57.76	182.00	0.00	182.00	
4989.00	625132	14.35	6.15	3115974	71.53	240.00	0.00	240.00	
4990.00	670621	15.40	7.15	3763718	86.40	300.00	0.00	300.00	
4991.00	745077	17.10	8.15	4471240	102.65	362.00	0.00	362.00	
4992.00	963777	22.13	9.15	5323325	122.21	422.00	0.00	422.00	Emergency Spillway Elevation
4993.00	1105173	25.37	10.15	6356994	145.94	480.00	175.00	655.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 6.0' wide x 8.0' high RCBC outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 618 - JOHNSON FARM POND A									
Stage (NAVD 88) (ft)[1]	**AutoCAD Area (ft^2)[2]**	**AutoCAD Area (acre)**	**Unit Depth (ft)**	**Total Volume (ft^3)**	**Total Volume (acre-ft)**	**Pipe Discharge (cfs)[3]**	**Weir Discharge (cfs)[4]**	**Total Discharge (cfs)**	**Notes:**
4902.74	0	0.00	0.00	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4903.00	10	0.00	0.26	1	0.00	0.31	0.00	0.31	Normal Depth Flow Through Pipe
4904.00	587	0.01	1.26	226	0.01	4.67	0.00	4.67	Orifice Flow Through 10-Year Opening
4905.00	5891	0.14	2.26	3005	0.07	7.53	0.00	7.53	
4906.00	15864	0.36	3.26	13478	0.31	9.57	0.00	9.57	
4907.00	26243	0.60	4.26	34315	0.79	11.25	0.00	11.25	
4908.00	36123	0.83	5.26	65367	1.50	12.71	0.00	12.71	
4908.06	38390	0.88	5.32	67602	1.55	12.79	0.00	12.79	Top of Inlet Box for 100-Year Opening
4908.50	39286	0.90	5.76	84690	1.94	26.72	0.00	26.72	Orifice Flow Through 100-Year Opening/ Emergency Spillway Elevation
4909.00	43119	0.99	6.26	105284	2.42	28.06	87.80	115.86	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 15" circular orifice outside of box

[3]100-Year discharge based 36" outlet pipe with 21.5" circular orifice in front

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 619 - MOORE FARM POND N

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4917.17	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4918.00	2862	0.07	0.83	792	0.02	3.04	0.00	3.04	Normal Depth Flow Through opening
4919.00	26768	0.61	1.83	13586	0.31	5.01	0.00	5.01	Orifice Flow Through 10-Year Opening
4920.00	58067	1.33	2.83	55006	1.26	7.59	0.00	7.59	
4920.85	71324	1.64	3.68	109901	2.52	9.22	0.00	9.22	Top of Inlet Box for 100-Year Opening
4921.00	72390	1.66	3.83	120679	2.77	16.18	0.00	16.18	Orifice Flow Through 100-Year Opening
4922.00	79181	1.82	4.83	196439	4.51	18.62	0.00	18.62	
4922.40	83222	1.91	5.23	228916	5.26	19.51	0.00	19.51	Emergency Spillway Elevation
4923.00	85802	1.97	5.83	279621	6.42	20.78	205.10	225.88	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.59' wide x 1.85' high rectangular orifice

[3]100-Year discharge based 24" outlet pipe with 18" circular orifice in front

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 621 - FOX RUN NORTH POND

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4943.32	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4944.00	28790	0.66	0.68	6526	0.15	0.79	0.00	0.79	Orifice Flow Through 100-Year Opening
4945.00	61259	1.41	1.68	50541	1.16	1.36	0.00	1.36	
4946.00	76438	1.75	2.68	119249	2.74	1.76	0.00	1.76	
4947.00	81808	1.88	3.68	198357	4.55	2.08	0.00	2.08	
4948.00	86934	2.00	4.68	282715	6.49	2.35	0.00	2.35	
4948.50	90761	2.08	5.18	327135	7.51	2.48	0.00	2.48	Emergency Spillway Elevation
4949.00	93564	2.15	5.68	373215	8.57	2.60	112.80	115.40	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 12" outlet pipe with orifice plate located 4" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 638 - MEADOWLARK BUSINESS PARK (NORTH POND)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4953.76	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4954.00	5763	0.13	0.24	461	0.01	0.00	0.00	0.00	
4955.00	24647	0.57	1.24	14570	0.33	0.00	0.00	0.00	
4956.00	28980	0.67	2.24	41354	0.95	0.00	0.00	0.00	
4956.45	32322	0.74	2.69	55141	1.27	0.00	0.00	0.00	Invert of 10-Year Weir
4957.00	34470	0.79	3.24	73505	1.69	0.19	0.00	0.19	Weir Flow Through 10-Year Opening
4957.50	37439	0.86	3.74	91477	2.10	0.98	0.00	0.98	
4957.90	38406	0.88	4.14	106646	2.45	2.19	0.00	2.19	Top of Inlet Box for 100-Year Opening
4958.00	40034	0.92	4.24	110568	2.54	3.28	0.00	3.28	Add Weir Flow Around Top of Box/ Emergency Spillway Elevation
4958.50	40544	0.93	4.74	130712	3.00	17.00	59.00	76.00	Orifice Flow Through 100-Year Opening

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.9' wide x 1.45' high triangular weir

[3]Discharge controlled by weir around 3.5' wide x 3.0' long top of box

[3]100-Year discharge based 18" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 639 - MEADOWLARK BUSINESS PARK (SOUTH POND)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4956.31	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4957.00	429	0.01	0.69	99	0.00	0.00	0.00	0.00	
4958.00	15137	0.35	1.69	6137	0.14	0.00	0.00	0.00	
4959.00	41464	0.95	2.69	33354	0.77	0.00	0.00	0.00	
4960.00	54504	1.25	3.69	81190	1.86	0.00	0.00	0.00	
4960.88	58128	1.33	4.57	130739	3.00	0.00	0.00	0.00	Invert of 10-Year Weir
4961.00	49488	1.14	4.69	137189	3.15	0.00	0.00	0.00	Weir Flow Through 10-Year Opening
4962.00	64245	1.47	5.69	193895	4.45	1.10	0.00	1.10	
4962.55	66835	1.53	6.24	229940	5.28	3.00	0.00	3.00	Top of Inlet Box for 100-Year Opening
4962.88	68709	1.58	6.57	252304	5.79	11.64	0.00	11.64	Add Weir Flow Around Top of Box/ Emergency Spillway Elevation
4963.00	69461	1.59	6.69	260594	5.98	16.76	6.90	23.66	
4963.50	72874	1.67	7.19	296174	6.80	21.59	101.10	122.69	Orifice Flow Through 100-Year Opening

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 1.0' wide x 1.67' high triangular weir

[3]Discharge controlled by weir around 4.3' wide x 4.3' long top of box

[3]100-Year discharge based 18" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 641 - COUNTRYSIDE (POND B)									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4973.37	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4974.00	17336	0.40	0.63	3641	0.08	0.82	0.00	0.82	Orifice Flow Through 10-Year Opening
4975.00	41468	0.95	1.63	32179	0.74	1.87	0.00	1.87	
4975.75	43426	1.00	2.38	64012	1.47	2.37	0.00	2.37	Top of Inlet Box for 100-Year Opening
4976.00	60268	1.38	2.63	76916	1.77	11.67	0.00	11.67	Orifice Flow Through 100-Year Opening
4976.75	66354	1.52	3.38	124381	2.86	13.80	0.00	13.80	Emergency Spillway Elevation
4977.00	69442	1.59	3.63	141354	3.25	14.44	8.50	22.94	
4977.50	74717	1.72	4.13	177386	4.07	15.64	105.39	121.03	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 8" diameter circular orifice on front of box

[3]100-Year discharge based 18" outlet pipe with no orifice

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 642 - WESTVIEW (POND B)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4985.53	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4986.00	238	0.01	0.47	37	0.00	0.33	0.00	0.33	Orifice Flow Through 100-Year Opening
4987.00	5169	0.12	1.47	2209	0.05	0.62	0.00	0.62	
4988.00	15919	0.37	2.47	12262	0.28	0.82	0.00	0.82	
4989.00	19980	0.46	3.47	30174	0.69	0.97	0.00	0.97	
4990.00	22641	0.52	4.47	51470	1.18	1.11	0.00	1.11	
4991.00	25537	0.59	5.47	75544	1.73	1.23	0.00	1.23	
4992.00	28490	0.65	6.47	102544	2.35	1.34	0.00	1.34	
4993.00	31624	0.73	7.47	132587	3.04	1.44	0.00	1.44	
4994.00	34891	0.80	8.47	165831	3.81	1.53	0.00	1.53	
4995.00	38196	0.88	9.47	202362	4.65	1.62	0.00	1.62	
4996.00	41685	0.96	10.47	242290	5.56	1.71	0.00	1.71	
4996.06	42573	0.98	10.53	244818	5.62	1.71	0.00	1.71	Emergency Spillway Elevation
4997.00	45562	1.05	11.47	286233	6.57	1.79	465.1	466.89	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

Appears water quality orifice plate has been removed or never installed

[3]100-Year discharge based 18" outlet pipe with orifice plate located 2" above pipe invert (orifice controls all pond releases)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 644 - COUNTRYSIDE (POND A)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4963.36	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4964.00	12	0.00	0.64	3	0.00	0.00	0.00	0.00	
4965.00	12	0.00	1.64	15	0.00	0.00	0.00	0.00	
4966.00	12	0.00	2.64	27	0.00	0.00	0.00	0.00	
4966.15	12	0.00	2.79	28	0.00	0.00	0.00	0.00	
4967.00	550	0.01	3.64	210	0.00	1.31	0.00	1.31	Orifice Flow Through 10-Year Opening
4968.00	23852	0.55	4.64	9551	0.22	2.24	0.00	2.24	
4969.00	58915	1.35	5.64	49636	1.14	2.89	0.00	2.89	Top of Inlet Box for 100-Year Opening/ Orifice Flow Through 100-Year Opening
4970.00	80633	1.85	6.64	119126	2.73	2.59	0.00	2.59	
4971.00	88035	2.02	7.64	203433	4.67	2.83	0.00	2.83	
4972.00	94045	2.16	8.64	294457	6.76	3.01	0.00	3.01	
4972.50	98497	2.26	9.14	342588	7.86	3.10	0.00	3.10	Emergency Spillway Elevation
4973.00	101231	2.32	9.64	392519	9.01	3.18	68.94	72.12	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 8" diameter circular orifice on front of box

[3]100-Year discharge based 12" outlet pipe with 6" circular orifice in front

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 647 - ASPEN DRIVE POND

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4964.42	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4965.00	10730	0.25	0.58	2075	0.05	1.48	0.00	1.48	Orifice Flow Through Low Flow Opening
4966.00	50402	1.16	1.58	30204	0.69	5.42	0.00	5.42	
4966.40	56624	1.30	1.98	51597	1.18	6.35	0.00	6.35	Top of Inlet Box for 100-Year Opening
4967.00	60840	1.40	2.58	86829	1.99	24.77	0.00	24.77	Add Weir Flow Around Top of Box
4967.20	64935	1.49	2.78	99404	2.28	44.96	0.00	44.96	Emergency Spillway Elevation
4968.00	68861	1.58	3.58	152915	3.51	58.19	81.87	140.06	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Low flow discharge based on 1.0' wide x 1.0' high rectangular orifice at bottom of box

[3]Discharge controlled by weir around 2.0' wide x 10.0' long top of box

[3]100-Year discharge based dual 27" outlet pipes with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 648 - COAL RIDGE (POND B)									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4974.47	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4975.00	750	0.02	0.53	132	0.00	0.00	0.00	0.00	
4976.00	1438	0.03	1.53	1208	0.03	0.00	0.00	0.00	
4977.00	17395	0.40	2.53	9153	0.21	0.00	0.00	0.00	
4977.70	27913	0.64	3.23	24866	0.57	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
4978.00	33894	0.78	3.53	34123	0.78	7.14	0.00	7.14	Weir Flow Around Top of Box
4979.00	50522	1.16	4.53	76055	1.75	13.60	0.00	13.60	Orifice Flow Through 100-Year Opening
4979.60	56143	1.29	5.13	108040	2.48	14.57	0.00	14.57	Emergency Spillway Elevation
4980.00	60539	1.39	5.53	131371	3.02	15.18	73.36	88.54	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Discharge controlled by weir around 3.6' wide x 4.6' long top of box

[3]100-Year discharge based 24" outlet pipe with orifice plate located 11" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 649 - VILLAGE EAST (POND B)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4995.21	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4996.00	20769	0.48	0.79	5469	0.13	0.00	0.00	0.00	
4997.00	24046	0.55	1.79	27856	0.64	0.00	0.00	0.00	
4997.60	24771	0.57	2.39	42501	0.98	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
4998.00	27505	0.63	2.79	52951	1.22	1.19	0.00	1.19	Orifice Flow Through 100-Year Opening/ Emergency Spillway Elevation
4999.00	30694	0.70	3.79	82036	1.88	1.39	145.00	146.39	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 18" outlet pipe with orifice plate located 2" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 650 - HIDDEN CREEK (WEST POND)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5011.32	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5012.00	310	0.01	0.68	70	0.00	0.00	0.00	0.00	
5013.00	1234	0.03	1.68	791	0.02	0.00	0.00	0.00	
5013.50	11044	0.25	2.18	3453	0.08	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
5014.00	15704	0.36	2.68	10106	0.23	1.76	0.00	1.76	Orifice Flow Through 100-Year Opening
5015.00	57011	1.31	3.68	44318	1.02	2.08	0.00	2.08	
5016.00	61489	1.41	4.68	103553	2.38	2.36	0.00	2.36	
5017.00	66084	1.52	5.68	167326	3.84	2.60	0.00	2.60	
5018.00	70787	1.63	6.68	235748	5.41	2.83	0.00	2.83	
5019.00	75598	1.74	7.68	308928	7.09	3.04	0.00	3.04	
5020.00	80517	1.85	8.68	386972	8.88	3.23	0.00	3.23	
5021.00	85543	1.96	9.68	469989	10.79	3.42	0.00	3.42	Emergency Spillway Elevation
5022.00	90676	2.08	10.68	558086	12.81	3.59	170.00	173.59	

[1]Invert based on survey

[2]Based on as-built pond certification

[3]100-Year discharge based 15" outlet pipe with orifice plate located 3.6" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 653 - MAPLE RIDGE

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4983.53	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4984.00	383	0.01	0.47	60	0.00	0.89	0.00	0.89	Orifice Flow Through 100-Year Opening
4985.00	26568	0.61	1.47	10108	0.23	1.95	0.00	1.95	
4986.00	52659	1.21	2.47	48985	1.12	2.61	0.00	2.61	
4987.00	77037	1.77	3.47	113447	2.60	3.13	0.00	3.13	
4988.00	106168	2.44	4.47	204661	4.70	3.58	0.00	3.58	
4989.00	133407	3.06	5.47	324190	7.44	3.98	0.00	3.98	
4989.50	147714	3.39	5.97	394440	9.06	4.16	0.00	4.16	Emergency Spillway Elevation
4990.00	165950	3.81	6.47	472811	10.85	4.34	55.10	59.44	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 15" outlet pipe with orifice plate located 5" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 654 - VILLAGE EAST (POND A)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4994.22	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4995.00	23406	0.54	0.78	6086	0.14	0.00	0.00	0.00	
4996.00	75241	1.73	1.78	52956	1.22	0.00	0.00	0.00	
4997.00	81149	1.86	2.78	131133	3.01	0.00	0.00	0.00	
4997.20	83395	1.91	2.98	147586	3.39	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
4998.00	87199	2.00	3.78	215818	4.95	1.00	0.00	1.00	Orifice Flow Through 100-Year Opening
4999.00	93363	2.14	4.78	306082	7.03	1.13	0.00	1.13	
5000.00	99692	2.29	5.78	402592	9.24	1.24	0.00	1.24	
5001.00	106111	2.44	6.78	505477	11.60	1.35	0.00	1.35	
5002.00	112664	2.59	7.78	614848	14.11	1.45	0.00	1.45	
5003.00	119337	2.74	8.78	730832	16.78	1.54	0.00	1.54	
5004.00	126065	2.89	9.78	853517	19.59	1.62	0.00	1.62	
5005.00	132965	3.05	10.78	983017	22.57	1.71	0.00	1.71	
5005.80	136457	3.13	11.58	1090783	25.04	1.77	0.00	1.77	Emergency Spillway Elevation
5006.00	156151	3.58	11.78	1120022	25.71	1.78	34.42	36.20	
5007.00	176336	4.05	12.78	1286163	29.53	1.86	314.21	316.07	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 15" outlet pipe with orifice plate located 2" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 656 - FREDERICK HIGH SCHOOL									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4970.36	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4971.00	25	0.00	0.64	5	0.00	0.00	0.00	0.00	
4972.00	25	0.00	1.64	30	0.00	0.00	0.00	0.00	
4973.00	25	0.00	2.64	55	0.00	0.00	0.00	0.00	
4973.88	25867	0.59	3.52	7886	0.18	0.00	0.00	0.00	Invert of 10-Year Opening
4974.00	51314	1.18	3.64	12431	0.29	0.11	0.00	0.11	Weir Flow Through 10-Year Opening
4975.00	90710	2.08	4.64	82514	1.89	2.25	0.00	2.25	Orifice Flow Through 10-Year Opening
4976.00	120691	2.77	5.64	187858	4.31	5.72	0.00	5.72	
4977.00	133290	3.06	6.64	314796	7.23	6.20	0.00	6.20	
4977.75	137259	3.15	7.39	416248	9.56	6.54	0.00	6.54	Top of Inlet Box for 100-Year Opening
4978.00	157318	3.61	7.64	453042	10.40	12.75	0.00	12.75	Add Weir Flow Around Top of Box
4978.65	226248	5.19	8.29	577024	13.25	21.77	0.00	21.77	Orifice Flow Through 100-Year Opening/ Emergency Spillway Elevation
4979.00	235467	5.41	8.64	657819	15.10	22.22	58.21	80.43	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.5' wide x 1.0' high rectangular weir/orifice on front of box

[3]Discharge controlled by weir around 4.6' wide x 4.6' long top of box

[3]100-Year discharge based 24" outlet pipe with orifice plate located 12" above pipe invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 657 - WESTVIEW (POND A)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4996.38	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4997.00	28838	0.66	0.62	5960	0.14	0.46	0.00	0.46	Orifice Flow Through 100-Year Opening
4998.00	41842	0.96	1.62	41099	0.94	0.78	0.00	0.78	
4999.00	51069	1.17	2.62	87478	2.01	1.00	0.00	1.00	
5000.00	56973	1.31	3.62	141473	3.25	1.18	0.00	1.18	Emergency Spillway Elevation
5001.00	63070	1.45	4.62	201468	4.63	1.33	78.50	79.83	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

Appears water quality orifice plate has been removed or never installed

[3]100-Year discharge based 24" outlet pipe with orifice plate located 2" above pipe invert (orifice controls all pond releases)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 667 - PRAIRIE GREENS (POND 3)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4995.90	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4996.00	364	0.01	0.10	12	0.00	0.11	0.00	0.11	Normal Depth Flow Through Opening
4997.00	10892	0.25	1.10	4428	0.10	3.54	0.00	3.54	Normal Depth Flow Through Opening
4998.00	51067	1.17	2.10	32942	0.76	16.78	0.00	16.78	Orifice Flow Through 100-Year Opening
4999.00	122045	2.80	3.10	116961	2.69	22.14	0.00	22.14	
5000.00	172366	3.96	4.10	263445	6.05	26.44	0.00	26.44	
5001.00	196332	4.51	5.10	447664	10.28	30.13	0.00	30.13	
5001.50	209094	4.80	5.60	549004	12.60	31.81	0.00	31.81	Emergency Spillway Elevation
5002.00	243758	5.60	6.10	662106	15.20	33.41	114.9	148.31	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based on 2.0' wide x 1.5' high rectangular orifice in front of 36" outlet pipe

*Note: Orifice plate was removed at time of site visit, but assumed to be in place for modeling

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 668 - PRAIRIE GREENS (POND 2)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5002.72	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5003.00	560	0.01	0.28	52	0.00	1.67	0.00	1.67	Normal Depth Flow Through Opening
5004.00	77533	1.78	1.28	28280	0.65	6.71	0.00	6.71	Orifice Flow Through 100-Year Opening
5005.00	83230	1.91	2.28	108644	2.49	10.89	0.00	10.89	
5006.00	89614	2.06	3.28	195047	4.48	13.86	0.00	13.86	
5007.00	94377	2.17	4.28	287032	6.59	16.29	0.00	16.29	
5007.30	95794	2.20	4.58	315558	7.24	16.95	0.00	16.95	Emergency Spillway Elevation
5008.00	99101	2.28	5.28	383768	8.81	18.41	69.00	87.41	
5009.00	103901	2.39	6.28	485259	11.14	20.31	305.00	325.31	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based on 1.33' wide x 1.33' high rectangular orifice in front of 24" outlet pipe

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 669 - PRAIRIE GREENS (POND 1)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5005.31	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5006.00	31297	0.72	0.69	7198	0.17	2.24	0.00	2.24	Normal Depth Flow Through Opening
5007.00	43109	0.99	1.69	44244	1.02	8.67	0.00	8.67	Orifice Flow Through 100-Year Opening
5008.00	56454	1.30	2.69	93876	2.16	12.19	0.00	12.19	
5009.00	62013	1.42	3.69	153087	3.51	14.90	0.00	14.90	
5010.00	65978	1.51	4.69	217072	4.98	17.19	0.00	17.19	
5011.00	69653	1.60	5.69	284880	6.54	19.21	0.00	19.21	
5012.00	73319	1.68	6.69	356358	8.18	21.03	0.00	21.03	
5013.00	77103	1.77	7.69	431561	9.91	22.71	0.00	22.71	
5013.20	77918	1.79	7.89	447063	10.26	23.03	0.00	23.03	Emergency Spillway Elevation
5014.00	81176	1.86	8.69	510696	11.72	24.28	65.00	89.28	
5015.00	86351	1.98	9.69	594447	13.65	25.75	295.00	320.75	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based on 1.33' wide x 1.33' high rectangular orifice in front of 30" outlet pipe

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 670 - ANGEL VIEW

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5019.30	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5020.00	9516	0.22	0.70	2220	0.05	1.96	0.00	1.96	
5021.00	41710	0.96	1.70	25937	0.60	7.39	0.00	7.39	
5022.00	83438	1.92	2.70	87317	2.00	11.60	0.00	11.60	
5023.00	156853	3.60	3.70	205548	4.72	12.77	0.00	12.77	
5024.00	212272	4.87	4.70	389413	8.94	13.64	0.00	13.64	
5025.00	249369	5.72	5.70	619984	14.23	14.42	0.00	14.42	
5026.00	267941	6.15	6.70	878583	20.17	15.15	0.00	15.15	
5027.00	278770	6.40	7.70	1151921	26.44	15.42	0.00	15.42	
5027.15	280840	6.45	7.85	1193891	27.41	15.51	0.00	15.51	Emergency Spillway Elevation
5028.00	292624	6.72	8.70	1437596	33.00	14.49	405.51	420.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 18" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 672 - SAVANNAH (POND F)									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5017.31	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5018.00	8502	0.20	0.69	1955	0.04	1.80	0.00	1.80	Orifice Flow Through 10-Year Opening
5019.00	57593	1.32	1.69	31363	0.72	3.79	0.00	3.79	
5020.00	85781	1.97	2.69	102584	2.35	5.05	0.00	5.05	
5021.00	92867	2.13	3.69	191884	4.41	6.06	0.00	6.06	
5021.64	95284	2.19	4.33	252091	5.79	6.62	0.00	6.62	Top of Inlet Box for 100-Year Opening
5022.00	99130	2.28	4.69	287084	6.59	11.54	0.00	11.54	Flow Through 100-Year Opening
5023.00	105778	2.43	5.69	389520	8.94	12.26	0.00	12.26	
5023.50	108515	2.49	6.19	443092	10.17	12.61	0.00	12.61	Emergency Spillway Elevation
5024.00	112960	2.59	6.69	498457	11.44	12.96	37.01	49.97	
5025.00	121602	2.79	7.69	615711	14.13	12.94	536.60	549.54	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.8' wide x 0.8' high rectangular orifice on front side of box at bottom

[3]100-Year discharge based 18" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 673 - SAVANNAH (POND E)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5025.39	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5026.00	561	0.01	0.61	114	0.00	1.46	0.00	1.46	Orifice Flow Through 10-Year Opening
5027.00	11639	0.27	1.61	5033	0.12	3.64	0.00	3.64	
5028.00	27158	0.62	2.61	23892	0.55	4.94	0.00	4.94	
5029.00	37679	0.86	3.61	56167	1.29	5.96	0.00	5.96	
5030.00	45733	1.05	4.61	97809	2.25	6.83	0.00	6.83	
5031.00	53901	1.24	5.61	147570	3.39	7.61	0.00	7.61	
5031.25	56096	1.29	5.86	161319	3.70	7.79	0.00	7.79	Top of Inlet Box for 100-Year Opening
5032.00	63233	1.45	6.61	206040	4.73	22.31	0.00	22.31	Orifice Flow Through 100-Year Opening
5033.00	74407	1.71	7.61	274784	6.31	24.14	0.00	24.14	
5033.30	77420	1.78	7.91	297557	6.83	24.67	0.00	24.67	Emergency Spillway Elevation
5034.00	90163	2.07	8.61	356154	8.18	25.84	305.00	330.84	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.8' wide x 0.8' high rectangular orifice on front side of box at bottom

[3]100-Year discharge based 18" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 674 - SAVANNAH (POND B)									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5048.00	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5049.00	795	0.02	1.00	265	0.01	2.59	0.00	2.59	Orifice Flow Through 10-Year Opening
5050.00	3864	0.09	2.00	2402	0.06	4.22	0.00	4.22	
5051.00	9431	0.22	3.00	8846	0.20	5.38	0.00	5.38	
5052.00	16614	0.38	4.00	21700	0.50	6.33	0.00	6.33	
5052.75	22057	0.51	4.75	36153	0.83	6.96	0.00	6.96	Top of Inlet Box for 100-Year Opening
5053.00	22880	0.53	5.00	41770	0.96	11.47	0.00	11.47	Add Weir Flow Around Top of Box
5054.00	29418	0.68	6.00	67850	1.56	20.79	0.00	20.79	Orifice Flow Through 100-Year Opening
5054.50	31282	0.72	6.50	83023	1.91	21.76	0.00	21.76	Emergency Spillway Elevation
5055.00	35304	0.81	7.00	99659	2.29	22.68	91.92	114.60	
5055.20	36833	0.85	7.20	106872	2.45	23.04	407.88	430.92	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.8' wide x 0.8' high rectangular orifice on front side of box at bottom

[3]Discharge controlled by weir around 3.0' wide x 3.5' long top of box

[3]100-Year discharge based 18" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 681 - 7TH STREET PARK

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5016.17	0	0.00	0.00	0	0	0.00	0.00	0.00	No Water Quality Outlet
5017.00	2958	0.07	0.83	818.51	0.02	1.50	0.00	1.50	
5018.00	12312	0.28	1.83	7920.25	0.18	3.71	0.00	3.71	
5019.00	16786	0.39	2.83	22411.54	0.51	4.76	0.00	4.76	Emergency Spillway Elevation
5020.00	19437	0.45	3.83	40507.09	0.93	5.66	24.34	30.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 12" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 682 - OSBORNE PARK

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5025.38	0	0.00	0.00	0.0	0	0.00	0.00	0.00	No Water Quality Outlet
5026.00	219	0.01	0.62	45	0.00	1.07	0.00	1.07	
5027.00	2239	0.05	1.62	1098	0.03	3.64	0.00	3.64	
5028.00	10228	0.23	2.62	6849	0.16	4.68	0.00	4.68	
5029.00	19432	0.45	3.62	21435	0.49	5.59	0.00	5.59	
5030.00	26323	0.60	4.62	44226	1.02	6.36	0.00	6.36	Emergency Spillway Elevation
5031.00	32863	0.75	5.62	73758	1.69	7.08	243.20	250.28	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 12" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 686 - AUTUMN VALLEY RANCH

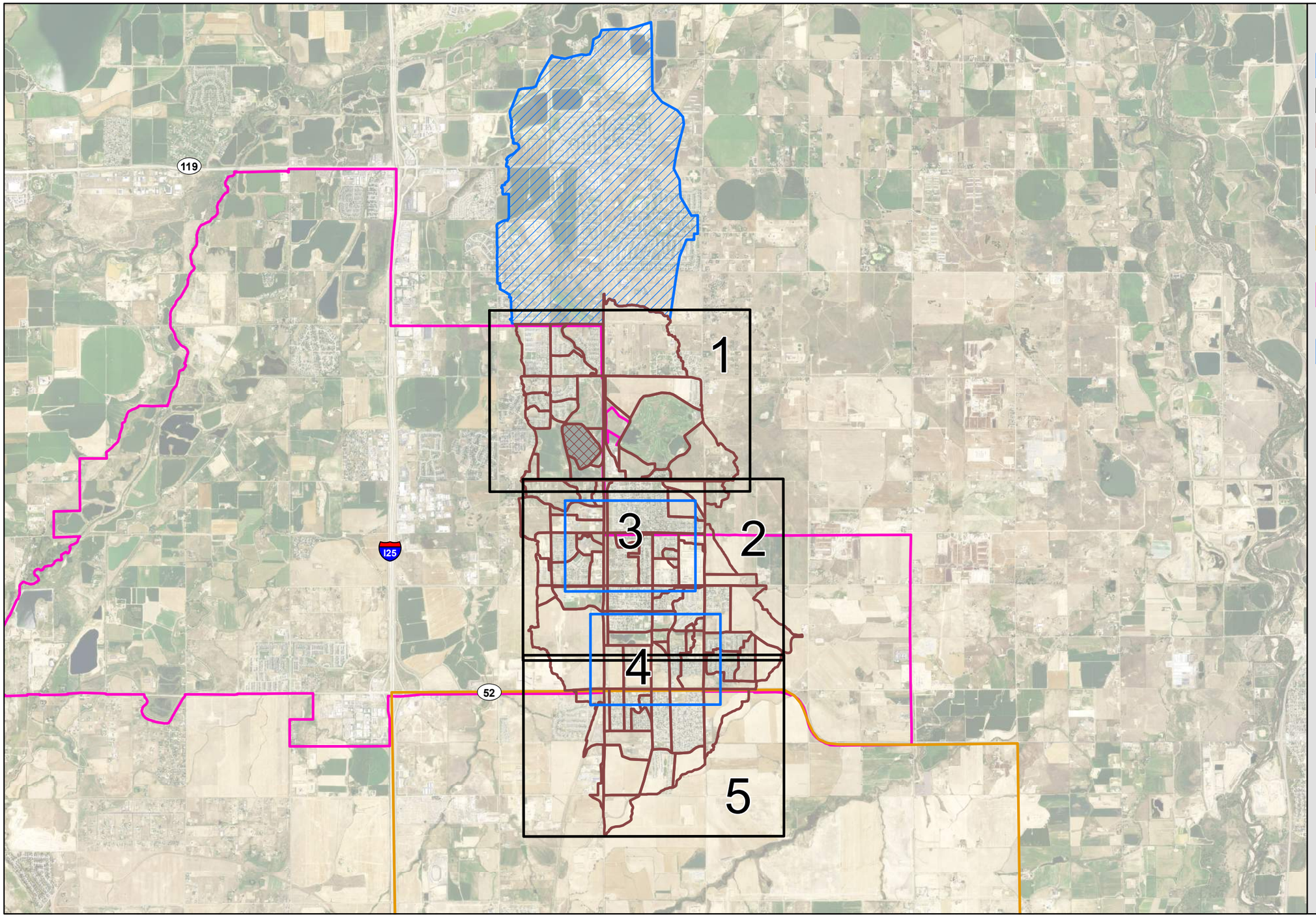
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5068.37	17	0.00	0.0	N/A	N/A	0.00	0.00	0.00	Water Quality Release Not Modeled
5069.90	17	0.00	1.53	26	0.00	0.00	0.00	0.00	
5071.00	4611	0.11	2.63	1800	0.04	0.00	0.00	0.00	
5072.00	41823	0.96	3.63	20107	0.46	0.00	0.00	0.00	
5073.00	82937	1.90	4.63	81326	1.87	0.00	0.00	0.00	
5074.00	114227	2.62	5.63	179491	4.12	0.00	0.00	0.00	
5075.00	134474	3.09	6.63	303704	6.97	0.00	0.00	0.00	
5075.41	137693	3.16	7.04	359497	8.25	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
5076.00	149472	3.43	7.63	444186	10.20	6.10	0.00	6.10	
5077.00	159891	3.67	8.63	598839	13.75	6.31	0.00	6.31	
5078.00	169371	3.89	9.63	763447	17.53	6.52	0.00	6.52	
5079.00	178365	4.09	10.63	937296	21.52	6.72	0.00	6.72	
5079.50	185382	4.26	11.13	1028227	23.60	6.82	0.00	6.82	Emergency Spillway Elevation
5080.00	188573	4.33	11.63	1120741	25.73	6.90	104.10	111.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 15" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve as pipe losses control)

[4]Weir flow approximated as a broad crested weir



Legend

- 500 Foot Scale
- 1000 Foot Scale
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
SWMM CONVEYANCE
ELEMENT MAPS

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CHECKED BY:	BS
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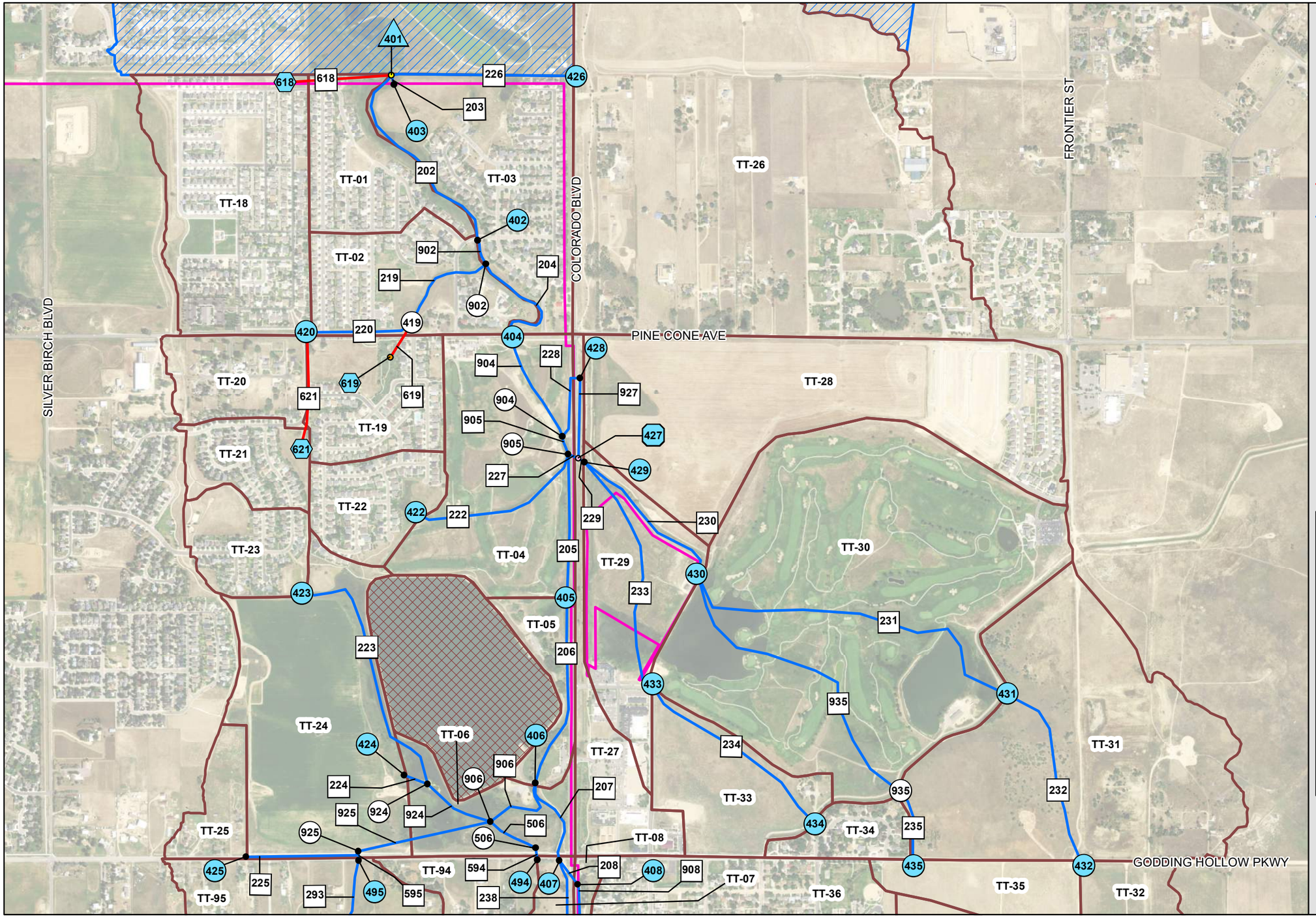
SHEET: TT	INDEX: C-INDEX



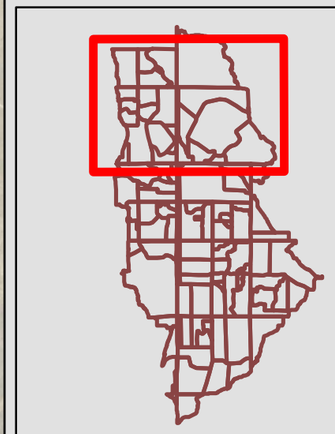
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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TRI-TOWN
EXISTING CONDITION
SWMM CONVEYANCE
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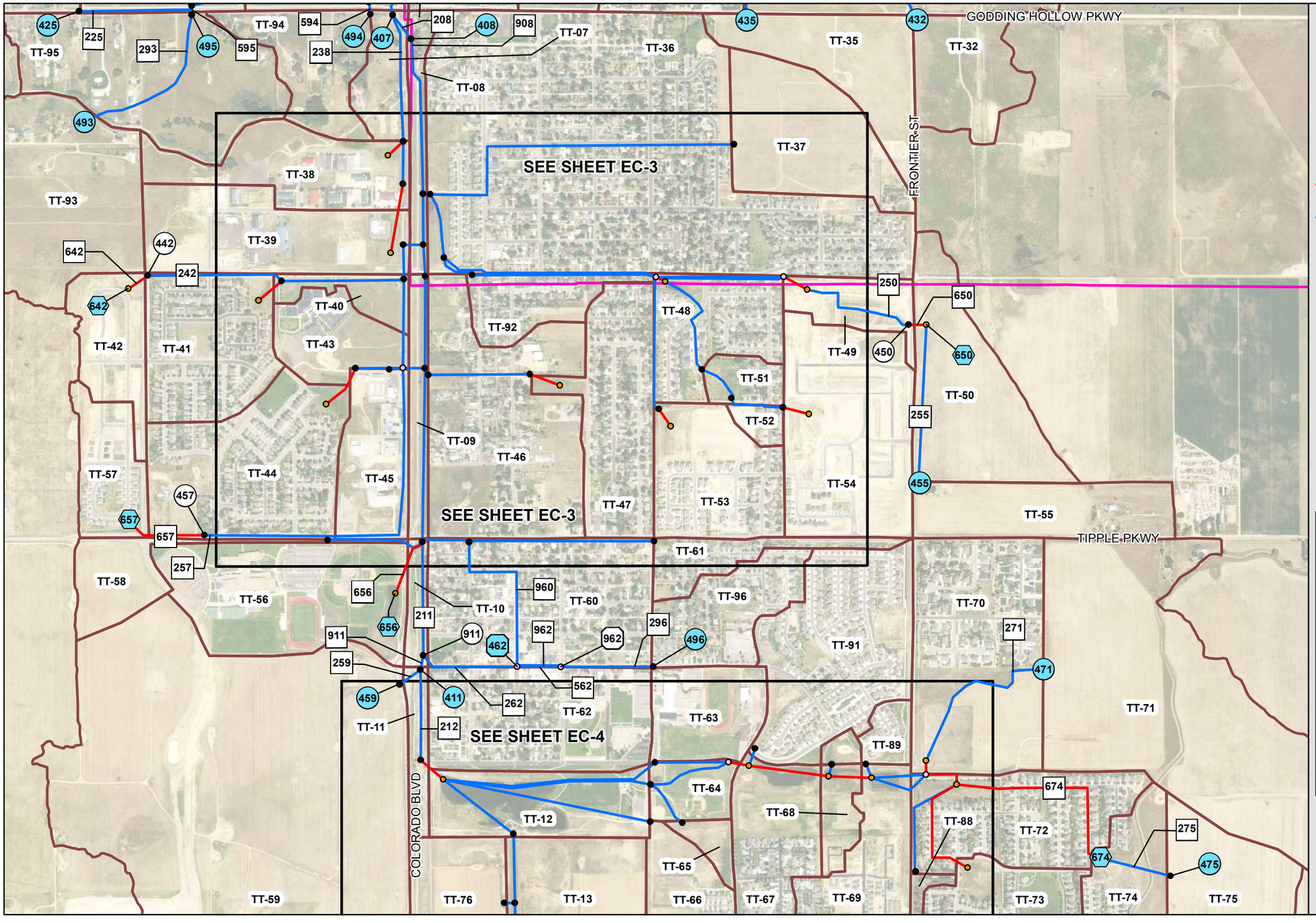


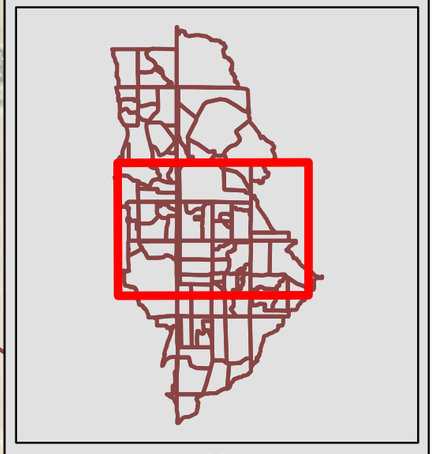
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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TRI-TOWN
EXISTING CONDITION
SWMM CONVEYANCE
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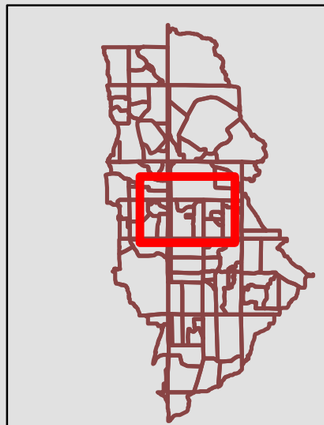
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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OUTFALL SYSTEM PLAN

TRI-TOWN
EXISTING CONDITION
SWMM CONVEYANCE
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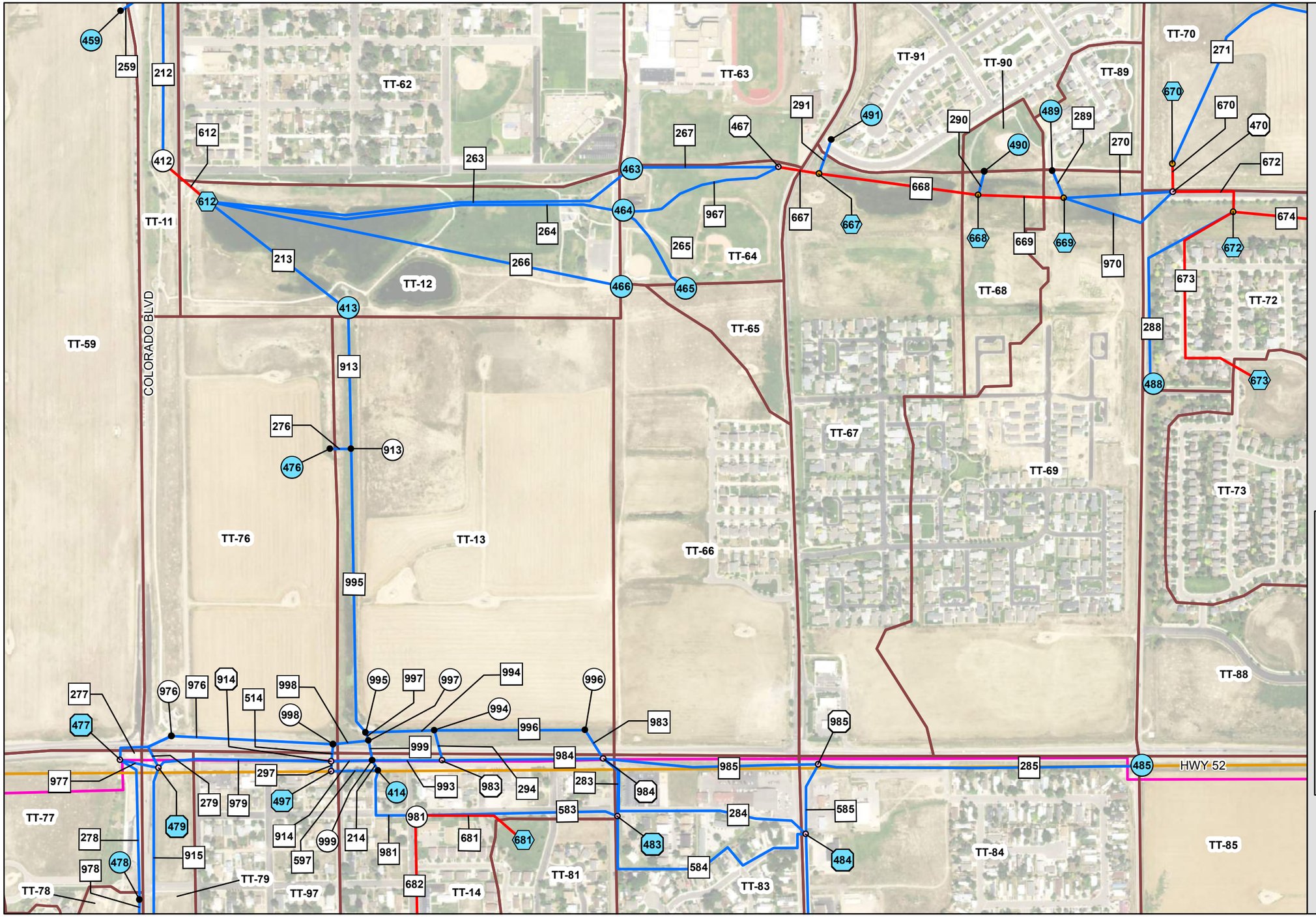

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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN EXISTING CONDITION SWMM CONVEYANCE ELEMENT MAPS

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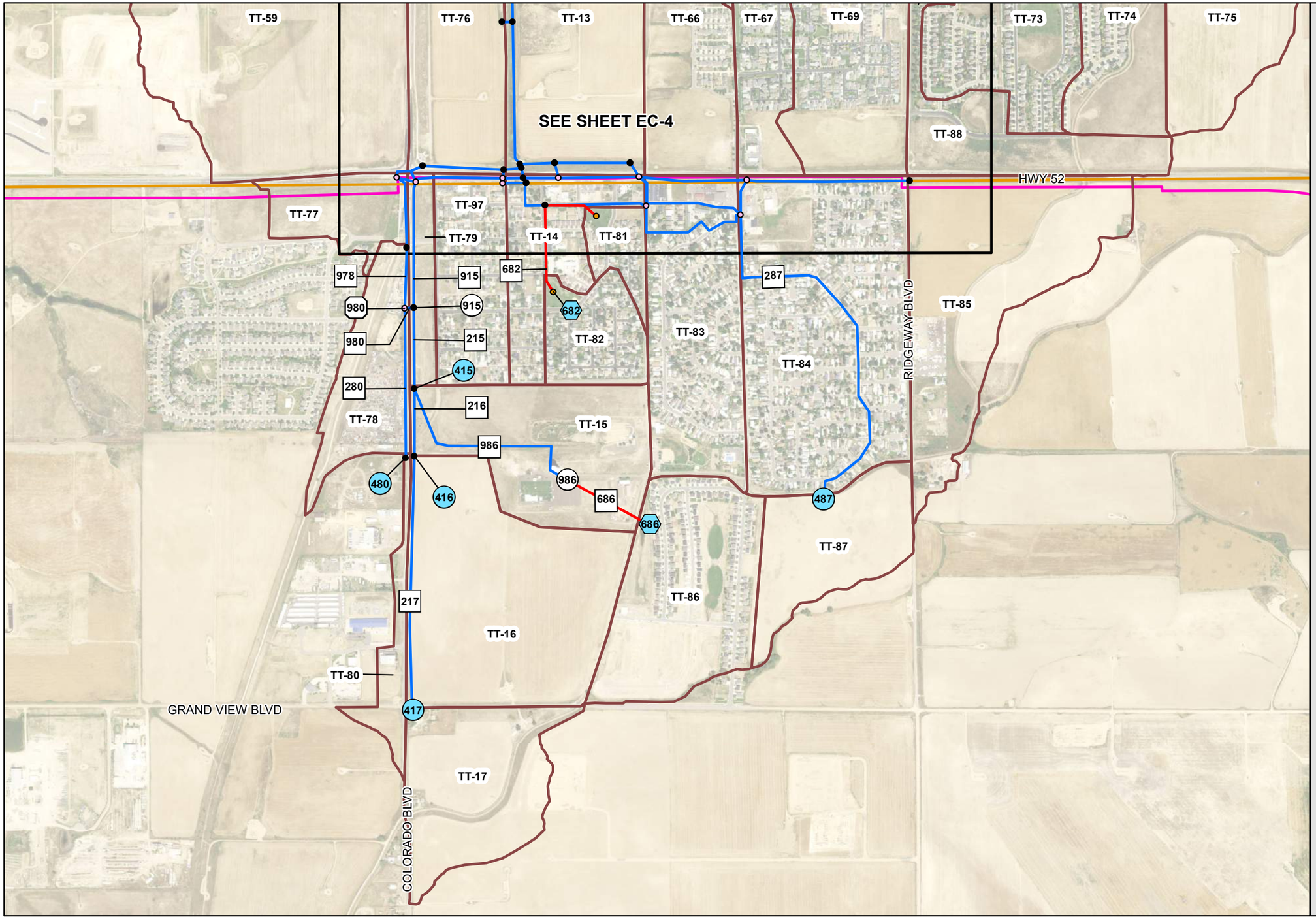

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map

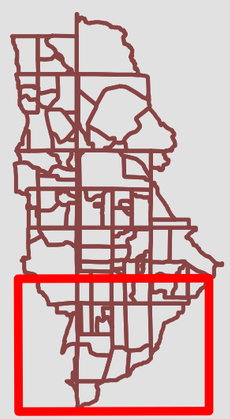

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Table C.1.3: Tri-Town Basin Peak Discharge Comparison: Existing Conditions ACE 1999 Study and 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	ACE 1999 Study Existing Condition SWMM Model Peak Discharge (cfs)					2022 OSP Study Existing Condition SWMM Model Peak Discharge (cfs)					Difference (2022 OSP - ACE 1999 Study) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	401	5030	N/A	N/A	N/A	N/A	N/A	153	257	433	1845	2889	N/A	N/A	N/A	N/A	N/A	
County Road 20/Bella Rosa Parkway	404	4366	336	769	1295	3050	3842	151	245	413	1682	2583	-185	-524	-882	-1368	-1259	
No Name Creek Tributary	904	4281	341	767	1272	2912	3659	151	244	410	1643	2508	-190	-523	-862	-1269	-1151	
County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	407	3183	334	729	1178	2765	3445	122	186	302	981	1464	-212	-543	-876	-1784	-1981	
Upstream Side of County Road 13/Colorado Blvd	408	3085	272	577	911	2060	2593	122	185	302	973	1407	-150	-392	-609	-1087	-1186	New culvert crossing of Colorado Blvd and Godding Hollow Parkway built in 2004.
McClure Avenue	409	2808	255	543	857	1957	2492	78	121	214	691	987	-177	-422	-643	-1266	-1505	New culvert crossing of McClure Avenue built in 2018.
County Road 16/Tipple Parkway/ First Street	410	2203	188	409	651	1517	1937	59	92	169	560	783	-129	-317	-482	-957	-1154	
Eighth Street/Main Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1652	193	416	659	1644	2108	33	52	94	278	388	-160	-364	-565	-1366	-1720	Regional Detention Pond Built in 2003.
State Highway 52 Frederick/Dacono Boundary	999	792	226	424	602	1240	1519	107	173	249	776	1088	-119	-251	-353	-464	-431	
Second Street, East of Colorado Blvd	415	287	16	66	116	295	372	9	15	52	216	308	-7	-51	-64	-79	-64	

*Milavec Reservoir considered non-contributing area due to surrounding berms isolating it from the watershed. Total non-contributing area ~ 67 acres.

Appendix C.2. Tri-Town Future Condition Documentation

TABLE C.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
TRI-TOWN																				
TT-01	401	0.05718	36.6	0.19914	1051	0.30567	1614	0.0177	26	0.35	0.05	4.35	0.0012	0.78	55.97	1.53	39.77	9.87	6.99	4.32
TT-02	402	0.07495	48.0	0.17565	927	0.36422	1923	0.0155	27	0.35	0.05	4.66	0.0010	0.87	71.32	1.49	49.05	13.06	9.17	5.51
TT-03	403	0.11961	76.6	0.28971	1530	0.54337	2869	0.0092	23	0.35	0.05	4.29	0.0011	0.80	90.42	1.18	61.54	13.99	9.68	5.81
TT-04	404	0.13322	85.3	0.34224	1807	0.51613	2725	0.0124	10	0.40	0.05	3.90	0.0013	0.72	94.75	1.11	62.92	6.82	4.19	1.76
TT-05	405	0.02972	19.0	0.32308	1706	0.37270	1968	0.0082	10	0.40	0.05	3.36	0.0016	0.59	14.82	0.78	9.98	1.96	0.72	0.35
TT-06	406	0.04863	31.1	0.12946	684	0.28033	1480	0.0030	10	0.40	0.05	3.21	0.0017	0.55	38.31	1.23	27.01	6.26	2.00	1.06
TT-07	707	0.02180	14.0	0.14741	778	0.22043	1164	0.0028	61	0.35	0.10	4.30	0.0014	0.71	29.56	2.12	22.96	10.06	7.45	5.17
TT-08	408	0.01895	12.1	0.18237	963	0.45081	2380	0.0048	10	0.40	0.05	4.44	0.0018	0.60	8.33	0.69	5.57	1.05	0.39	0.19
TT-09	409	0.01901	12.2	0.26122	1379	0.50052	2643	0.0042	9	0.40	0.05	4.50	0.0018	0.60	6.64	0.55	4.41	0.78	0.28	0.13
TT-10	410	0.01003	6.4	0.13281	701	0.24206	1278	0.0055	10	0.40	0.05	4.45	0.0018	0.60	5.12	0.80	3.47	0.66	0.25	0.12
TT-11	411	0.01322	8.5	0.16394	866	0.32457	1714	0.0182	10	0.40	0.05	3.04	0.0018	0.50	8.25	0.97	5.83	1.52	0.50	0.24
TT-12	612	0.05387	34.5	0.25080	1324	0.41861	2210	0.0044	10	0.40	0.05	3.34	0.0018	0.52	32.65	0.95	22.82	5.54	1.69	0.89
TT-13	713	0.11157	71.4	0.32593	1721	0.41567	2195	0.0039	62	0.35	0.10	3.23	0.0018	0.52	179.81	2.52	141.47	67.43	48.23	32.75
TT-14	414	0.05266	33.7	0.18583	981	0.39108	2065	0.0164	58	0.35	0.05	3.00	0.0018	0.50	98.34	2.92	77.17	37.83	26.89	18.16
TT-15	715	0.10112	64.7	0.37529	1982	0.52751	2785	0.0174	62	0.35	0.10	3.00	0.0018	0.50	177.42	2.74	139.51	66.93	48.05	32.48
TT-16	716	0.15757	100.8	0.34554	1824	0.57676	3045	0.0197	76	0.35	0.10	3.32	0.0018	0.52	361.46	3.58	289.20	152.62	114.15	80.49
TT-17	717	0.08289	53.0	0.19611	1035	0.33007	1743	0.0146	75	0.35	0.05	2.99	0.0018	0.50	205.55	3.87	162.67	88.74	67.48	48.36
TT-18	618	0.14237	91.1	0.33999	1795	0.59165	3124	0.0172	27	0.40	0.05	4.72	0.0013	0.77	124.52	1.37	86.64	22.11	15.52	9.55
TT-19	619	0.06094	39.0	0.11751	620	0.27865	1471	0.0279	32	0.35	0.05	5.00	0.0007	1.00	74.25	1.90	49.19	16.66	11.56	7.71
TT-20	420	0.04320	27.6	0.15072	796	0.25546	1349	0.0155	29	0.35	0.05	4.98	0.0007	0.99	36.82	1.33	24.24	7.29	5.04	3.19
TT-21	621	0.03609	23.1	0.13681	722	0.24604	1299	0.0222	25	0.35	0.05	5.00	0.0007	1.00	28.35	1.23	18.13	5.17	3.45	2.02
TT-22	422	0.04334	27.7	0.17365	917	0.26361	1392	0.0252	25	0.35	0.05	4.91	0.0008	0.98	34.63	1.25	22.65	6.17	4.18	2.37
TT-23	423	0.04107	26.3	0.15921	841	0.27376	1445	0.0126	22	0.35	0.05	4.78	0.0012	0.82	34.61	1.32	23.44	5.21	3.58	2.10
TT-24	724	0.15636	100.1	0.24003	1267	0.40015	2113	0.0120	27	0.40	0.05	4.54	0.0015	0.72	178.38	1.78	127.08	32.39	23.14	14.25
TT-25	725	0.02473	15.8	0.10149	536	0.17849	942	0.0140	30	0.35	0.05	4.37	0.0017	0.64	32.50	2.05	24.16	7.99	4.64	2.94
TT-26	726	0.46181	295.6	0.40181	2122	0.73615	3887	0.0158	23	0.35	0.05	4.91	0.0009	0.93	374.72	1.27	244.86	59.15	40.25	22.58
TT-27	427	0.05392	34.5	0.31233	1649	0.57310	3026	0.0109	75	0.40	0.10	4.39	0.0011	0.84	78.22	2.27	61.38	30.11	23.29	16.91
TT-28	728	0.22366	143.1	0.46804	2471	0.91655	4839	0.0156	59	0.35	0.10	4.66	0.0013	0.78	336.63	2.35	258.28	110.47	83.82	58.52
TT-29	729	0.08365	53.5	0.29500	1558	0.63817	3370	0.0126	75	0.35	0.10	3.73	0.0015	0.65	147.10	2.75	116.59	58.18	43.84	31.62
TT-30	430	0.37932	242.8	0.42563	2247	0.78642	4152	0.0161	10	0.40	0.05	4.25	0.0015	0.67	311.94	1.28	212.60	30.87	14.56	6.77
TT-31	731	0.23533	150.6	0.20945	1106	0.53156	2807	0.0135	50	0.35	0.10	4.69	0.0010	0.89	437.40	2.90	322.46	133.08	98.15	69.45
TT-32	732	0.04313	27.6	0.11716	619	0.20899	1103	0.0094	30	0.35	0.05	5.00	0.0007	1.00	39.88	1.44	26.13	8.31	5.71	3.70
TT-33	733	0.06515	41.7	0.25265	1334	0.36218	1912	0.0146	66	0.35	0.10	4.98	0.0007	1.00	109.16	2.62	83.26	40.84	31.51	23.32
TT-34	434	0.02312	14.8	0.14795	781	0.18825	994	0.0226	30	0.35	0.05	5.00	0.0007	1.00	19.35	1.31	12.70	3.97	2.74	1.80
TT-35	735	0.05650	36.2	0.12625	667	0.36887	1948	0.0170	46	0.35	0.05	4.93	0.0008	0.95	85.05	2.35	61.70	25.23	18.69	13.81
TT-36	436	0.34202	218.9	0.44891	2370	1.02863	5431	0.0153	45	0.35	0.05	4.74	0.0013	0.79	441.78	2.02	325.18	119.68	89.52	60.77
TT-37	737	0.07041	45.1	0.18222	962	0.41848	2210	0.0162	45	0.35	0.05	4.83	0.0011	0.86	99.63	2.21	72.93	28.37	21.08	14.77
TT-38	638	0.05689	36.4	0.23176	1224	0.34051	1798	0.0214	48	0.35	0.05	4.94	0.0008	0.95	76.45	2.10	56.11	23.62	17.59	13.06
TT-39	639	0.07456	47.7	0.36281	1916	0.52203	2756	0.0121	70	0.40	0.05	4.97	0.0008	0.98	108.46	2.27	83.67	41.70	32.87	24.96
TT-40	740	0.01580	10.1	0.13973	738	0.25226	1332	0.0092	48	0.35	0.10	4.80	0.0011	0.84	17.73	1.75	13.20	4.95	3.67	2.53
TT-41	641	0.06719	43.0	0.17752	937	0.35787	1890	0.0136	27	0.35	0.05	4.71	0.0013	0.77	67.34	1.57	47.85	12.43	8.64	5.41
TT-42	642	0.03516	22.5	0.16064	848	0.36100	1906	0.0070	25	0.35	0.05	4.78	0.0012	0.83	23.81	1.06	16.15	3.91	2.71	1.65
TT-43	743	0.03389	21.7	0.16138	852	0.22425	1184	0.0123	57	0.35	0.10	4.85	0.0010	0.88	56.89	2.62	42.66	18.88	14.19	10.17
TT-44	644	0.09710	62.1	0.25304	1336	0.46344	2447	0.0141	27	0.35	0.05	4.53	0.0017	0.63	99.18	1.60	72.14	22.84	12.77	8.22
TT-45	445	0.04196	26.9	0.19439	1026	0.34493	1821	0.0142	70	0.40	0.05	4.72	0.0013	0.78	77.59	2.89	60.47	30.07	23.41	17.01
TT-46	446	0.12297	78.7	0.33234	1755	0.55303	2920	0.0059	21	0.40	0.05	4.50	0.0018	0.60	90.85	1.15	64.70	17.10	9.26	5.63
TT-47	647	0.06774	43.4	0.20188	1066	0.43324	2288	0.0115	28	0.35	0.05	4.50	0.0018	0.60	68.40	1.58	50.11	16.36	8.97	5.82
TT-48	648	0.04840	31.0	0.18823	994	0.29774	1572	0.0076	26	0.35	0.05	4.50	0.0018	0.60	44.92	1.45	32.92	10.60	5.68	3.66
TT-49	649	0.02395	15.3	0.15219	804	0.25524	1348	0.0158	21	0.35	0.05	4.50	0.0018	0.60	21.35	1.39	15.46	4.59	2.23	1.40
TT-50	650	0.07948	50.9	0.16943	895	0.41075	2169	0.0140	23	0.35	0.05	4.50	0.0018	0.60	86.34	1.70	63.34	19.93	10.03	6.27
TT-51	451	0.01342	8.6	0.08013	423	0.17058	901	0.0133	21	0.35	0.05	4.50	0.0018	0.60	13.63	1.59	10.04	3.04	1.46	0.91
TT-52	452	0.00657	4.2	0.04816	254	0.10360	547	0.0240	30	0.35	0.05	4.50	0.0018	0.60	9.44	2.25	7.05	2.51	1.40	0.88
TT-53	653	0.05776	37.0	0.14500	766	0.25480	1345	0.0174	26	0.35	0.05	4.50	0.0018	0.60	75.41	2.04	56.34	18.59	9.78	6.26
TT-54	654	0.09979	63.9	0.17300	913	0.35086	1853	0.0209	22	0.35	0.05	4.50	0.0018	0.60	129.81	2.03	96.31	30.03	14.63	9.16
TT-55	755	0.05376	34.4	0.24610	1299	0.49331	2605	0.0111	30	0.35	0.05	4.50	0.0018	0.60	47.16	1.37	34.61	11.52	6.49	4.16
TT-56	656	0.09320	59.6	0.28640	1512	0.54963	2902	0.0108	46	0.40	0.10	4.24	0.0018	0.58	123.36	2.07	94.12	37.09	24.72	16.67
TT-57	657	0.03302	21.1	0.14885	786	0.31023	1638	0.0070	25	0.35	0.05	4.50	0.0018	0.60	28.04	1.33	20.47	6.46	3.41	2.18
TT-58	758	0.02917	18.7	0.59689	3152	0.69730	3682	0.0105	33	0.35	0.05	4.47	0.0018	0.60	14.23	0.76	10.16	3.48	2.09	1.33
TT-59	759	0.45848	293.4	0.60423	3190	0.81906	4325	0.0118	40	0.35	0.10	3.08	0.0018	0.51	612.27	2.09	466.31	190.60	120.94	73.44
TT-60	460	0.10635	68.1	0.21998	1162	0.41644	2199	0.0104	43	0.35	0.05	3.67	0.0018	0.54	171.91	2.53	131.93	55.04	35.97	23.50
TT-61	461	0.02262	14.5	0.17294	913	0.46312	2445	0.0190	29	0.35	0.05	4.50	0.0018	0.60	18.32	1.27	13.42	4.35	2.42	1.55
TT-62	462	0.08492	54.4	0.19670	1039	0.39653	2094	0.0053	60	0.35	0.05	3.04	0.0018	0.50	152.46	2.81	119.70	58.56	41.99	28.62
TT-63	463	0.03806	24.4	0.19139	1011	0.28670	1514	0.0100	52	0.40	0.10	3.04	0.0018	0.50	59.61	2.45	46.23	20.15	13.43	9.16
TT-64	464	0.01827	11.7	0.08370	442	0.17267	912	0.0105	10	0.40	0.05	3.00	0.0018	0.50	18.36	1.57	13.20	3.60	1.20	0.57
TT-65	765	0.00821	5.3	0.10306	544	0.20323	1073	0.0211	60	0.35	0.10	3.35	0.0018	0.52	13.29	2.53	10.39	5.01	3.53	2.38
TT-66	766	0.06966	44.6	0.25739	1359	0.47210	2493	0.0178	42	0.35	0.05	3.55	0.0018	0.54	97.05	2.18	74.51	30.84	20.10	12.92
TT-67	667	0.07448	47.7	0.32788	1731	0.59914	3163	0.0172	31	0.35	0.05	3.81	0.0018	0.55	70.13	1.47	51.89	18.42	10.80	6.63
TT-68	668	0.01408	9.0	0.08710	460	0.17967	949	0.0263	23	0.35	0.05	3.32	0.0018	0.52	16.69	1.85	12.53	4.36	2.40	1.29
TT-69	669	0.09974	63.8	0.31918	1685	0.52870	2792	0.0103	33	0.35	0.05	3.74	0.0018	0.55	105.44	1.65	78.78	28.94	17.41	10.79
TT-70	670	0.11356	72.7	0.24524	1295	0.46793	2471	0.0166	27	0.35	0.05	4.50	0.0018	0.60	128.05	1.76	93.82	31.14	16.86	10.74
TT-71	771	0.21215	135.8	0.32488	1715	0.65177	3441	0.0151	21	0.35	0.05	4.50	0.0018	0.60	212.27	1.56	155.11	46.49	22.48	14.06
TT-72	672	0.07282	46.6	0.22454	1186	0.40451	2136	0.0263	27	0.35	0.05	4.34	0.0018	0.59	82.97	1.78	61.79	20.68	11.06	7.09
TT-73	673	0.06968	44.6	0.17407	919	0.36406	1922	0.0210	24	0.35	0.05	4.10	0.0018	0.57	81.87	1.84	61.29	20.21	10.50	6.41
TT-74	674	0.06518	41.7	0.17672	933	0.36826	1944	0.0228	24	0.35	0.05	4.50	0.0018	0.60	74.32	1.78	55.33	17.68	9.04	5.70
TT-75	775	0.07280	46.6	0.15103	797	0.27042	1428	0.0181	12	0.40	0.05	4.42	0.0018	0.59	84.17	1.81	60.27	13.44	5.31	2.81
TT-76	776	0.07751	49.6	0.21629	1142	0.41828	2209	0.0126	72	0.35	0.10	3.34	0.0018	0.52	165.87	3.34	131.65	68.08	50.33	35.21
TT-77	777	0.03562	22.8	0.17641	931	0.28145	1486	0.0104	79	0.35	0.10	3.34	0.0018	0.52	74.56	3.27	59.46	31.87	24.13	17.19
TT-78	478	0.05282	33.8	0.29468	1556	0.53458	2823	0.0073	68	0.35	0.05	3.00	0.0018	0.50	75.50	2.23	60.11	30.18	22.47	15.77
TT-79	779	0.02061	13.2	0.23427	1237	0.41686	2201	0.0061	77	0.35	0.10	3.00	0.0018	0.50	26.60	2.02	21.05	10.72	8.09	5.72
TT-80	780	0.02001	12.8	0.39569	2089	0.60945	3218	0.0181	80	0.35	0.10	3.00	0.0018	0.50	23.24	1.81	18.47	9.43	7.19	5.16
TT-81	681	0.01714	11.0	0.11771	621	0.27218	1437	0.0249	39	0.35	0.05	3.02	0.0018	0.50	24.04	2.19	18.49	7.65	4.94	3.01
TT-82	682	0.03673	23.5	0.17084	902	0.27364	1445	0.0284	45	0.35	0.05	3.18	0.0018	0.51	64.82	2.76	49.88	22.34	14.79	9.48
TT-83	483	0.10501	67.2	0.34258	1809	0.56799	2999	0.0184	72	0.35	0.05	3.29	0.0018	0.52	203.22	3.02	162.74	85.25	63.94	45.33
TT-84	484	0.18923	121.1	0.42132	2225	0.70669	3731	0.0123	76	0.35	0.05	3.36	0.0018	0.52	377.99	3.12	301.18	158.02	120.66	87.28
TT-85	785	0.13972	89.4	0.33732	1781	0.64838	3423	0.0090	61	0.35	0.10	3.68	0.0018	0.54	233.42	2.61	183.05	85.77	60.91	41.93
TT-86	686	0.10651	68.2	0.34577	1826	0.42248	2231	0.0131	45	0.35	0.05	3.04	0.0018	0.50	162.90	2.39	126.05	55.09	36.84	23.44
TT-87	787	0.06404	41.0	0.15657	827	0.33573	1773	0.0113	75	0.35	0.10	2.99	0.0018	0.50	152.62	3.72	120.84	64.52	48.35	34.01
TT-88	788	0.06092	39.0	0.46237	2441	0.74704	3944	0.0155	34	0.35	0.05	4.01	0.0018	0.57	46.14	1.18	34.10	12.19	7.33	4.66
TT-89	489	0.01039	6.7	0.07540	398	0.10888	575	0.0118	24	0.35	0.05	4.50	0.0018	0.60	11.70	1.76	8.72	2.78	1.42	0.90
TT-90	490	0.00401	2.6	0.05027	265	0.07736	408	0.0051	10	0.35	0.05	4.50	0.0018	0.60	3.22	1.25	2.27	0.54	0.17	0.09
TT-91	491	0.09632	61.6	0.26608	1405	0.48227	2546	0.0166	27	0.35	0.05	4.34	0.0018	0.59	99.86	1.62	73.22	24.13	12.96	8.41
TT-92	492	0.02868	18.4	0.09054	478	0.18245	963	0.0055	21	0.40	0.05	4.50	0.0018	0.60	29.52	1.61	21.43	5.87	3.13	1.90
TT-93	793	0.10082	64.5	0.26096	1378	0.41290	2180	0.0139	34	0.35	0.05	4.88	0.0009	0.91	103.46	1.60	72.49	22.82	16.42	10.54
TT-94	794	0.04333	27.7	0.12533	662	0.21093	1114	0.0160	31	0.35	0.05	4.49	0.0012	0.80	56.29	2.03	40.23	11.67	8.25	5.20
TT-95	795	0.10549	67.5	0.15318	809	0.36458	1925	0.0106	30	0.35	0.05	4.55	0.0017	0.65	145.38	2.15	107.63	35.21	20.55	13.07
TT-96	496	0.04344	27.8	0.17147	905	0.34942	1845	0.0137	36	0.35	0.05	3.63	0.0018	0.54	55.73	2.00	42.43	16.41	10.20	6.35
TT-97	497	0.05625	36.0	0.19162	1012	0.38465	2031	0.0116	50	0.35	0.05	3.70	0.0022	0.62	90.74	2.52	70.39	31.51	21.55	14.34
Totals/Averages			**5030.1**						**38**						**103.20**	**1.99**	**77.11**	**30.28**	**20.81**	**14.02**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

CONCEPTUAL POND 707 FOR TRI-TOWN SUBBASIN TT-707

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4942.00	0	0.00	0.0	0	0.00	0.00	Bottom
4947.00	48000	1.10	5.00	112227	2.58	0.20	100-2 Detention

CONCEPTUAL POND 713 FOR TRI-TOWN SUBBASIN TT-713

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4992.24	0	0.00	0.0	0	0.00	0.00	Bottom
4997.24	255000	5.85	5.00	616257	14.15	0.64	100-2 Detention

CONCEPTUAL POND 715 FOR TRI-TOWN SUBBASIN TT-715

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5031.30	0	0.00	0.0	0	0.00	0.00	Bottom
5036.30	205000	4.71	5.00	509807	11.70	8.56	100-2 Detention

CONCEPTUAL POND 716 FOR TRI-TOWN SUBBASIN TT-716

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5043.00	0	0.00	0.0	0	0.00	0.00	Bottom
5048.00	375000	8.61	5.00	932397	21.40	0.81	100-2 Detention

CONCEPTUAL POND 717 FOR TRI-TOWN SUBBASIN TT-717

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5089.00	0	0.00	0.0	0	0.00	0.00	Bottom
5094.00	198000	4.55	5.00	489389	11.23	0.53	100-2 Detention

CONCEPTUAL POND 724 FOR TRI-TOWN SUBBASIN TT-724

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4951.00	0	0.00	0.0	0	0.00	0.00	Bottom
4954.50	28500	0.65	3.50	49560	1.14	14.25	Top of 10-Year Detention Zone
4956.00	72000	1.65	5.00	123826	2.84	150.31	Top of 100-Year Detention Zone

CONCEPTUAL POND 725 FOR TRI-TOWN SUBBASIN TT-725

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4966.40	0	0.00	0.0	0	0.00	0.00	Bottom
4969.90	3800	0.09	3.50	6635	0.15	4.76	Top of 10-Year Detention Zone
4971.40	14000	0.32	5.00	19874	0.46	26.65	Top of 100-Year Detention Zone

CONCEPTUAL POND 726 FOR TRI-TOWN SUBBASIN TT-726

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4904.19	0	0.00	0.0	0	0.00	0.00	Bottom
4907.69	105000	2.41	3.50	182235	4.18	9.03	Top of 10-Year Detention Zone
4909.19	205000	4.71	5.00	415196	9.53	267.78	Top of 100-Year Detention Zone

CONCEPTUAL POND 728 FOR TRI-TOWN SUBBASIN TT-728

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4917.00	0	0.00	0.0	0	0.00	0.00	Bottom
4922.00	425000	9.76	5.00	1053779	24.19	9.64	100-2 Detention

CONCEPTUAL POND 729 FOR TRI-TOWN SUBBASIN TT-729

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4918.70	0	0.00	0.0	0	0.00	0.00	Bottom
4923.70	180000	4.13	5.00	443513	10.18	6.08	100-2 Detention

CONCEPTUAL POND 731 FOR TRI-TOWN SUBBASIN TT-731

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4969.00	0	0.00	0.0	0	0.00	0.00	Bottom
4974.00	415000	9.53	5.00	1023732	23.50	0.09	100-2 Detention

CONCEPTUAL POND 732 FOR TRI-TOWN SUBBASIN TT-732

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5005.50	0	0.00	0.0	0	0.00	0.00	Bottom
5010.50	49500	1.14	5.00	122442	2.81	0.01	100-2 Detention

CONCEPTUAL POND 733 FOR TRI-TOWN SUBBASIN TT-733

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4939.50	0	0.00	0.0	0	0.00	0.00	Bottom
4944.50	126000	2.89	5.00	311859	7.16	0.02	100-2 Detention

CONCEPTUAL POND 735 FOR TRI-TOWN SUBBASIN TT-735

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4990.80	0	0.00	0.0	0	0.00	0.00	Bottom
4995.80	90000	2.07	5.00	223470	5.13	0.12	100-2 Detention

CONCEPTUAL POND 737 FOR TRI-TOWN SUBBASIN TT-737

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5000.60	0	0.00	0.0	0	0.00	0.00	Bottom
5005.60	121000	2.78	5.00	299169	6.87	0.06	100-2 Detention

CONCEPTUAL POND 740 FOR TRI-TOWN SUBBASIN TT-740

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4957.60	0	0.00	0.0	0	0.00	0.00	Bottom
4962.60	28500	0.65	5.00	69739	1.60	0.03	100-2 Detention

CONCEPTUAL POND 743 FOR TRI-TOWN SUBBASIN TT-743

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4957.88	0	0.00	0.0	0	0.00	0.00	Bottom
4962.88	53000	1.22	5.00	131074	3.01	4.77	100-2 Detention

CONCEPTUAL POND 755 FOR TRI-TOWN SUBBASIN TT-755

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5036.00	0	0.00	0.0	0	0.00	0.00	Bottom
5041.00	98000	2.25	5.00	237154	5.44	0.15	100-2 Detention

CONCEPTUAL POND 758 FOR TRI-TOWN SUBBASIN TT-758

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4996.00	0	0.00	0.0	0	0.00	0.00	Bottom
5001.00	53000	1.22	5.00	129165	2.97	0.18	100-2 Detention

CONCEPTUAL POND 759 FOR TRI-TOWN SUBBASIN TT-759

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4980.90	0	0.00	0.0	0	0.00	0.00	Bottom
4985.90	910000	20.89	5.00	2256211	51.80	3.11	100-2 Detention

CONCEPTUAL POND 765 FOR TRI-TOWN SUBBASIN TT-765

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5003.50	0	0.00	0.0	0	0.00	0.00	Bottom
5008.50	17800	0.41	5.00	43966	1.01	0.03	100-2 Detention

CONCEPTUAL POND 766 FOR TRI-TOWN SUBBASIN TT-766

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4999.40	0	0.00	0.0	0	0.00	0.00	Bottom
5004.40	136000	3.12	5.00	336513	7.73	1.32	100-2 Detention

CONCEPTUAL POND 771 FOR TRI-TOWN SUBBASIN TT-771

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5044.00	0	0.00	0.0	0	0.00	0.00	Bottom
5049.00	355000	8.15	5.00	875683	20.10	0.86	100-2 Detention

CONCEPTUAL POND 775 FOR TRI-TOWN SUBBASIN TT-775

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5076.40	0	0.00	0.0	0	0.00	0.00	Bottom
5081.40	110000	2.53	5.00	272414	6.25	0.40	100-2 Detention

CONCEPTUAL POND 776 FOR TRI-TOWN SUBBASIN TT-776

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4998.00	0	0.00	0.0	0	0.00	0.00	Bottom
5003.00	181000	4.16	5.00	444905	10.21	0.77	100-2 Detention

CONCEPTUAL POND 777 FOR TRI-TOWN SUBBASIN TT-777

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5019.45	0	0.00	0.0	0	0.00	0.00	Bottom
5024.45	85000	1.95	5.00	208656	4.79	0.74	100-2 Detention

CONCEPTUAL POND 779 FOR TRI-TOWN SUBBASIN TT-779

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5018.49	0	0.00	0.0	0	0.00	0.00	Bottom
5023.49	50000	1.15	5.00	122492	2.81	0.13	100-2 Detention

CONCEPTUAL POND 780 FOR TRI-TOWN SUBBASIN TT-780

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5040.60	0	0.00	0.0	0	0.00	0.00	Bottom
5045.60	40000	0.92	5.00	98592	2.26	2.80	100-2 Detention

CONCEPTUAL POND 785 FOR TRI-TOWN SUBBASIN TT-785

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5046.83	0	0.00	0.0	0	0.00	0.00	Bottom
5051.83	298000	6.84	5.00	738247	16.95	3.94	100-2 Detention

CONCEPTUAL POND 785 FOR TRI-TOWN SUBBASIN TT-787

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5079.00	0	0.00	0.0	0	0.00	0.00	Bottom
5084.00	153000	3.51	5.00	375229	8.61	0.38	100-2 Detention

CONCEPTUAL POND 788 FOR TRI-TOWN SUBBASIN TT-788

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5026.00	0	0.00	0.0	0	0.00	0.00	Bottom
5031.00	112000	2.57	5.00	274934	6.31	0.73	100-2 Detention

CONCEPTUAL POND 793 FOR TRI-TOWN SUBBASIN TT-793

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4975.80	0	0.00	0.0	0	0.00	0.00	Bottom
4980.80	141000	3.24	5.00	348821	8.01	1.07	100-2 Detention

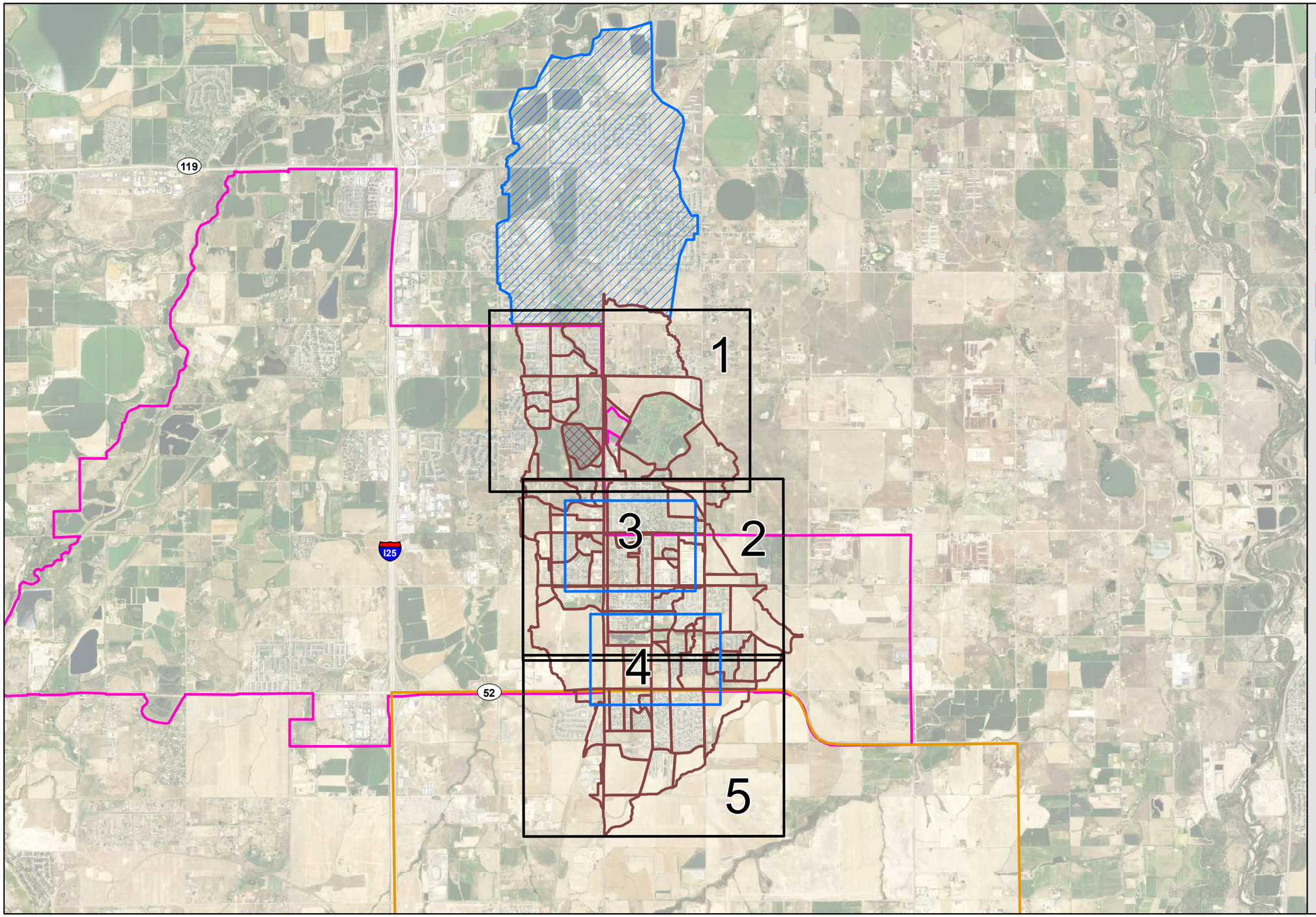
CONCEPTUAL POND 794 FOR TRI-TOWN SUBBASIN TT-794

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4947.28	0	0.00	0.0	0	0.00	0.00	Bottom
4952.28	63000	1.45	5.00	155641	3.57	1.82	100-2 Detention

CONCEPTUAL POND 795 FOR TRI-TOWN SUBBASIN TT-795

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4957.11	0	0.00	0.0	0	0.00	0.00	Bottom
4962.11	175000	4.02	5.00	433123	9.94	2.93	100-2 Detention

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run



Legend

- 500 Foot Scale
- 1000 Foot Scale
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

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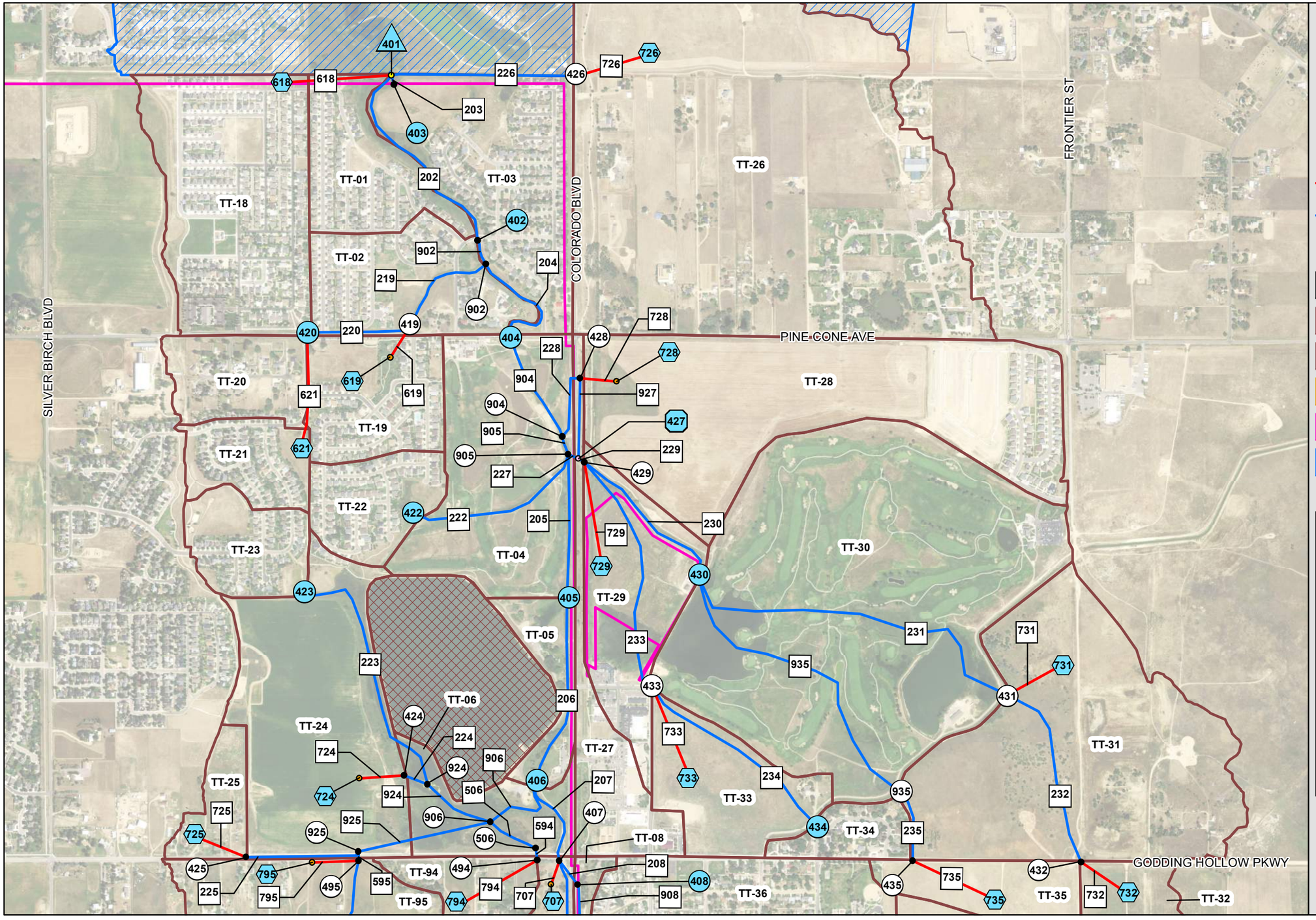
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/14/21	
SHEET: TT	INDEX: C-INDEX



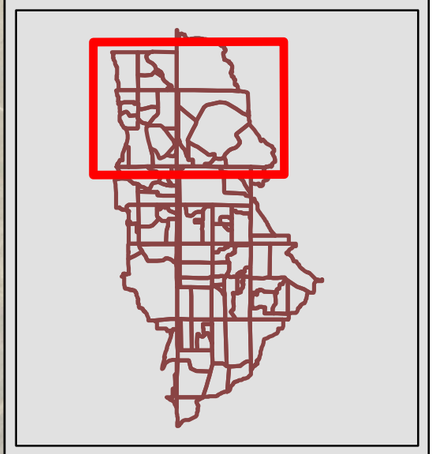
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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0 500 1,000 2,000
Feet

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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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PROJECT NUMBER: COTOF.03	
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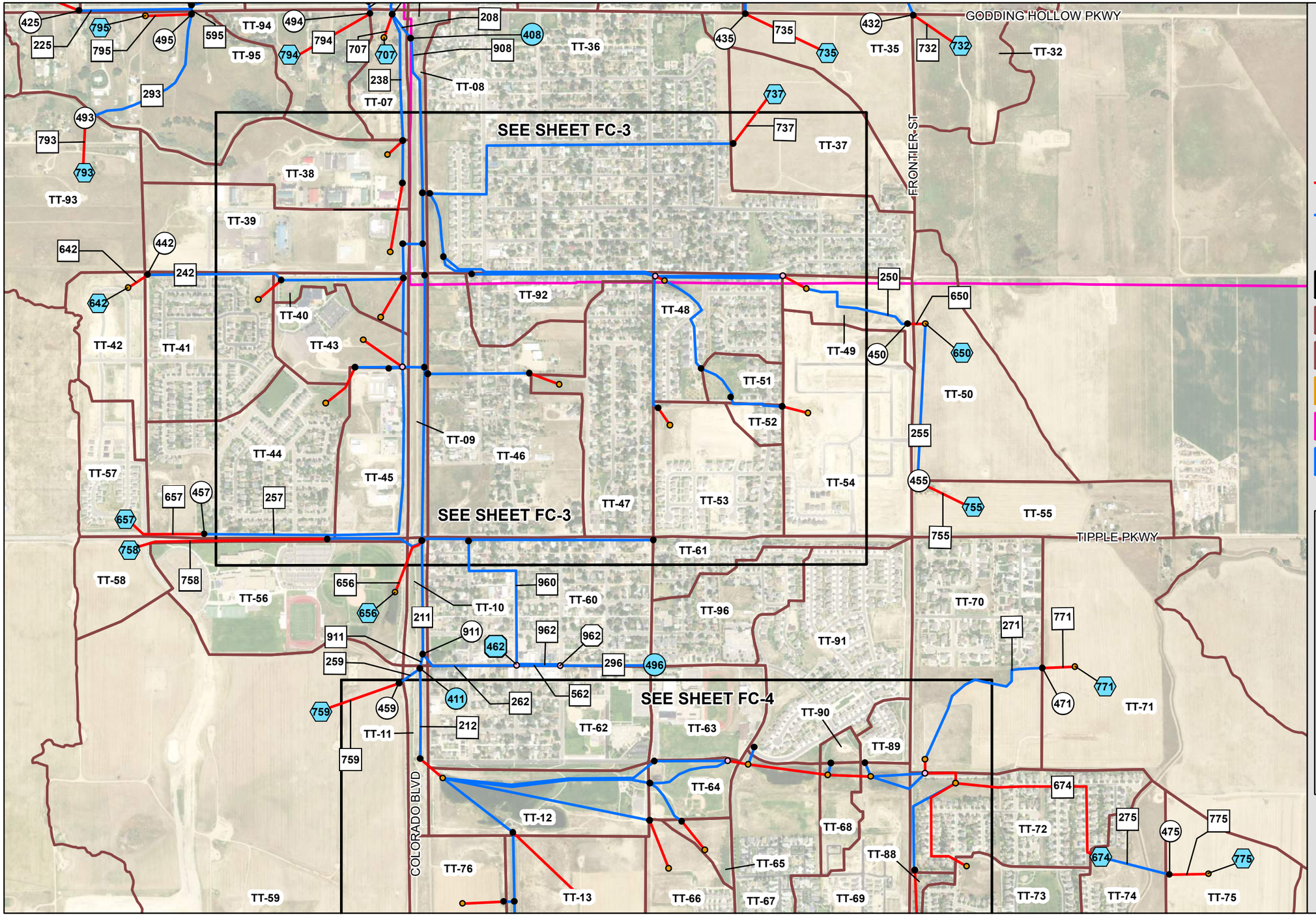
SHEET: TT	INDEX: FC-1



Legend

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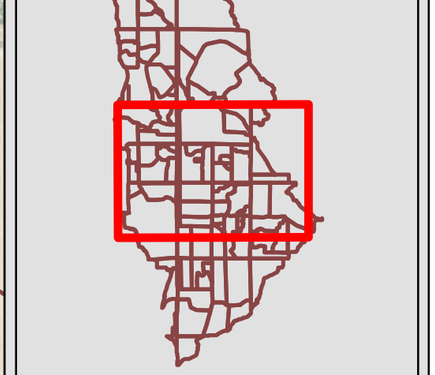
Key Map



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Feet

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TRI-TOWN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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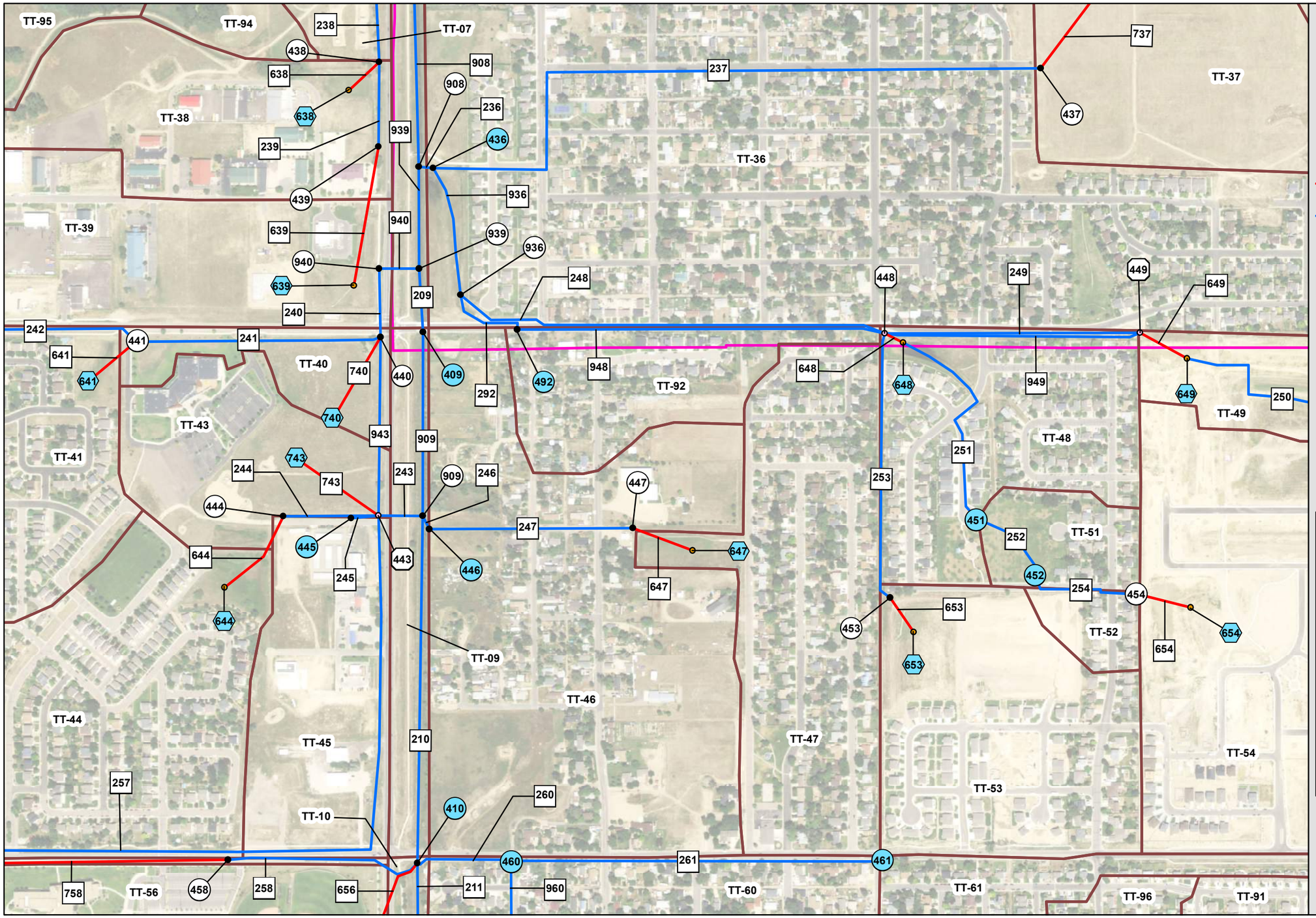
SHEET: TT	INDEX: FC-2



Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
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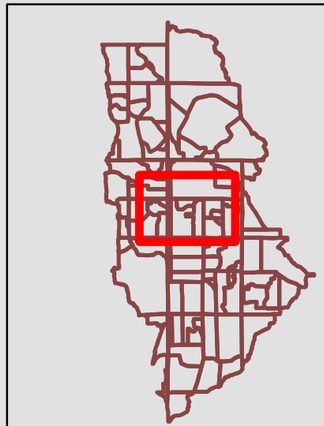
Key Map



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Feet

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OUTFALL SYSTEM PLAN

TRI-TOWN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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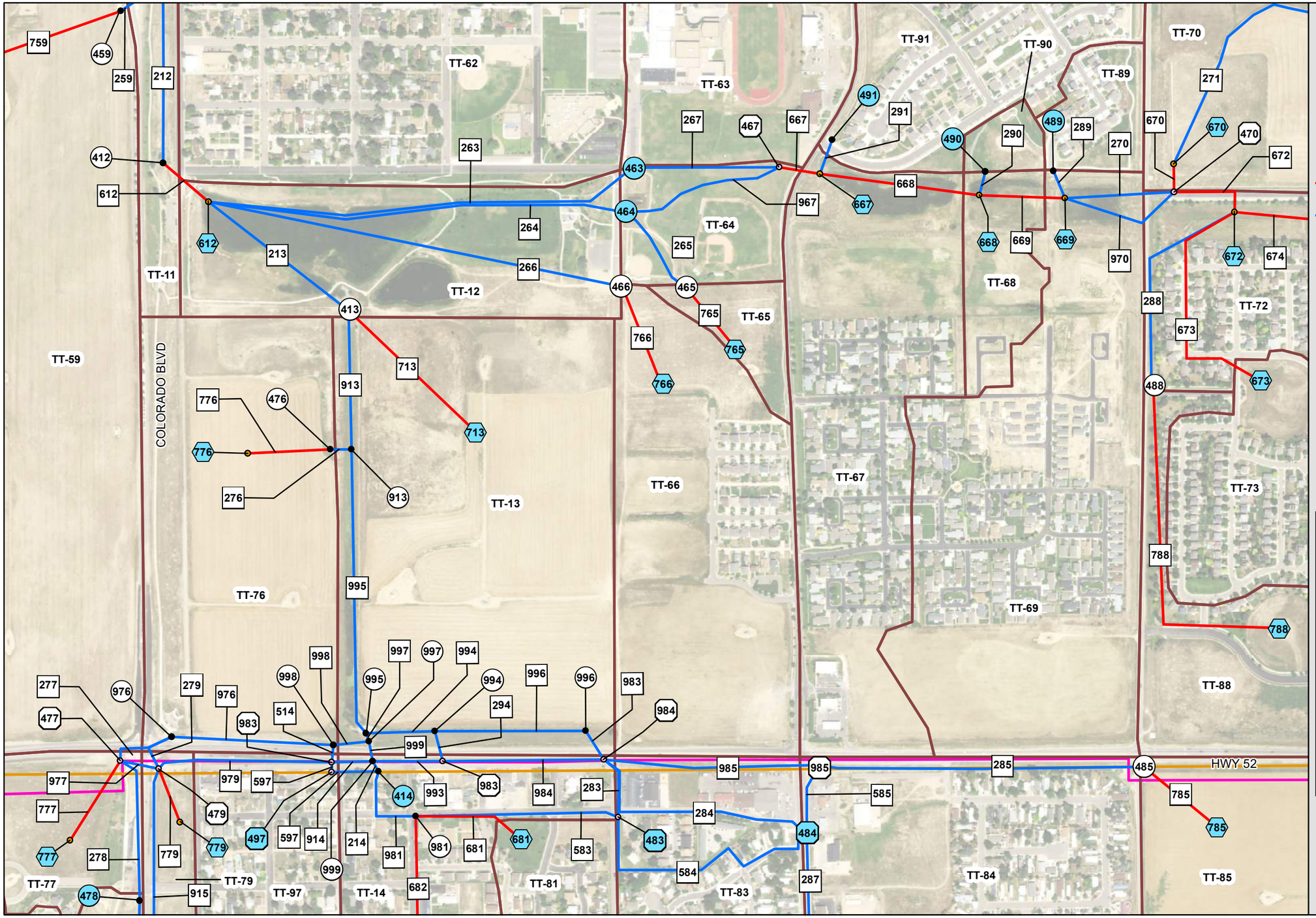
PROJECT NUMBER: COTOF.03	
DATE: 10/14/21	
SHEET: TT	INDEX: FC-3



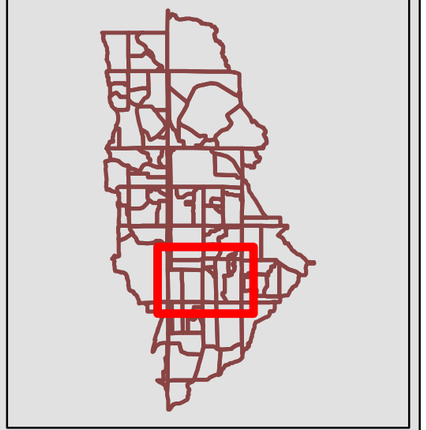
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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0 250 500 1,000
Feet

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OUTFALL SYSTEM PLAN

TRI-TOWN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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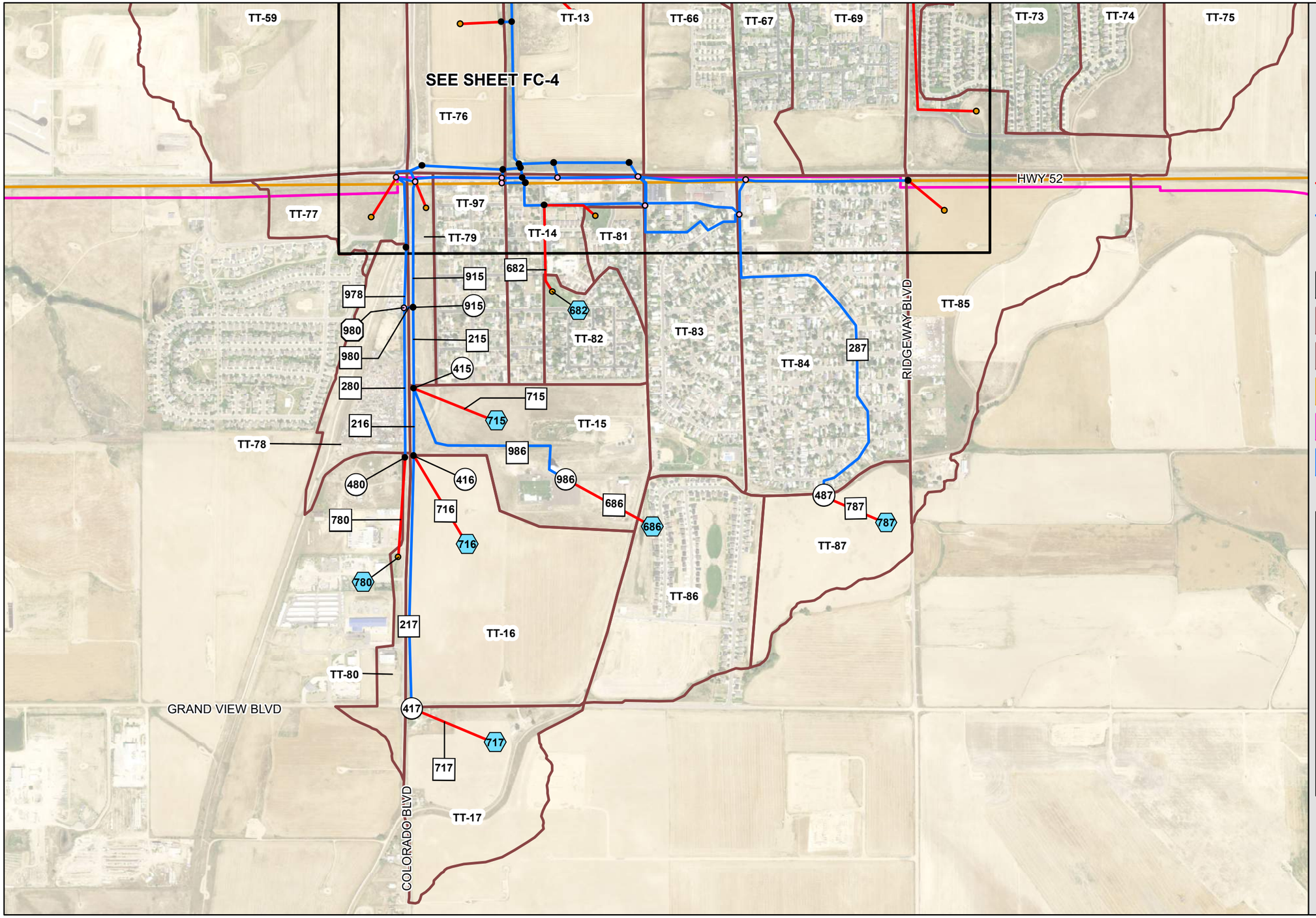
PROJECT NUMBER: COTOF.03	
DATE: 10/14/21	
SHEET: TT	INDEX: FC-4



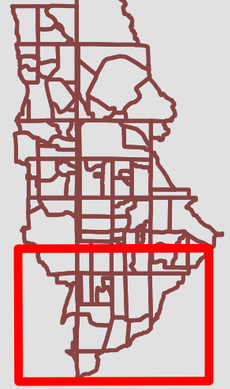
Legend

- Junction (X)
- Flow Diversion Node (X)
- Outfall (X)
- Detention Pond (X)
- Outlet (X)
- Link (X)

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



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0 500 1,000 2,000
Feet

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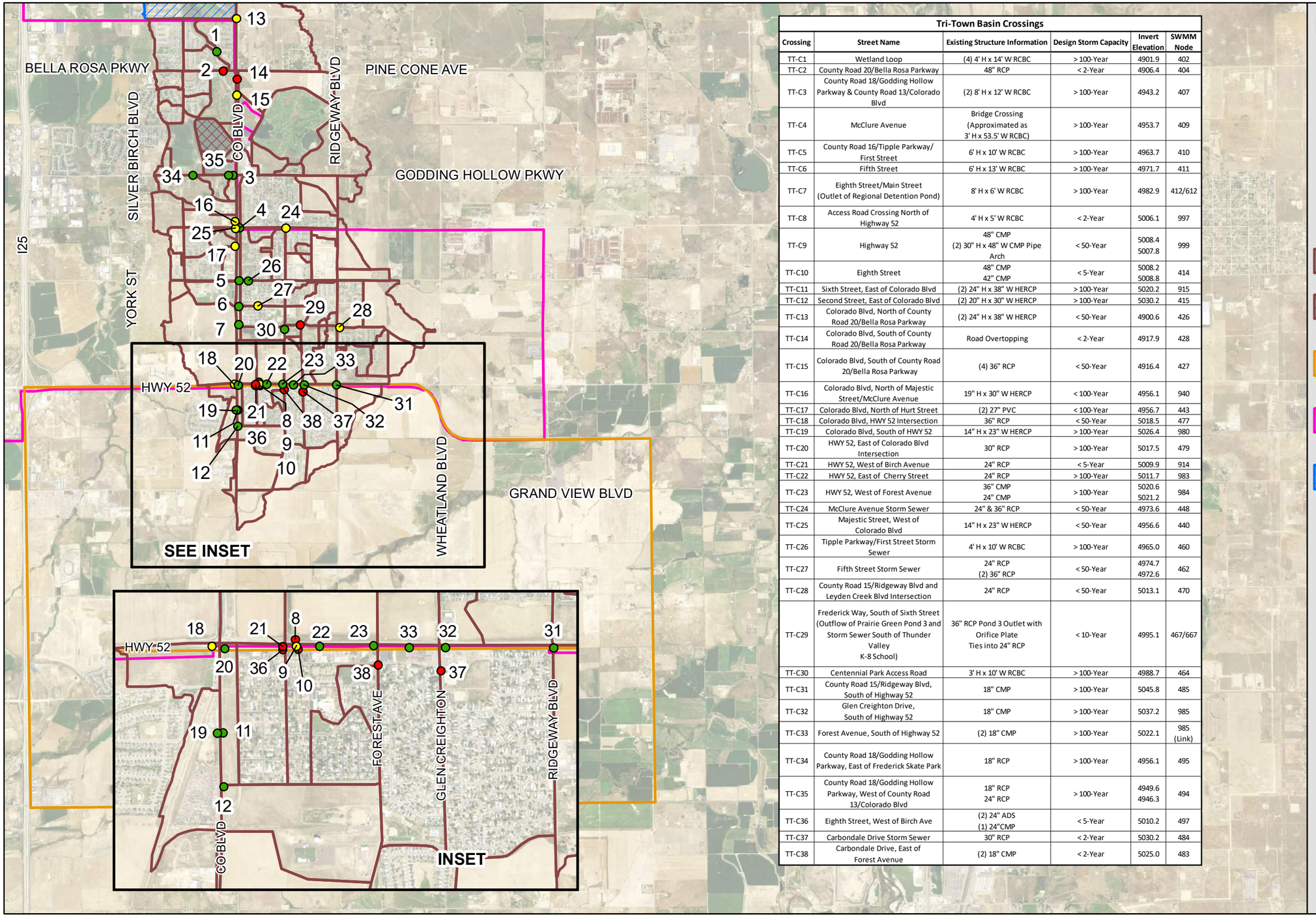
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/14/21	
SHEET: TT	INDEX: FC-5



Tri-Town Basin Crossings

Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation	SWMM Node
TT-C1	Wetland Loop	(4) 4' H x 14' W RCBC	> 100-Year	4901.9	402
TT-C2	County Road 20/Bella Rosa Parkway	48" RCP	< 2-Year	4906.4	404
TT-C3	County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	(2) 8' H x 12' W RCBC	> 100-Year	4943.2	407
TT-C4	McClure Avenue	Bridge Crossing (Approximated as 3' H x 53.5' W RCBC)	> 100-Year	4953.7	409
TT-C5	County Road 16/Tipple Parkway/ First Street	6' H x 10' W RCBC	> 100-Year	4963.7	410
TT-C6	Fifth Street	6' H x 13' W RCBC	> 100-Year	4971.7	411
TT-C7	Eighth Street/Main Street (Outlet of Regional Detention Pond)	8' H x 6' W RCBC	> 100-Year	4982.9	412/612
TT-C8	Access Road Crossing North of Highway 52	4' H x 5' W RCBC	< 2-Year	5006.1	997
TT-C9	Highway 52	48" CMP (2) 30" H x 48" W CMP Pipe Arch	< 50-Year	5008.4 5007.8	999
TT-C10	Eighth Street	48" CMP 42" CMP	< 5-Year	5008.2 5008.8	414
TT-C11	Sixth Street, East of Colorado Blvd	(2) 24" H x 38" W HERCP	> 100-Year	5020.2	915
TT-C12	Second Street, East of Colorado Blvd	(2) 20" H x 30" W HERCP	> 100-Year	5030.2	415
TT-C13	Colorado Blvd, North of County Road 20/Bella Rosa Parkway	(2) 24" H x 38" W HERCP	< 50-Year	4900.6	426
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	Road Overtopping	< 2-Year	4917.9	428
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	(4) 36" RCP	< 50-Year	4916.4	427
TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	19" H x 30" W HERCP	< 100-Year	4956.1	940
TT-C17	Colorado Blvd, North of Hurt Street	(2) 27" PVC	< 100-Year	4956.7	443
TT-C18	Colorado Blvd, HWY 52 Intersection	36" RCP	< 50-Year	5018.5	477
TT-C19	Colorado Blvd, South of HWY 52	14" H x 23" W HERCP	> 100-Year	5026.4	980
TT-C20	HWY 52, East of Colorado Blvd Intersection	30" RCP	> 100-Year	5017.5	479
TT-C21	HWY 52, West of Birch Avenue	24" RCP	< 5-Year	5009.9	914
TT-C22	HWY 52, East of Cherry Street	24" RCP	> 100-Year	5011.7	983
TT-C23	HWY 52, West of Forest Avenue	36" CMP 24" CMP	> 100-Year	5020.6 5021.2	984
TT-C24	McClure Avenue Storm Sewer	24" & 36" RCP	< 50-Year	4973.6	448
TT-C25	Majestic Street, West of Colorado Blvd	14" H x 23" W HERCP	< 50-Year	4956.6	440
TT-C26	Tipple Parkway/First Street Storm Sewer	4' H x 10' W RCBC	> 100-Year	4965.0	460
TT-C27	Fifth Street Storm Sewer	24" RCP (2) 36" RCP	< 50-Year	4974.7 4972.6	462
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP	< 50-Year	5013.1	470
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate Ties into 24" RCP	< 10-Year	4995.1	467/667
TT-C30	Centennial Park Access Road	3' H x 10' W RCBC	> 100-Year	4988.7	464
TT-C31	County Road 15/Ridgeway Blvd, South of Highway 52	18" CMP	> 100-Year	5045.8	485
TT-C32	Glen Creighton Drive, South of Highway 52	18" CMP	> 100-Year	5037.2	985
TT-C33	Forest Avenue, South of Highway 52	(2) 18" CMP	> 100-Year	5022.1	985 (Link)
TT-C34	County Road 18/Godding Hollow Parkway, East of Frederick Skate Park	18" RCP	> 100-Year	4956.1	495
TT-C35	County Road 18/Godding Hollow Parkway, West of County Road 13/Colorado Blvd	18" RCP 24" RCP	> 100-Year	4949.6 4946.3	494
TT-C36	Eighth Street, West of Birch Ave	(2) 24" ADS (1) 24"CMP	< 5-Year	5010.2	497
TT-C37	Carbondale Drive Storm Sewer	30" RCP	< 2-Year	5030.2	484
TT-C38	Carbondale Drive, East of Forest Avenue	(2) 18" CMP	< 2-Year	5025.0	483

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN
FUTURE CONDITION
CROSSING MAP

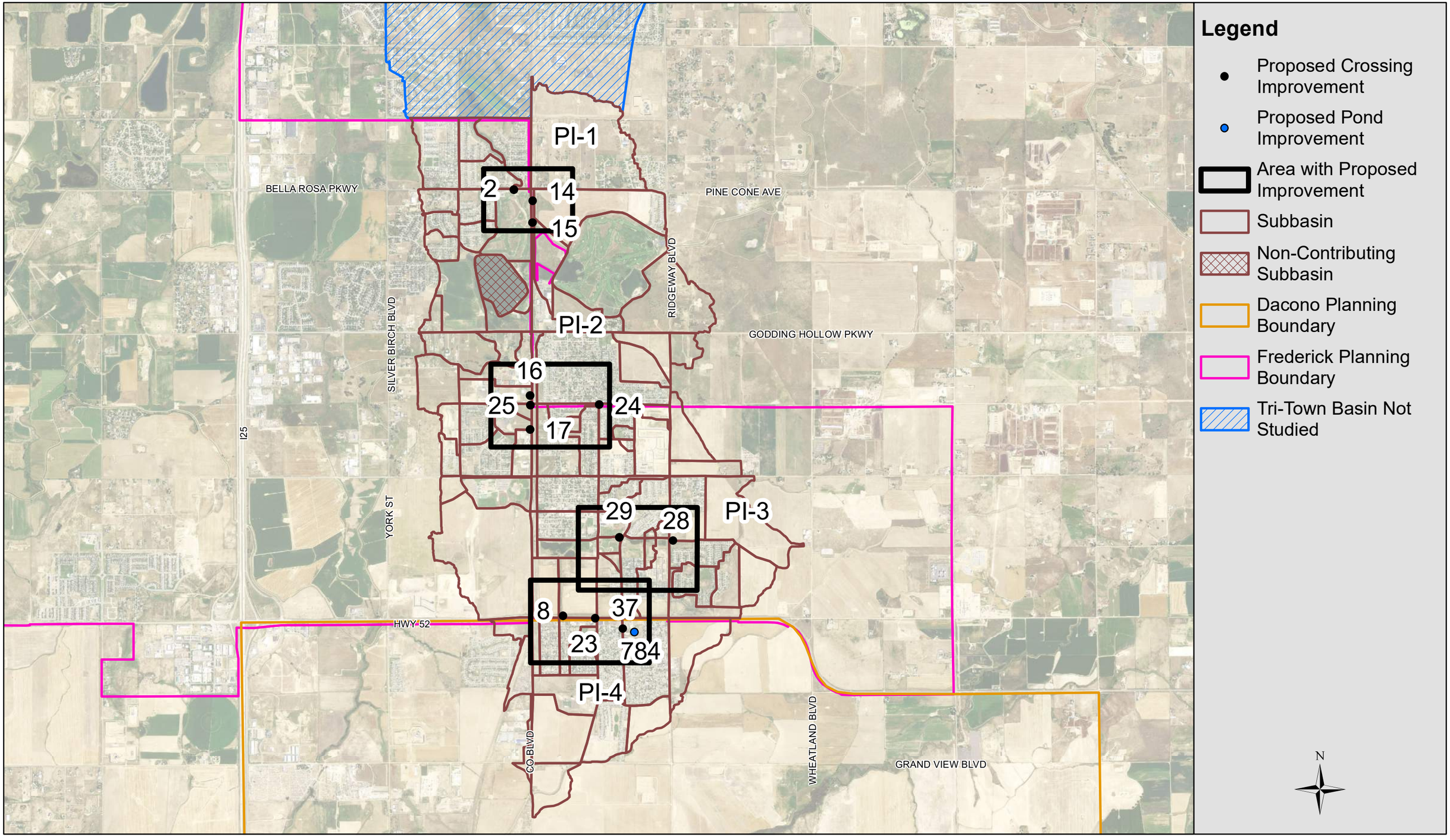
DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/18/2021	
SHEET: TT	INDEX: FC-CROSS

Table C.2.2: Tri-Town Basin Peak Discharge Comparison: Existing Conditions 2022 OSP and Future Conditions 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Difference (Future Condition - Existing Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	401	5030	153	257	433	1845	2889	148	234	347	1360	2061	-5	-23	-86	-486	-829	
County Road 20/Bella Rosa Parkway	404	4366	151	245	413	1682	2583	142	218	324	1121	1647	-9	-28	-90	-561	-936	
No Name Creek Tributary	904	4281	151	244	410	1643	2508	142	216	320	1082	1580	-9	-27	-89	-561	-928	
County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	407	3183	122	186	302	981	1464	118	176	255	701	1016	-4	-10	-47	-280	-449	
Upstream Side of County Road 13/Colorado Blvd	408	3085	122	185	302	973	1407	118	176	255	701	976	-4	-9	-47	-272	-431	New culvert crossing of Colorado Blvd and Godding Hollow Parkway built in 2004.
McClure Avenue	409	2808	78	121	214	691	987	74	112	167	417	569	-4	-9	-47	-274	-418	New culvert crossing of McClure Avenue built in 2018.
County Road 16/Tipple Parkway/ First Street	410	2203	59	92	169	560	783	58	88	131	299	394	-2	-4	-38	-261	-389	
Eighth Street/Main Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1652	33	52	94	278	388	31	46	68	142	192	-2	-6	-26	-136	-196	Regional Detention Pond Built in 2003.
State Highway 52 Frederick/Dacono Boundary	999	792	107	173	249	776	1088	107	173	249	548	736	0	0	0	-228	-353	
Second Street, East of Colorado Blvd	415	287	9	15	52	216	308	4	5	6	12	16	-5	-10	-46	-204	-292	

*Milavec Reservoir considered non-contributing area due to surrounding berms isolating it from the watershed. Total non-contributing area ~ 67 acres.

Appendix C.3. Tri-Town Proposed Improvement Documentation



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OUTFALL SYSTEM PLAN

TRI-TOWN
PROPOSED
IMPROVEMENTS
INDEX

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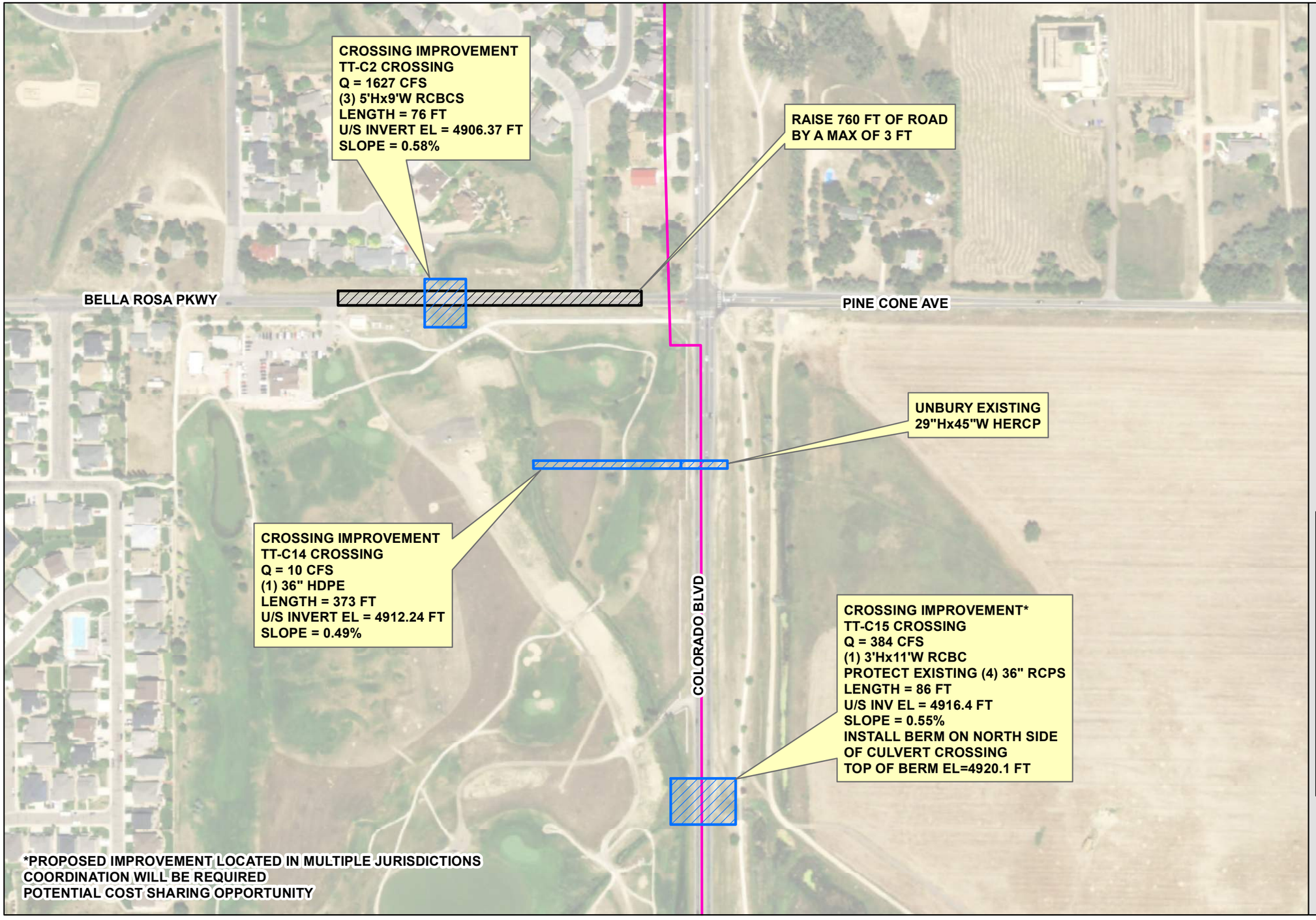
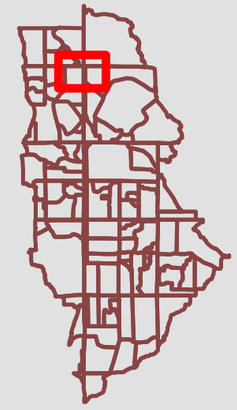


Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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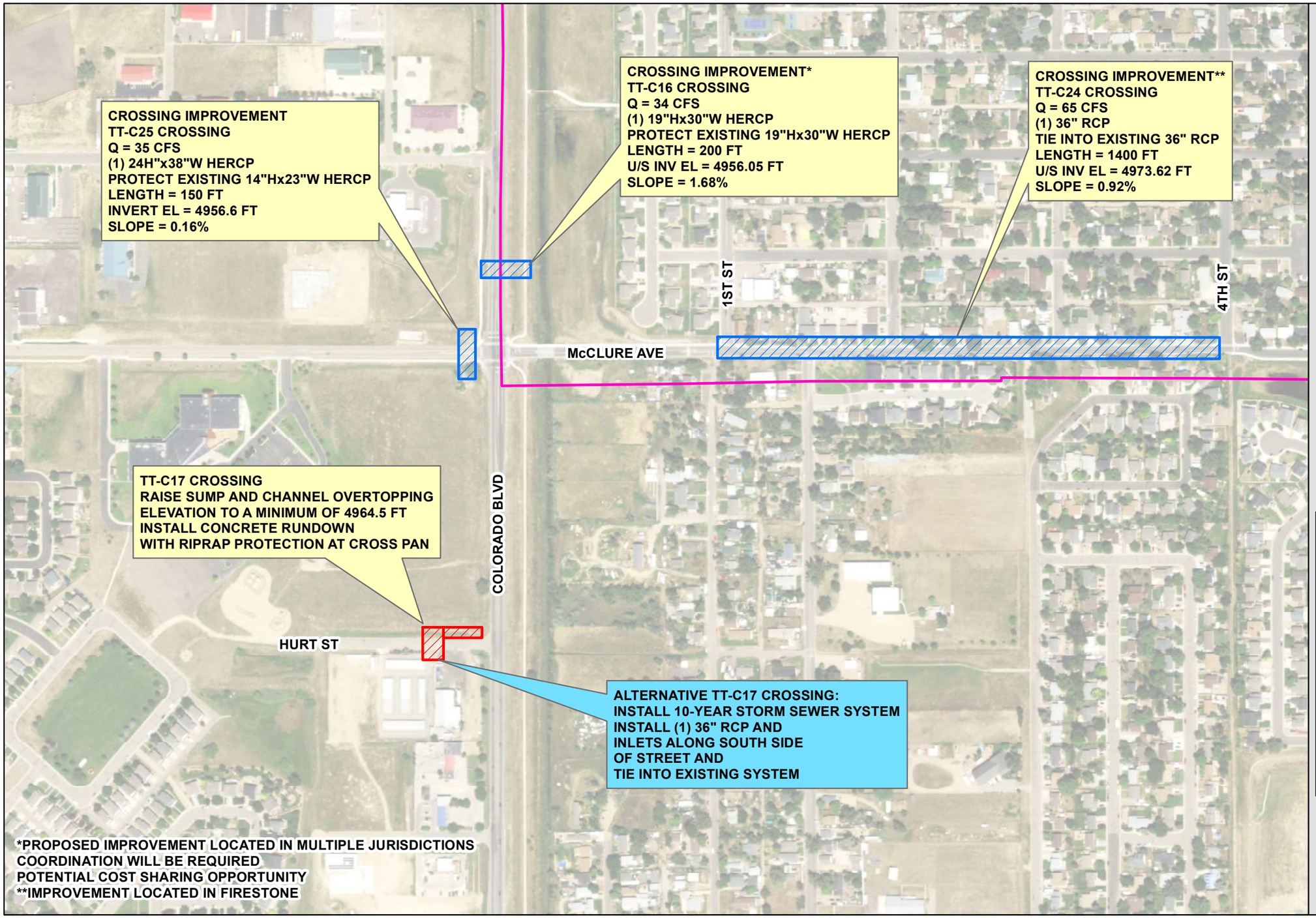
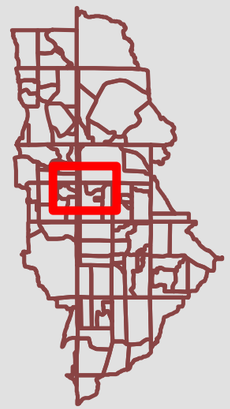


Legend

- Crossing Improvement
- Hurt St Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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TRI-TOWN
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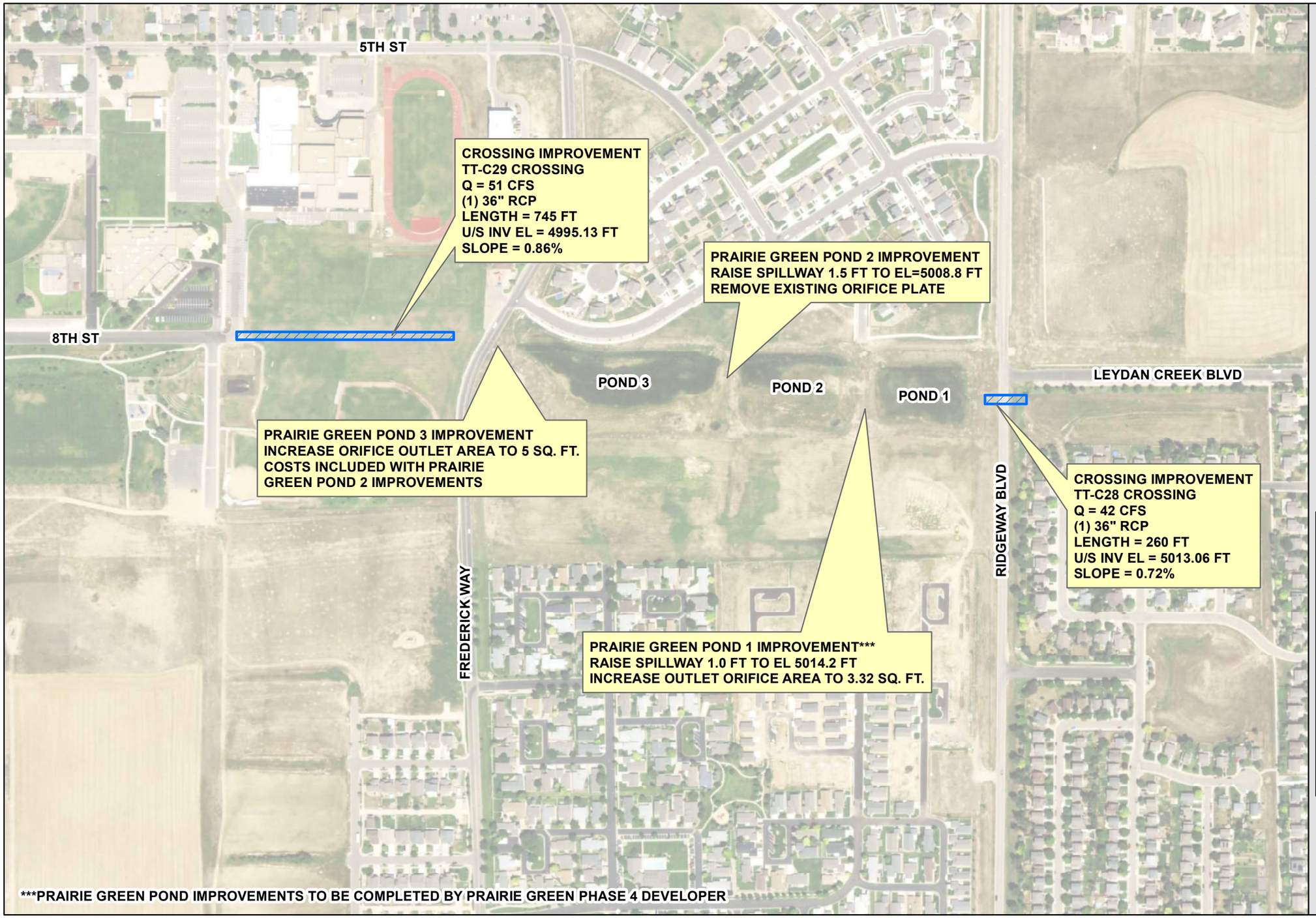
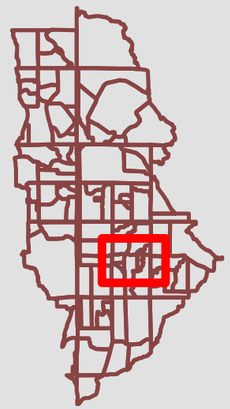
SHEET: TT	INDEX: PI-2



Legend

- Crossing Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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TRI-TOWN
PROPOSED
IMPROVEMENTS

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SHEET: TT	INDEX: PI-3

CHANNEL IMPROVEMENT*
Q = 504 CFS
LENGTH = 1110 FT
BOTTOM WIDTH = 10 FT
DEPTH = 4.5 FT
4H:1V SIDE SLOPES
U/S INV EL = 5018.9 FT
SLOPE = 1.16%
COSTS INCLUDED WITH TT-C23
CROSSING IMPROVEMENT

TIE INTO EXISTING
CHANNEL

CROSSING IMPROVEMENT*
TT-C23 & TT-C38 CROSSINGS
Q = 504 CFS
(2) 3'Hx12'W RCBCS
LENGTH = 420 FT
U/S INV EL = 5021.24 FT
SLOPE = 0.47%

POND IMPROVEMENT
TT POND 784
DEPTH = 7.5 FT
VOLUME = 3.67 AC-FT
QIN = 74 CFS
QOUT= 17 CFS
D/S INV EL = 5032.5 FT

CROSSING IMPROVEMENT
TT-C8 CROSSING
REMOVE EXISTING 4'Hx5'W RCBC
INSTALL CONCRETE LOW
FLOW CROSSING

HWY 52

8TH ST

7TH ST

CARBONDALE DR

INLET IMPROVEMENTS

CROSSING IMPROVEMENT*
TT-C9 & TT-C10 CROSSINGS
Q = 223 CFS
(1) 3'Hx10'W RCBC
LENGTH = 160 FT
U/S INV EL = 5008.2 FT
SLOPE = 1.08%

JUNCTION BOX

CROSSING IMPROVEMENT
TT-C37 CROSSING
Q = 319 CFS
(1) 78" RCP
LENGTH = 980 FT
U/S INV EL = 5025.1 FT
SLOPE = 0.39%

MAINTAIN EXISTING CHANNEL

BIRCH AVE

CHERRY ST

FOREST AVE

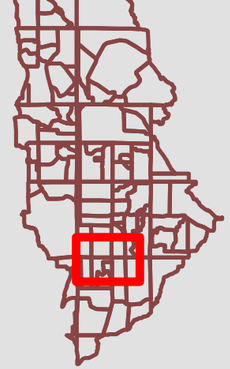
GLENN CREIGHTON DR

*PROPOSED IMPROVEMENT LOCATED IN MULTIPLE JURISDICTIONS
COORDINATION WILL BE REQUIRED
POTENTIAL COST SHARING OPPORTUNITY

Legend

- Crossing Improvement
- Channel Improvement
- Pond Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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TRI-TOWN
PROPOSED
IMPROVEMENTS

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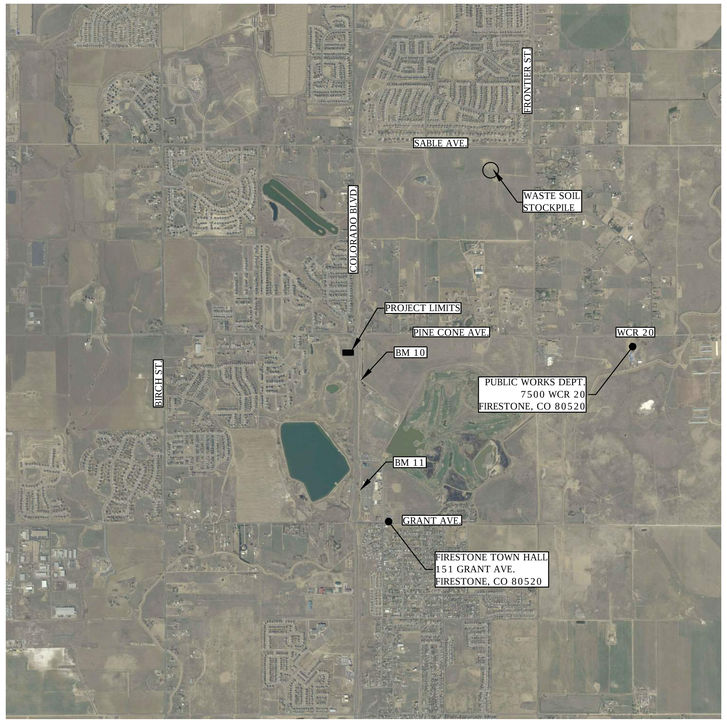
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/4/2021	
SHEET: TT	INDEX: PI-4

PUBLIC IMPROVEMENT CONSTRUCTION PLANS FOR THE

BELLA ROSA GOLF COURSE CULVERT

TOWN OF FREDERICK
COUNTY OF WELD
STATE OF COLORADO



VICINITY MAP

APPROX. SCALE: 1"=2000'

INDEX TO PLANS

SHEET TITLE	SHEET NUMBER
COVER	1
GENERAL NOTES	2
STORM SEWER PLAN AND PROFILE	3
CONSTRUCTION DETAILS	4-5

DATUM AND BENCHMARKS

1. ELEVATIONS ARE TOWN OF FIRESTONE DATUM RELATIVE TO TOWN OF FIRESTONE BENCHMARK BM 10, PUBLISHED ELEVATION = 4821.93 FEET (NGVD 1929), CHISELED CUT IN SOUTHWEST END OF NORTHEAST WING WALL O F TRAIL BRIDGE ABOUT 1250' SOUTH OF CR 20.

2. BENCHMARK BM 11, PUBLISHED ELEVATION = 4947.76 FEET (NGVD 1929), CHISELED CROSS IN NORTHWEST CORNER OF STORM INLET BOX ABOUT 100' NORTH OF SOUTHWEST CORNER OF THE SAFEWAY PARKING LOT. ABOUT 600' NORTH OF CENTERLINE OF GRANT STREET (CR 18).

OWNER

NAME: TOWN OF FIRESTONE
CONTACT: THEO ABKES, PUBLIC WORKS DIRECTOR
ADDRESS: 151 GRANT AVENUE
P.O. BOX 100
FIRESTONE, COLORADO 80520
PHONE: (303) 833-3544
E-MAIL: tabkes@ci.firestone.co.us

ENGINEER

NAME: COLORADO CIVIL GROUP, INC.
CONTACT: DAVE LINDSAY, P.E.
ADDRESS: 1413 W. 29TH STREET
LOVELAND, COLORADO 80538
PHONE: (970) 278-0029 x 108
E-MAIL: dlindsay@ccginc.us

SURVEYOR

NAME: CIVILARTS
CONTACT: FRANK DREXEL
ADDRESS: 1860 LEFTHAND CIRCLE
SUITE A
LONGMONT, COLORADO 80501
PHONE: (303) 682-1131
FAX: (303) 682-1149
E-MAIL: fdrexel@civilarts.us

TOWN OF FREDERICK

APPROVED:_____ DATE:_____
TOWN OF FREDERICK

TOWN OF FIRESTONE

APPROVED:_____ DATE:_____
TOWN OF FIRESTONE

REVISIONS
DATE | REVISION DESCRIPTION

CCG COLORADO CIVIL GROUP, INC.
ENGINEERING CONSULTANTS
1413 W. 29TH STREET
LOVELAND, COLORADO 80538
(970) 278-0029

BELLA ROSA GOLF COURSE CULVERT

COVER

FILENAME: 0668.0122.04_COVER-NOTES
DESIGNED: D.A.H.
CHECKED: D.B.L.
JOB NO.: 0668.0122.04
SCALE: N/A
DATE: JANUARY 2015

SHEET NO.: 1 OF 5

FIRESTONE
A COMMUNITY IN MOTION

CALL THE UTILITY NOTIFICATION CENTER OF COLORADO
COLORADO 811
3 DAYS BEFORE YOU DIG
811 OR 1-800-922-1987
www.UNCC.org

GENERAL NOTES: TOWN OF FIRESTONE (OWNER)

1. THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) AT 1-800-922-1987, AT LEAST 2 WORKING DAYS PRIOR TO BEGINNING EXCAVATION OR GRADING, TO HAVE ALL REGISTERED UTILITY LOCATIONS MARKED. OTHER UNREGISTERED UTILITY ENTITIES (I.E. DITCH COMPANY, CENTRAL WELD WATER DISTRICT, ST. VRAIN SANITATION DISTRICT) ARE TO BE LOCATED BY CONTACTING THE RESPECTIVE REPRESENTATIVE. UTILITY SERVICE LATERALS ARE ALSO TO BE LOCATED PRIOR TO BEGINNING EXCAVATION OR GRADING.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL UTILITIES DURING CONSTRUCTION AND FOR COORDINATING WITH THE APPROPRIATE UTILITY COMPANY FOR ANY UTILITY CROSSINGS REQUIRED. REPAIR OF DAMAGED UTILITIES SHALL BE AT THE CONTRACTORS EXPENSE, INCLUDING UNKNOWN UNDERGROUND UTILITIES.

3. DURING CONSTRUCTION AND UPON COMPLETION OF CONSTRUCTION, THE SITE SHALL BE CLEANED AND RESTORED TO A CONDITION EQUAL TO, OR BETTER THAN, THAT WHICH EXISTED BEFORE CONSTRUCTION, OR TO THE GRADES AND CONDITION AS REQUIRED BY THESE PLANS.

4. THE CONTRACTOR SHALL CONFORM TO ALL SAFETY PRECAUTIONS DURING CONSTRUCTION AS SET FORTH BY BOTH OSHA PUBLICATION 2226 FOR EXCAVATING AND TRENCHING OPERATIONS, AND INCLUDING ALL STATE AND FEDERAL REGULATIONS SET FORTH IN CFR (CODE OF FEDERAL REGULATIONS) 29, ALL PARTS.

5. THE CONTRACTOR SHALL KEEP A COPY OF THE APPROVED SET OF PLANS AND THE PROJECT MANUAL ON-SITE AT ALL TIMES.

6. EXISTING FENCES, TREES, SIDEWALKS, CURBS AND GUTTERS, LANDSCAPING, STRUCTURES, AND IMPROVEMENTS DESTROYED, DAMAGED OR REMOVED DUE TO CONSTRUCTION OF THIS PROJECT SHALL BE REPLACED OR RESTORED IN LIKE KIND AT THE CONTRACTOR'S EXPENSE, UNLESS OTHERWISE INDICATED ON THESE PLANS.

7. A COLORADO DEPARTMENT OF HEALTH CONSTRUCTION DEWATERING WASTEWATER DISCHARGE PERMIT IS REQUIRED IF DEWATERING IS REQUIRED TO INSTALL UTILITIES AND WATER IS DISCHARGED INTO A STORM SEWER, CHANNEL, IRRIGATION DITCH OR ANY WATERS OF THE UNITED STATES.

8. ALL DISTURBED SOIL, ON- OR OFF-SITE, AND RELATED TO WORK AT THIS PROJECT SITE, IS REQUIRED TO BE PROTECTED FROM WIND AND STORM WATER EROSION.

9. THE CONTRACTOR IS RESPONSIBLE FOR FIELD LOCATING AND VERIFYING ELEVATIONS OF ALL EXISTING SEWER MAINS, WATER MAINS, CURBS, GUTTERS AND OTHER UTILITIES AT THE POINTS OF CONNECTION SHOWN ON THE PLANS, AND AT ANY UTILITY CROSSINGS PRIOR TO INSTALLING ANY OF THE NEW IMPROVEMENTS. IF A CONFLICT EXISTS AND/OR A DESIGN MODIFICATION IS REQUIRED, THE CONTRACTOR SHALL COORDINATE WITH THE ENGINEER TO MODIFY THE DESIGN.

10. THE TYPE, SIZE, LOCATION AND NUMBER OF ALL KNOWN UNDERGROUND UTILITIES ARE APPROXIMATE WHEN SHOWN ON THE DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE ROUTE OF THE WORK BEFORE COMMENCING NEW CONSTRUCTION.

11. ANY DISRUPTION OF UTILITY SERVICE THAT IS REQUIRED TO ADJUST, EXTEND, RELOCATE OR OTHERWISE MODIFY ANY UTILITY WITHIN THE PROJECT AREA SHALL BE COORDINATED IN ADVANCE WITH THE AFFECTED UTILITY ENTITY AND CUSTOMERS SHALL BE NOTIFIED 48 HRS PRIOR TO THE START OF DISRUPTION.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING ALL OTHER APPLICABLE PERMITS NOT SPECIFICALLY REQUIRED BY THE OWNER.

13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSURING THAT NO MUD OR DEBRIS SHALL BE TRACKED ONTO THE EXISTING PUBLIC STREET SYSTEM. MUD AND DEBRIS MUST BE REMOVED IMMEDIATELY BY AN APPROPRIATE METHOD (I.E. MACHINE BROOM SWEEP, LIGHT DUTY FRONT-END LOADER, HANDWORK, ETC.) AND APPROVED BY THE INSPECTOR. THE FREQUENCY AND EFFORT OF STREET CLEANING OPERATIONS SHALL BE DIRECTLY RELATED TO THE AMOUNT OF CONSTRUCTION TRAFFIC AND WEATHER CONDITIONS. THE CONTRACTOR SHALL IMMEDIATELY ADDRESS ANY STREET CLEANING PROBLEMS IDENTIFIED BY THE TOWN.

14. CONSTRUCTION WORK SHALL NOT OCCUR BEFORE 7AM OR AFTER 7PM ON WEEKDAYS.

15. CONTRACTOR SHALL POTHOLE ALL EXISTING UTILITY CONFLICTS WITH PROPOSED UTILITIES AND IMPROVEMENTS WITHIN THE FIRST TWO WEEKS OF CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ALL EXISTING UTILITY INFORMATION.

STORM DRAINAGE NOTES

1. THE CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL ALIGNMENT OF ALL POINTS OF CONNECTION AND UTILITY CROSSINGS PRIOR TO INSTALLING ANY STORM DRAIN PIPE. IF A DESIGN MODIFICATION IS REQUIRED IT SHALL BE COORDINATED WITH THE ENGINEER.

2. AFTER EACH STORM, THE CONTRACTOR SHALL INSPECT AND REPAIR AS MAY BE REQUIRED, ALL EROSION CONTROL FACILITIES.

TOWN OF FIRESTONE GRADING & EROSION CONTROL NOTES

1. ALL FILLS IN STREET RIGHT-OF-WAYS SHALL BE COMPACTED PER TOWN OF FIRESTONE SPECIFICATIONS. ALL EARTHWORK IN STREET RIGHT-OF-WAYS SHALL COMPLY WITH TOWN OF FIRESTONE SPECIFICATIONS.

2. ALL DISTURBED AREAS IN THE GOLF COURSE FAIRWAY SHALL BE RESEEDED AND MULCHED NO MORE THAN 30 DAYS AFTER COMPLETION OF GRADING OPERATIONS. PRIOR TO RESEEDING THE SOIL SHALL BE AMENDED WITH 4 CY OF ORGANIC MATTER PER 1,000 S.F. OF DISTURBED AREA.

   DRYLAND SEED:

SPECIES	LBS.PLS/ACRE
CRESTED WHEATGRASS	12
ANNUAL RYE GRASS	20
WINTER WHEAT	40
WESTERN WHEATGRASS	20
SWITCH GRASS	6

   HAY OR STRAW MULCH SHALL BE APPLIED AT A RATE 2 TONS/ACRE AND MECHANICALLY CRIMPED INTO THE SOIL.

3. THE CONSTRUCTION AREA SHALL BE WATERED AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION ACTIVITIES SO AS TO PREVENT WIND-CAUSED EROSION AND DUST. ALL LAND DISTURBING ACTIVITIES SHALL BE IMMEDIATELY DISCONTINUED WHEN FUGITIVE DUST IMPACTS ADJACENT PROPERTIES, AS DETERMINED BY THE TOWN.

4. ALL RECOMMENDATIONS OF THE STORM WATER MANAGEMENT PLAN SHALL BE FOLLOWED AND IMPLEMENTED.

GENERAL NOTES: TOWN OF FREDERICK

1. ALL CONSTRUCTION SHALL CONFORM TO THE LATEST "DESIGN STANDARDS AND CONSTRUCTION SPECIFICATIONS" BY THE TOWN OF FREDERICK. COPIES OF THE TOWN OF FREDERICK STANDARDS AND SPECIFICATIONS MAY BE OBTAINED FROM THE TOWN OF FREDERICK.

2. THE OWNER SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE TOWN OF FREDERICK ENGINEERING STAFF AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION. THOSE IN ATTENDANCE SHALL INCLUDE THE OWNER, HIS ENGINEER, THE TOWN OF FREDERICK ENGINEERING STAFF, REPRESENTATIVES OF THE CONTRACTORS AND OTHER AFFECTED AGENCIES.

3. EXCEPT WHERE OTHERWISE PROVIDED FOR IN THESE PLANS AND SPECIFICATIONS, THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, AND THE COLORADO DEPARTMENT OF TRANSPORTATION M & S STANDARDS, LATEST EDITION, SHALL APPLY.

4. THE CONTRACTOR SHALL PROVIDE INGRESS AND EGRESS TO PRIVATE PROPERTY ADJACENT TO THE PROJECT THROUGHOUT THE PERIOD OF CONSTRUCTION. PRIOR TO BEGINNING WORK, THE CONTRACTOR SHALL OBTAIN A WRITTEN AGREEMENT FROM THE PROPERTY OWNERS IMPACTED BY THIS ACCESS. UPON REQUEST, THE CONTRACTOR SHALL PROVIDE A COPY OF THESE WRITTEN AGREEMENTS TO THE TOWN OF FREDERICK.

5. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE TOWN OF FREDERICK ENGINEERING STAFF. THE TOWN RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO TOWN STANDARDS AND SPECIFICATIONS. REQUEST FOR INSPECTION BY THE TOWN OF FREDERICK SHALL BE MADE BY THE CONTRACTOR AT LEAST FORTY-EIGHT (48) HOURS BEFORE THE SERVICE THEREOF WILL BE REQUIRED.

6. CONTRACTOR SHALL HAVE IN HIS POSSESSION AT ALL TIMES ONE (1) SIGNED AND STAMPED BY THE DESIGN ENGINEER, COPY OF PLANS ACCEPTED BY THE TOWN OF FREDERICK. THE TOWN OF FREDERICK, THROUGH ACCEPTANCE OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT. THE OWNER AND ENGINEER UNDERSTAND THAT THE RESPONSIBILITY FOR THE ENGINEERING ADEQUACY OF THE FACILITIES DEPICTED IN THIS DOCUMENT LIES SOLELY WITH THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT. REPORT ALL DISCREPANCIES TO THE DESIGN ENGINEER IMMEDIATELY.

7. CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE SPECIFICATIONS AND PERMITS NECESSARY TO PERFORM THE PROPOSED WORK BEFORE THE WORK BEGINS.

8. AS-BUILT DRAWINGS AND A CD OF ELECTRONIC FILES, AS REQUIRED IN SECTION 0100 OF THE TOWN'S SPECIFICATIONS, ARE TO BE SUBMITTED BY THE CONTRACTOR PRIOR TO SUBSTANTIAL COMPLETION/CONSTRUCTION ACCEPTANCE OF THE CONSTRUCTION.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING AND REPLACING ANY EXISTING SIGNS, STRUCTURES, FENCES, ETC., ENCOUNTERED ON THE JOB AND RESTORING THEM TO THEIR ORIGINAL CONDITION.

10. THE CONTRACTOR IS RESPONSIBLE FOR:
    A. NOTIFYING THE TOWN OF FREDERICK UTILITY CUSTOMERS OF POTENTIAL SERVICE OUTAGES, AND COORDINATE WITH THE TOWN OF FREDERICK FOR DETERMINATION OF MINIMUM TIME REQUIREMENT.
    B. NOTIFYING THE TOWN OF FREDERICK FORTY-EIGHT (48) HOURS IN ADVANCE FOR OBSERVATIONS OF WORK IN PROGRESS. OBSERVATION AND ON-SITE VISITS ARE NOT TO BE CONSTRUED AS A GUARANTEE BY THE TOWN ENGINEERING STAFF OF THE CONTRACTORS' CONTRACTUAL COMMITMENT. IF WORK IS SUSPENDED FOR ANY PERIOD OF TIME AFTER INITIAL START-UP, THE CONTRACTOR SHALL NOTIFY THE TOWN OF FREDERICK FORTY-EIGHT (48) HOURS PRIOR TO RESTART.
    C. NOTIFYING THE FREDERICK-FIRESTONE FIRE PROTECTION DISTRICT OF ALL STREET CLOSURES AND EXISTING FIRE HYDRANTS TAKEN OUT OF SERVICE FOR AT LEAST FORTY-EIGHT (48) HOURS PRIOR TO THE START OF CONSTRUCTION.

11. PRIOR TO INSTALLATION OF UTILITY MAINS, ROAD CONSTRUCTION MUST HAVE PROGRESSED TO AT LEAST THE "SUB-GRADE" STAGE. THE CONTRACTOR WILL ADJUST ALL VALVE BOXES AND FIRE HYDRANTS TO THE FINAL FINISHED GRADE.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. A CONSTRUCTION DEWATERING PERMIT MUST BE OBTAINED FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE). GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF NEITHER EXISTING STREET NOR EROSION OF ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. THE USE OF ANY SANITARY SEWER TO DISPOSE OF TRENCH WATER WILL NOT BE PERMITTED. NO CONCRETE SHALL BE PLACED WHERE GROUNDWATER IS VISIBLE OR UNTIL THE GROUNDWATER TABLE HAS BEEN LOWERED BELOW THE PROPOSED IMPROVEMENTS. ANY UNSTABLE AREAS, AS A RESULT OF GROUNDWATER, ENCOUNTERED DURING THE CONSTRUCTION OF THE PROPOSED IMPROVEMENTS SHALL BE STABILIZED AS AGREED UPON BY THE CONTRACTOR, THE TOWN OF FREDERICK, AND THE DESIGN ENGINEER AT THE TIME OF THE OCCURRENCE. THE CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE AND/OR MAINTAIN ALL EXISTING DRAINAGE PATTERNS AT ALL TIMES WITHIN THE CONSTRUCTION AREAS.

13. IT SHALL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO RESOLVE CONSTRUCTION PROBLEMS WITH THE TOWN OF FREDERICK DUE TO CHANGED CONDITIONS ENCOUNTERED BY THE CONTRACTOR DURING THE PROGRESS OF ANY PORTION OF THE PROPOSED WORK. IF, IN THE OPINION OF THE TOWN OF FREDERICK, PROPOSED ALTERATIONS TO THE SIGNED CONSTRUCTION PLANS INVOLVES SIGNIFICANT CHANGES TO THE CHARACTER OF THE WORK, OR TO THE FUTURE CONTIGUOUS PUBLIC OR PRIVATE IMPROVEMENTS, THE DESIGN ENGINEER SHALL BE RESPONSIBLE FOR SUBMITTING REVISED PLANS TO THE TOWN OF FREDERICK FOR REVIEW, PRIOR TO ANY FURTHER CONSTRUCTION RELATED TO THAT PORTION OF THE WORK.

14. DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FLAGMEN, OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND IS NOT LIMITED TO NORMAL WORKING HOURS. THE TOWN OF FREDERICK OR THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE SAFETY OR ADEQUACY OF ANY EQUIPMENT, BUILDING COMPONENTS, SCAFFOLDING, FORMS OR OTHER WORK AIDS USED IN OR ABOUT THE PROJECT, OR IN THE SUPERINTENDING OF THE SAME. THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS FROM ANY AND ALL LIABILITY, REAL AND ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER, THE DESIGN ENGINEER OR THE TOWN. THE TOWN OF FREDERICK ENGINEERING STAFF, OR ANY CONTRACTED ENGINEERS, ARE NOT RESPONSIBLE FOR SAFETY IN, ON OR ABOUT THE PROJECT SITE, OR FOR COMPLIANCE BY THE APPROPRIATE PARTY OF ANY REGULATIONS RELATING THERETO.

15. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL PROCEED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.

16. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK.

17. EACH TYPE OF CONSTRUCTION SHALL BE COMPLETED BY A CONTRACTOR THAT HAS DEMONSTRATED ACCEPTABLE QUALIFICATIONS TO THE TOWN AND IS A LICENSED CONTRACTOR IN THE TOWN OF FREDERICK.

18. 21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TRAFFIC CONTROL DURING CONSTRUCTION. ALL TRAFFIC CONTROLS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, (MUTCD) LATEST EDITION.

22. ALL BACKFILL SHALL CONFORM TO THE TRENCH DETAIL LOCATED IN THE TOWN OF FREDERICK DESIGN STANDARDS & CONSTRUCTION SPECIFICATIONS.

23. THE CONTRACTOR SHALL IMMEDIATELY REMOVE ANY CONSTRUCTION DEBRIS OR MUD TRACKED ONTO EXISTING ROADWAYS. THE CONTRACTOR SHALL REPAIR ANY EXCAVATION OR PAVEMENT FAILURES CAUSED BY HIS CONSTRUCTION.

24. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED DURING HIS OPERATION. RENEWAL OF PAVEMENT STRIPING AND MARKING SHALL BE DONE IN CONFORMANCE WITH THE TOWN OF FREDERICK STANDARD SPECIFICATIONS.

25. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO TAKE EVERY MEASURE NECESSARY TO COMPLY WITH ANY STATE, COUNTY OR TOWN DUST CONTROL ORDINANCE. CONSTRUCTION VEHICLES SHALL USE TRUCK ROUTES DESIGNATED BY THE TOWN. EXTRA-LEGAL, OVERSIZE AND OVERWEIGHT VEHICLES REQUIRE AN EXTRA-LEGAL VEHICAL PERMIT FROM THE TOWN OF FREDERICK PRIOR TO TRAVELING TO THE CONSTRUCTION SITE ON TOWN STREETS.

26. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR THE PROPER FUNCTIONING OF THE IMPROVEMENTS FOR A MINIMUM OF TWO (2) YEARS FROM THE DATE OF SUBSTANTIAL COMPLETION/ CONSTRUCTION ACCEPTANCE OF THE IMPROVEMENTS BY THE TOWN OF FREDERICK. ANY FAILURE DURING THIS PERIOD OF GUARANTEE SHALL BE REMEDIED BY THE CONTRACTOR TO THE SATISFACTION OF THE TOWN OF FREDERICK AT NO EXPENSE TO THE TOWN.

27. THE DESIGN CIVIL ENGINEER SHALL PERFORM SUFFICIENT INSPECTIONS AND SURVEYS DURING GRADING AND CONSTRUCTION SO THAT HE MAY RENDER AN OPINION VERIFIED IN WRITING AS TO COMPLIANCE WITH THE PLANS AND CODES WITHIN HIS PURVIEW.

28. THE SOILS ENGINEER SHALL PERFORM SUFFICIENT INSPECTIONS DURING GRADING AND CONSTRUCTION SO THAT HE MAY RENDER AN OPINION VERIFIED IN WRITING AS TO COMPLIANCE WITH THE PLANS AND CODES WITHIN HIS PURVIEW.

REVISIONS	
DATE	REVISION DESCRIPTION

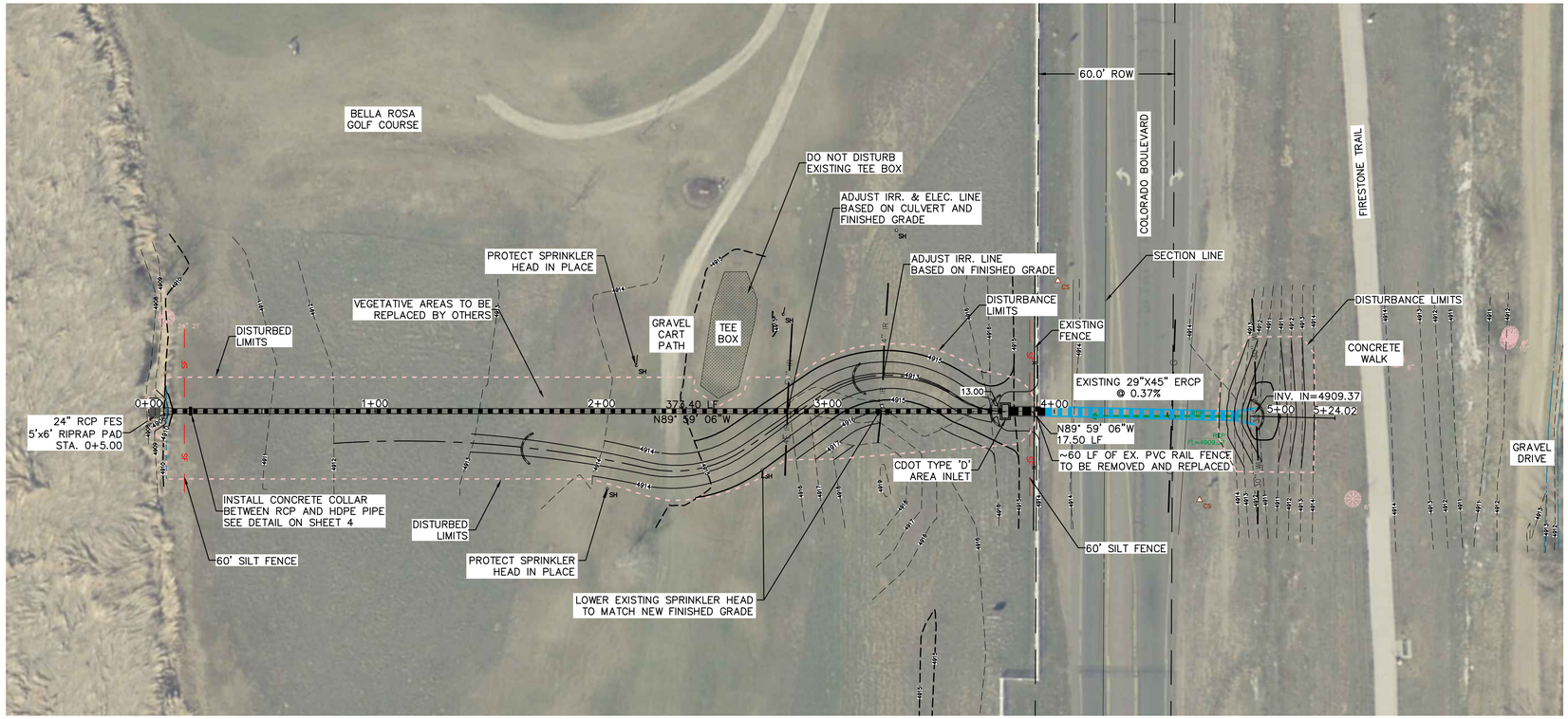
COLORADO CIVIL GROUP, INC.
ENGINEERING CONSULTANTS
1413 W. 29TH STREET
LOVELAND, COLORADO 80538
(970) 278-0029

BELLA ROSA GOLF COURSE CULVERT

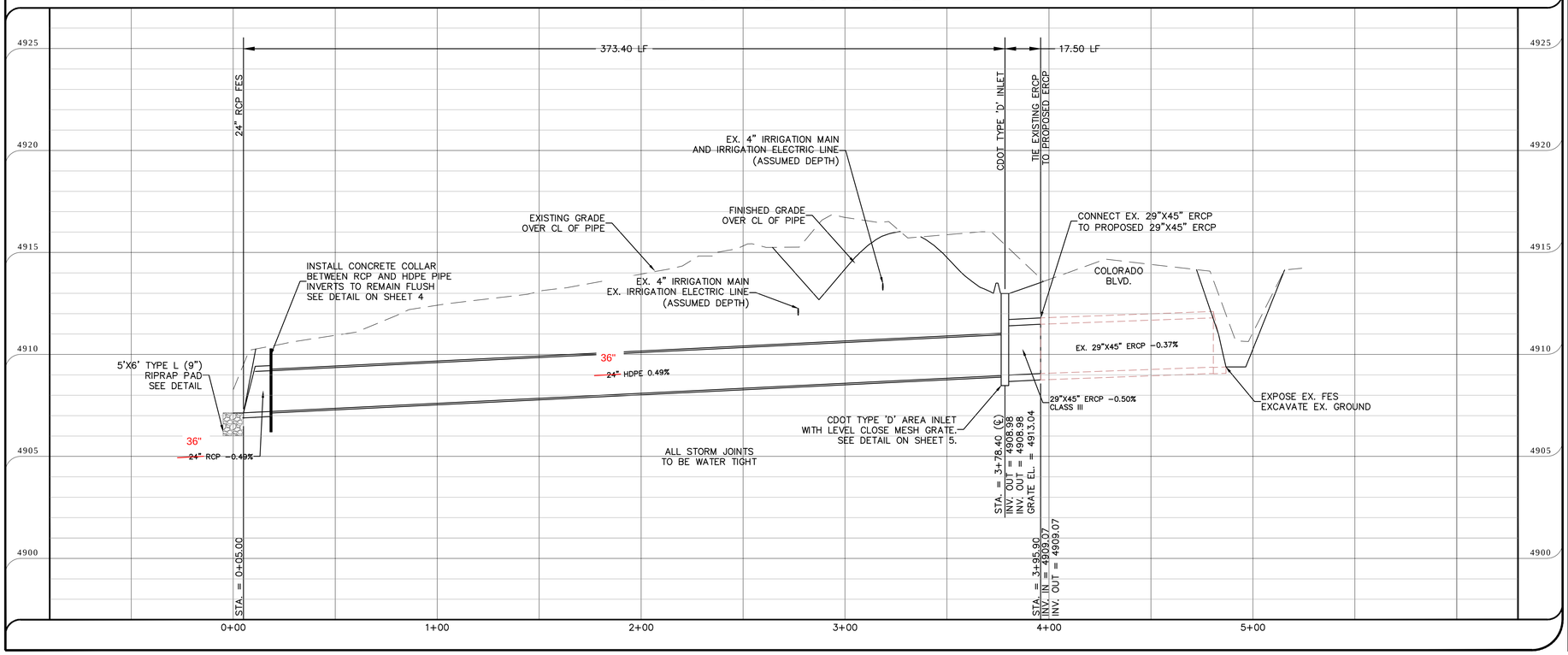
GENERAL NOTES

FILENAME: 0668.0122.04_COVER-NOTES
DESIGNED: D.A.H.
CHECKED: D.B.L.
JOB NO.: 0668.0122.04
SCALE: N/A
DATE: JANUARY 2015

SHEET NO.: 2 OF 5



BELLA ROSA GOLF COURSE CULVERT



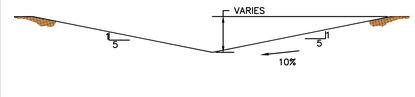
LEGEND

- EXISTING 1' CONTOUR
- EXISTING 5' CONTOUR (4855)
- EXISTING ELECTRIC LINE (E)
- EXISTING GAS LINE (G)
- EXISTING WATER LINE (30" WL)
- EXISTING IRRIGATION LINE (4" IR)
- EXISTING STORM SEWER
- PROPOSED 1' CONTOUR
- PROPOSED 5' CONTOUR (4845)
- PROPOSED SWALE FLOWLINE
- PROPOSED FLOW ARROW
- PROPOSED SILT FENCE (SF)
- PROPOSED STRAW WATTLE
- PROPOSED STORM SEWER
- PROPOSED STORM SEWER F.E.S.
- PROPOSED STORM SEWER INLET
- PROPOSED RIPRAP
- PROPOSED DISTURBANCE LIMITS
- SODDED AREA REPLACED BY OTHERS
- TEE BOX (PROTECTED IN PLACE)

NOTES

1. THE CONTRACTOR SHALL VERIFY THE HORIZONTAL LOCATION AND VERTICAL ELEVATION OF EACH UTILITY IN THE VICINITY OF THE PROPOSED STORM LINE. ALL UTILITIES SHALL BE VERIFIED PRIOR TO THE INSTALLATION OF ANY STORM LINE COMPONENTS. THE CONTRACTOR SHALL NOTIFY THE TOWN OF FREDERICK INSPECTOR OF ANY POTENTIAL CONFLICTS.
2. DUE TO THE SIZE AND NATURE OF THE PROJECT, NO STORMWATER MANAGEMENT PLAN AND DISCHARGE PERMIT IS REQUIRED. HOWEVER, CONTRACTOR SHALL IMPLEMENT AND MAINTAIN ALL EROSION CONTROL BMPs SHOWN ON THESE PLANS. CONTRACTOR SHALL ADD, REMOVE, OR MODIFY BMPs IF NECESSARY TO ENSURE SEDIMENT DOES NOT LEAVE THE PROJECT SITE.
3. A VEHICLE TRACKING PAD WILL BE REQUIRED, THE LOCATION SHALL BE DETERMINED BY THE CONTRACTOR.
4. ALL VEGETATIVE AREAS DISTURBED BY PROPOSED ACTIVITIES SHALL BE REPLACED BY OTHERS AND SHALL NOT BE CONSIDERED WITHIN THE CONTRACTORS SCOPE OF WORK.
5. CONTRACTOR SHALL TEMPORARILY REMOVE APPROXIMATELY 60 LF OF THE EXISTING WHITE VINYL SPLIT RAIL FENCE, TO BE REPLACED AFTER CONSTRUCTION OF THE CULVERT IS COMPLETE. REMOVAL OF FENCE SHALL BE AT POSTS.
6. ALL STORM JOINTS SHALL BE WATER TIGHT.
7. ELLIPTICAL REINFORCED CONCRETE PIPE (ERCP) SHALL BE CLASS III PIPE.
8. HDPE PIPE SHALL BE ADS N-12 IB WT PIPE, OR APPROVED EQUAL.
9. RIPRAP PADS SHALL BE EXPOSED AND PLACED AROUND THE FLARED END SECTION OR PIPE END WHERE SHOWN. SEE DETAIL SHEET 4 FOR INSTALLATION INSTRUCTIONS.
10. GOLF COURSE SHALL BE OPEN TO WINTER PLAY. CONTRACTOR SHALL ACCOMMODATE PERIODIC GOLFERS CROSSING THROUGH WORK AREA.

TYPICAL CHANNEL CROSS-SECTION



NOTE: THE CHANNEL HEIGHT VARIES FROM APPROXIMATELY 2.9' – 1.5'. AT APPROXIMATELY CULVERT STATION 2+00, THE CHANNEL BEGINS TO DAYLIGHT INTO THE NATURAL FALL OF THE GOLF COURSE TO CREATE AN OVERLAND FLOW.

N

0 30 60
scale 1" = 30' feet

CALL THE UTILITY NOTIFICATION CENTER OF COLORADO
COLORADO 811
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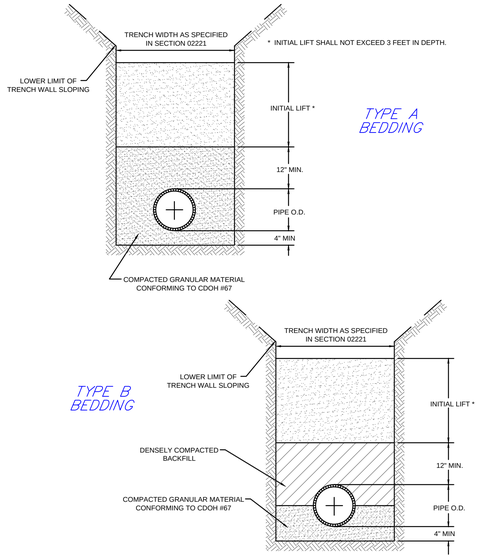
REVISIONS	
DATE	REVISION DESCRIPTION

CCG COLORADO CIVIL GROUP, INC.
ENGINEERING CONSULTANTS
1413 W. 29TH STREET
LOVELAND, COLORADO 80538
(970) 278-0029

TOWNS OF FIRESTONE AND FREDERICK
BELLA ROSA GOLF COURSE CULVERT
STORM SEWER - PLAN AND PROFILE

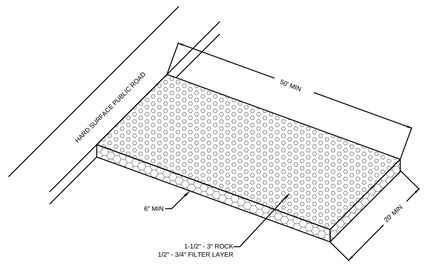
FILENAME: 0668.0122.04_STORM SEWER
DESIGNED: D.A.H.
CHECKED: D.B.L.
JOB NO.: 0668.0122.04
SCALE: HORIZONTAL: 1" = 30' VERTICAL: 1" = 3'
DATE: JANUARY 2015

SHEET NO.: 3 OF 5



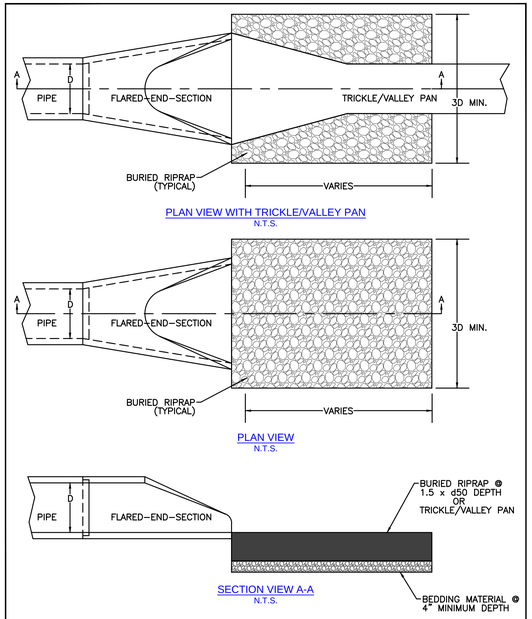
PIPE BEDDING DETAIL

FIRESTONE — A COMMUNITY IN MOTION | STORM CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: OCTOBER 2009



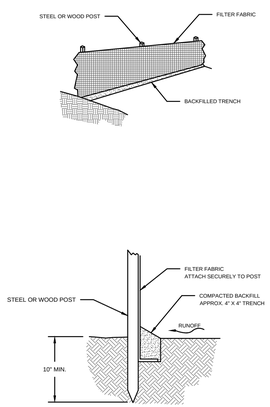
TEMPORARY VEHICLE TRACKING CONTROL PAD DETAIL

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: JULY 2008



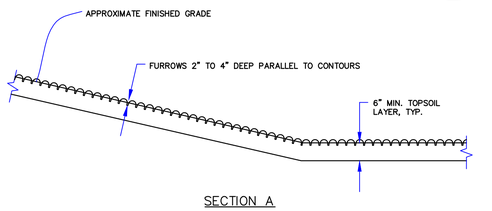
RIPRAP DETAIL

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: JULY 2008



SILT FENCE DETAIL

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: JULY 2008



SURFACE ROUGHENING INSTALLATION NOTES

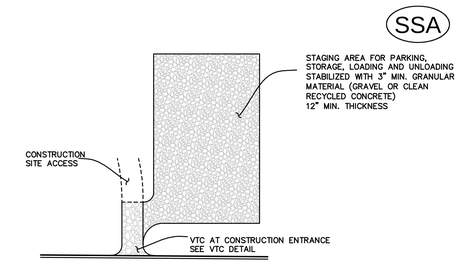
1. SURFACE ROUGHENING SHALL BE PROVIDED ON ALL FINISHED GRADES (SLOPES AND "FLAT" AREAS) WITHIN 2 DAYS OF COMPLETION OF FINISHED GRADE (FOR AREAS NOT RECEIVING TOPSOIL) OR WITHIN 2 DAYS OF TOPSOIL PLACEMENT.
2. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD IS TO BE PLACED WITHIN 7-DAYS OF FINISHED GRADING DO NOT NEED TO BE SURFACE ROUGHENED.
3. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

SURFACE ROUGHENING MAINTENANCE NOTES

1. THE CONSTRUCTION SITE OPERATOR SHALL INSPECT THE SURFACE ROUGHENING WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. VEHICLES AND EQUIPMENT SHALL GENERALLY BE CONFINED TO ACCESS DRIVES AND SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.
3. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.
4. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER ANY RILL EROSION.

SURFACE ROUGHENING

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: MAY 2009



STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR GENERAL LOCATION OF STAGING AREA. CONTRACTOR MAY MODIFY LOCATION AND SIZE OF STABILIZED STAGING AREA WITH APPROVAL FROM THE TOWN.
2. STABILIZED STAGING AREA SHALL BE LARGE ENOUGH TO FULLY CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
3. IF REQUIRED BY THE LOCAL JURISDICTION, SITE ACCESS ROADS SHALL BE STABILIZED IN THE SAME MANNER AS THE STAGING AREA.
4. STAGING AREA SHALL BE STABILIZED PRIOR TO ANY OTHER OPERATIONS ON THE SITE.
5. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM OF 3" OF GRANULAR MATERIAL (GRAVEL OR CLEAN RECYCLED CONCRETE).

STABILIZED STAGING AREA MAINTENANCE NOTES

1. THE CONSTRUCTION SITE OPERATOR SHALL INSPECT THE STABILIZED STAGING AREA WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. THE CONSTRUCTION SITE OPERATOR SHALL PROVIDE ADDITIONAL THICKNESS OF GRANULAR MATERIAL IF ANY RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.
3. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
4. ANY ACCUMULATED DIRT OR MUD SHALL BE REMOVED FROM THE SURFACE OF THE STABILIZED STAGING AREA.
5. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE TOWN, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

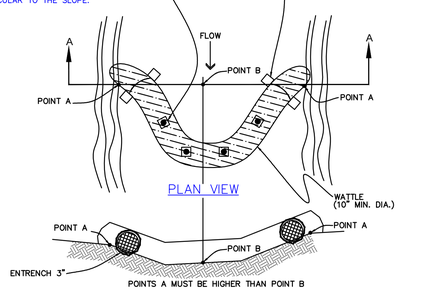
STABILIZED STAGING AREA

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: MAY 2009

STAKES SHOULD BE DRIVEN THROUGH THE MIDDLE OF THE WATTLE. STAKES SHOULD BE DRIVEN FLUSH WITH THE TOP OF THE WATTLE. A HEAVY SEDIMENT LOAD WILL TEND TO PICK THE WATTLE UP AND COULD PULL IT OFF THE STAKES IF THEY ARE DRIVEN DOWN TOO LOW. IT MAY BE NECESSARY TO MAKE A HOLE IN THE WATTLE WITH A PICK END OF YOUR MADDOX IN ORDER TO GET THE STAKE THROUGH THE STRAW. WHEN STRAW WATTLES ARE USED FOR FLAT GROUND APPLICATIONS, DRIVE THE STAKES STRAIGHT DOWN; WHEN INSTALLING WATTLES ON SLOPES, DRIVE THE STAKES PERPENDICULAR TO THE SLOPE.

OR

STAKES SHOULD BE DRIVEN ACROSS FROM EACH OTHER AND ON EACH SIDE OF THE WATTLE. LEAVING 4"-6" OF STAKE PROTRUDING ABOVE THE WATTLE. BAILING WIRE OR NYLON ROPE SHOULD BE TIED TO THE STAKES ACROSS THE WATTLE. STAKES SHOULD THEN BE DRIVEN UNTIL THE BAILING WIRE OR NYLON ROPE IS SUFFICIENTLY SNUG TO THE WATTLE AND STAKES ARE FLUSH WITH THE TOP OF THE WATTLE.



WATTLE DIKE DITCH INSTALLATION

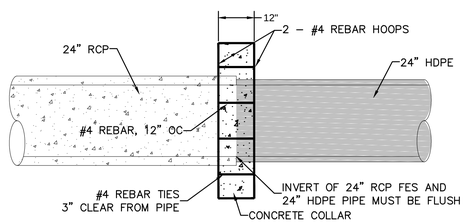
SW

MAINTENANCE NOTES:

1. THE CONTRACTOR SHALL INSPECT DIKES EVERY TWO WEEKS AND AFTER SIGNIFICANT STORM EVENTS AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF DIKES SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES 1/2 OF THE DESIGN DEPTH.
3. DIKES ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE TOWN.
4. WHEN REINFORCED ROCK BERMS ARE REMOVED, ANY DISTURBED AREA SHALL BE SEEDED, CRIMPED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER ACCEPTED BY THE TOWN.

STRAW WATTLE DIKE DETAIL

FIRESTONE — A COMMUNITY IN MOTION | EROSION CONTROL CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: OCTOBER 2012



CONCRETE COLALR DETAIL

FIRESTONE — A COMMUNITY IN MOTION | CONSTRUCTION DRAWINGS | SCALE: N.T.S. | DATE: JANUARY 2015

REVISIONS

DATE	REVISION DESCRIPTION

CCG COLORADO CIVIL GROUP, INC.
ENGINEERING CONSULTANTS
1413 W. 29TH STREET
LOVELAND, COLORADO 80538
(970) 278-0029

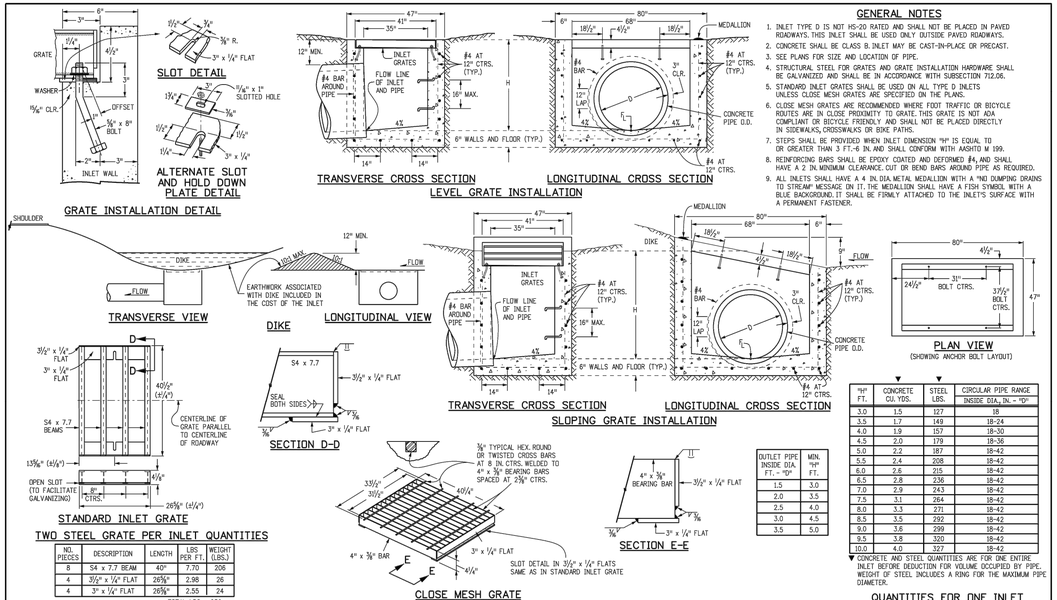
BELLA ROSA GOLF COURSE CULVERT

CONSTRUCTION DETAILS

1 OF 2

FILENAME: 0668.0122.04_DETAILS
DESIGNED: D.A.H.
CHECKED: D.B.L.
JOB NO.: 0668.0122.04
SCALE: N/A
DATE: JANUARY 2015

SHEET NO.: 4 OF 5



NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
8	S4 x 7.7 BEAM	40"	7.70	205
4	3½" x ¼" FLAT	26⅝"	2.98	26
4	3" x ¼" FLAT	26⅝"	2.55	24
TOTAL LBS. = 256				

OUTLET PIPE INSIDE DIA. FT. = "D"	MIN. "H" FT.
1.5	3.0
2.0	3.5
2.5	4.0
3.0	4.5
3.5	5.0

"H" FT.	CONCRETE CU. YDS.	STEEL LBS.	CIRCULAR PIPE RANGE INSIDE DIA., IN. = "D"
3.0	1.5	127	18
3.5	1.7	149	18-24
4.0	1.9	157	18-30
4.5	2.0	179	18-36
5.0	2.2	187	18-42
5.5	2.4	208	18-42
6.0	2.6	215	18-42
6.5	2.8	236	18-42
7.0	2.9	243	18-42
7.5	3.1	264	18-42
8.0	3.3	271	18-42
8.5	3.5	292	18-42
9.0	3.6	299	18-42
9.5	3.8	320	18-42
10.0	4.0	327	18-42

▼ CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

Computer File Information	
Creation Date: 07/04/12	Initials: DD
Last Modification Date: 07/04/12	Initials: LTA
Full Path: www.coloradodot.info/business/designsupport	
Drawing File Name: 80401101101.dgn	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	

Sheet Revisions	
Date:	Comments

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083
Fax: (303) 757-9820
Project Development Branch DD/LTA

INLET, TYPE D

STANDARD PLAN NO.
M-604-11
Sheet No. 1 of 1

Issued By: Project Development Branch July 4, 2012

REVISIONS
REVISION DESCRIPTION
DATE

CCG COLORADO CIVIL GROUP, INC.
ENGINEERING CONSULTANTS
1413 W. 29TH STREET
LOVELAND, COLORADO 80538
(970) 278-0029

BELLA ROSA GOLF COURSE CULVERT

CONSTRUCTION DETAILS
2 OF 2

FILENAME: 0668.0122.04_DETAILS
DESIGNED: D.A.H.
CHECKED: D.B.L.
JOB NO.: 0668.0122.04
SCALE: N/A
DATE: JANUARY 2015

SHEET NO.: 5 OF 5

TRI-TOWN EXISTING POND 667 - PRAIRIE GREENS (POND 3) WITH PROPOSED IMPROVEMENTS

(Outlet Orifice Modified to Increase Orifice Area to 5.0 ft ^{2})

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4995.90	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4996.00	364	0.01	0.10	12	0.00	0.11	0.00	0.11	Normal Depth Flow Through Opening
4997.00	10892	0.25	1.10	4428	0.10	6.60	0.00	6.60	Normal Depth Flow Through Opening
4998.00	51067	1.17	2.10	32942	0.76	25.25	0.00	25.25	Orifice Flow Through 100-Year Opening
4999.00	122045	2.80	3.10	116961	2.69	34.89	0.00	34.89	
5000.00	172366	3.96	4.10	263445	6.05	42.39	0.00	42.39	
5001.00	196332	4.51	5.10	447664	10.28	48.75	0.00	48.75	
5001.50	209094	4.80	5.60	549004	12.60	51.63	0.00	51.63	Emergency Spillway Elevation
5002.00	243758	5.60	6.10	662106	15.20	54.37	114.9	169.27	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge on based 36" outlet pipe with orifice 2' above invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 668 - PRAIRIE GREENS (POND 2) WITH PROPOSED IMPROVEMENTS

(Spillway Elevation Raised 1.5-feet and Orifice Plate on Outlet Removed)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5002.72	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5003.00	560	0.01	0.28	52	0.00	1.67	0.00	1.67	Normal Depth Flow Through Opening
5004.00	77533	1.78	1.28	28280	0.65	8.00	0.00	8.00	Normal Depth Flow Through Opening
5005.00	83230	1.91	2.28	108644	2.49	17.11	0.00	17.11	Orifice Flow Through 100-Year Opening
5006.00	89614	2.06	3.28	195047	4.48	22.83	0.00	22.83	
5007.00	94377	2.17	4.28	287032	6.59	27.38	0.00	27.38	
5008.80	102941	2.36	6.08	464563	10.66	34.08	0.00	34.08	Emergency Spillway Elevation
5009.00	103901	2.39	6.28	485247	11.14	34.74	10.00	44.74	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based on 24" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

TRI-TOWN EXISTING POND 669 - PRAIRIE GREENS (POND 1)

(Spillway Elevation Raised 1.0-feet and Outlet Orifice Modified to Increase Orifice Area to 3.32 ft ^{2})

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5005.31	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5006.00	31297	0.72	0.69	7198	0.17	2.24	0.00	2.24	Normal Depth Flow Through Opening
5007.00	43109	0.99	1.69	44244	1.02	15.08	0.00	15.08	Orifice Flow Through 100-Year Opening
5008.00	56454	1.30	2.69	93876	2.16	21.98	0.00	21.98	
5009.00	62013	1.42	3.69	153087	3.51	27.18	0.00	27.18	
5010.00	65978	1.51	4.69	217072	4.98	31.53	0.00	31.53	
5011.00	69653	1.60	5.69	284880	6.54	35.35	0.00	35.35	
5012.00	73319	1.68	6.69	356358	8.18	38.80	0.00	38.80	
5013.00	77103	1.77	7.69	431561	9.91	41.96	0.00	41.96	
5014.00	81176	1.86	8.69	510692	11.72	44.90	0.00	44.90	
5014.20	82211	1.89	8.89	527031	12.10	45.47	0.00	45.47	Emergency Spillway Elevation
5015.00	86351	1.98	9.69	594449	13.65	47.66	105.00	152.66	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 30" outlet pipe with orifice 1.6' above invert

[4]Weir flow approximated as a broad crested weir

TRI-TOWN PROPOSED IMPROVEMENT POND 784

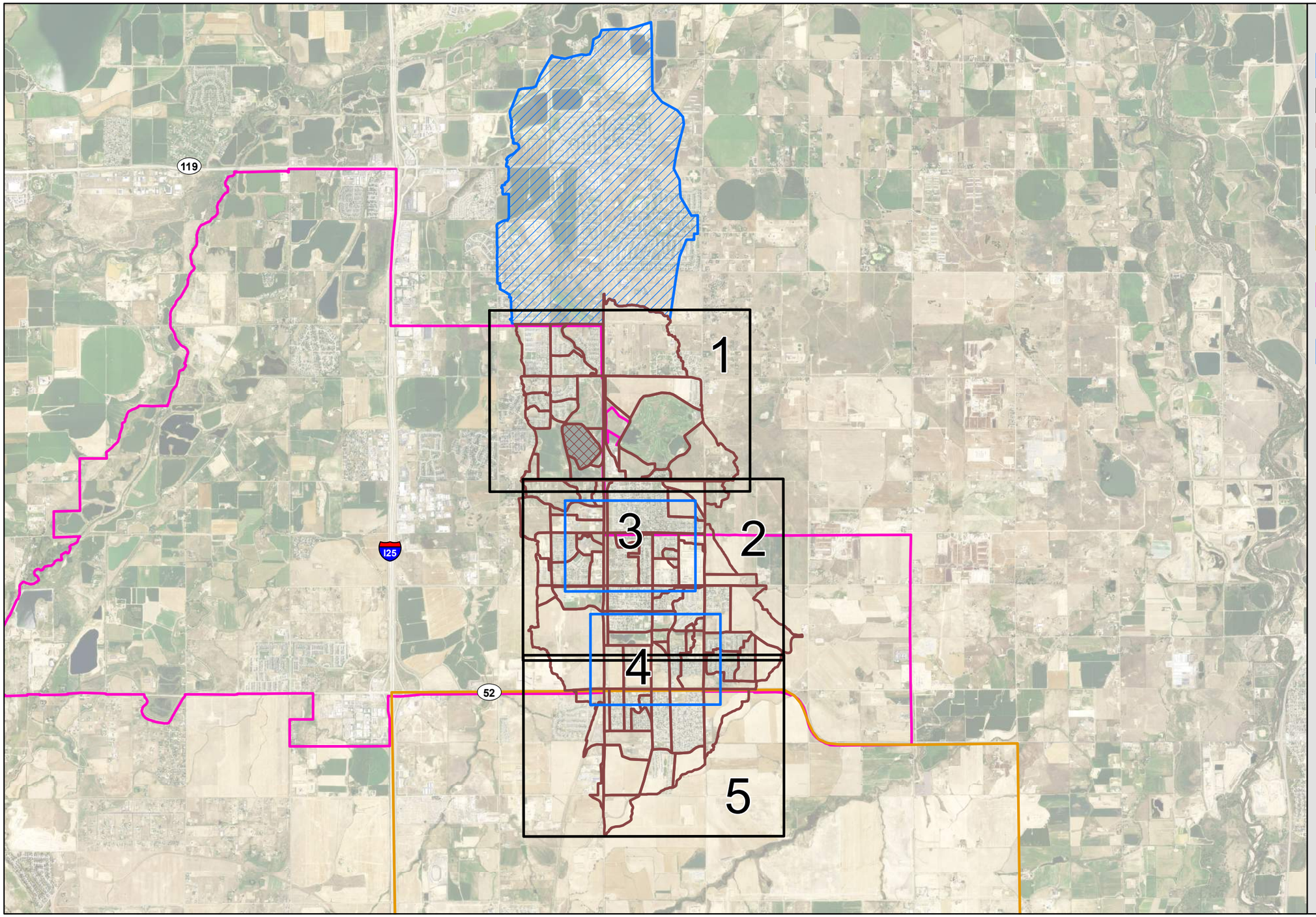
New Pond on City of Dacono Development Property

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)	Total Discharge (cfs)	Notes:
5032.50	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5033.0	1717	0.04	0.50	286	0.01	1.94	0.00	1.94	
5034.0	4484	0.10	1.50	3278	0.08	6.08	0.00	6.08	
5035.0	8159	0.19	2.50	9509	0.22	10.41	0.00	10.41	
5036.0	13173	0.30	3.50	20075	0.46	12.11	0.00	12.11	
5037.0	22468	0.52	4.50	37690	0.87	13.80	0.00	13.80	
5038.0	36145	0.83	5.50	66727	1.53	15.34	0.00	15.34	
5039.0	47648	1.09	6.50	108492	2.49	16.46	0.00	16.46	
5040.0	55983	1.29	7.50	160251	3.68	17.59	0.00	17.59	Emergency Spillway Elevation

[1]Invert based on conceptual design

[2]Based on conceptual design

[3]Based on HY-8 analysis



Legend

- 500 Foot Scale
- 1000 Foot Scale
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

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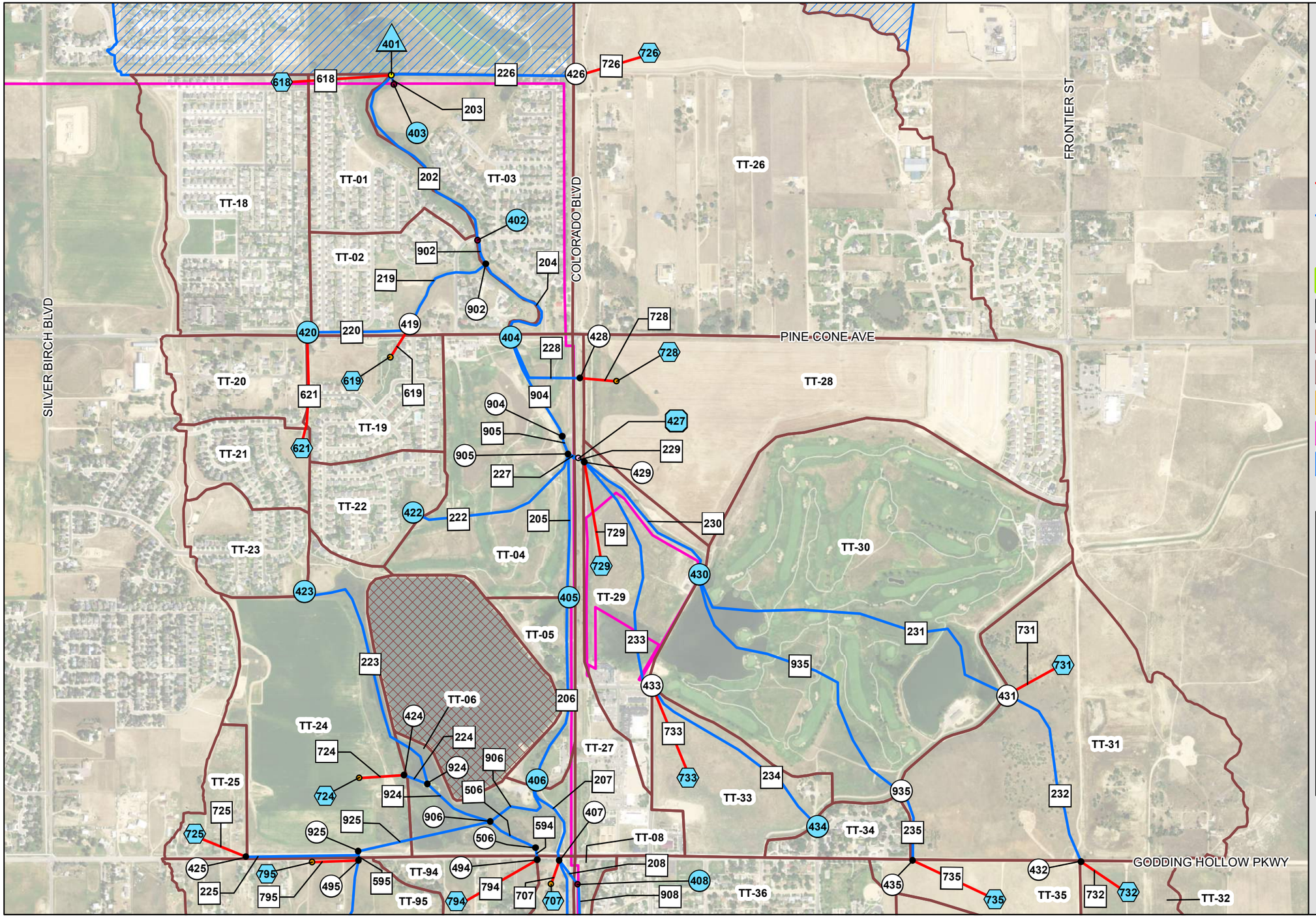
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/14/21	
SHEET: TT	INDEX: C-INDEX



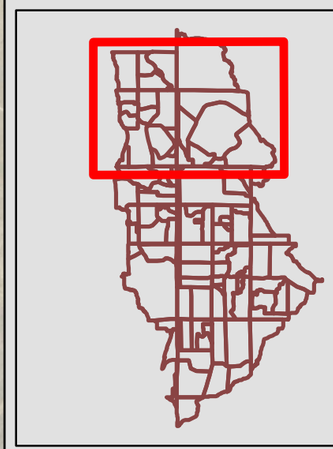
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement Subbasin
- Sheet Callout
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

Key Map



N

0 500 1,000 2,000
Feet

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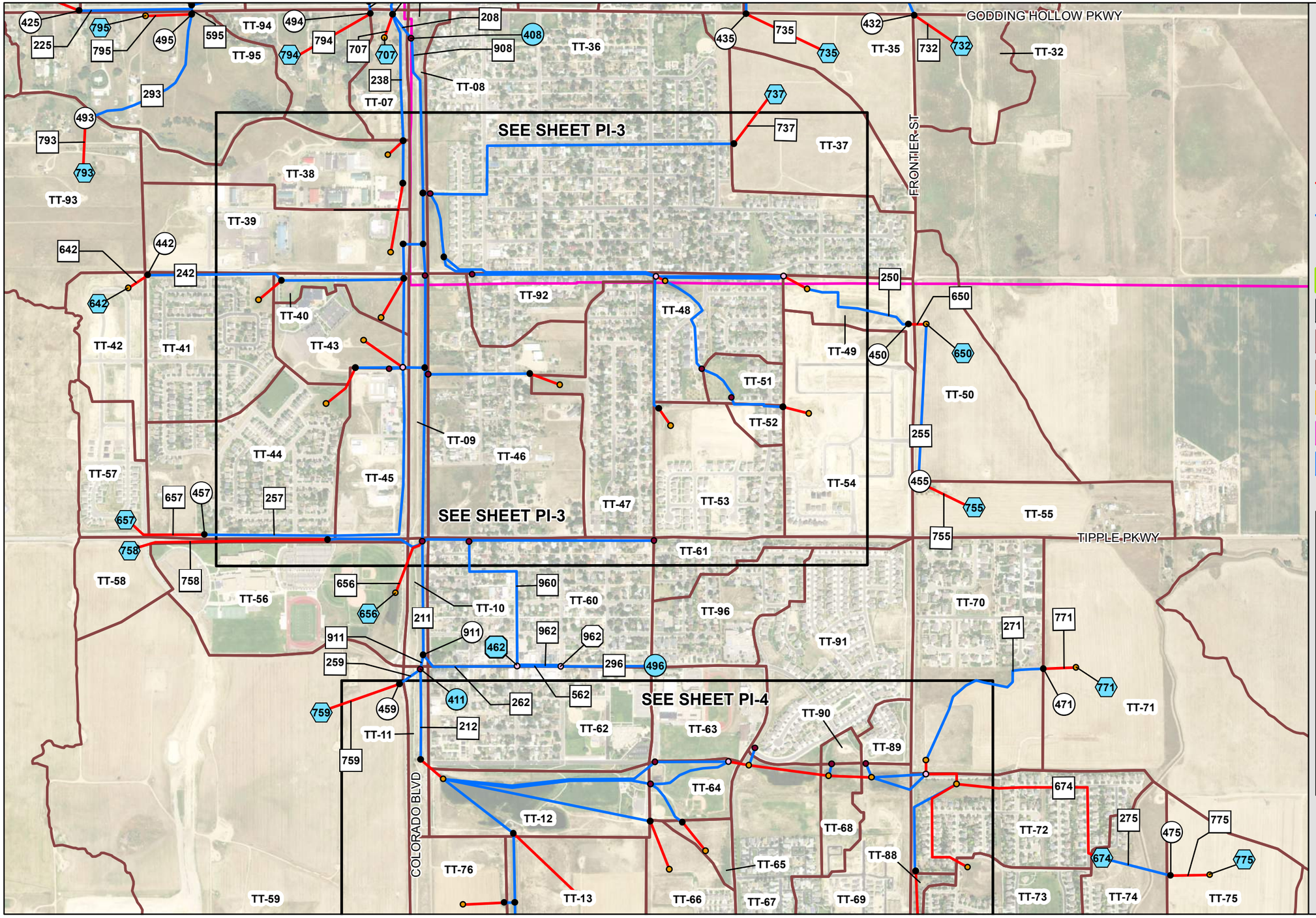
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/10/21	
SHEET: TT	INDEX: PI-1



Legend

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- Outlet
- Link

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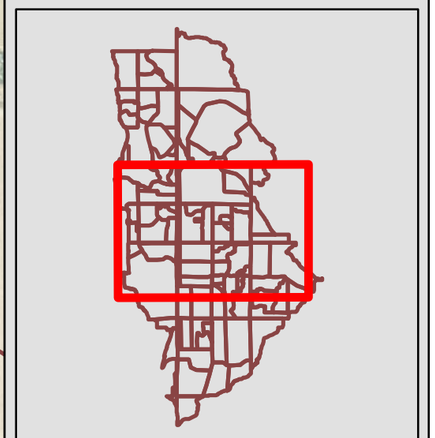
Key Map



N

0 500 1,000 2,000 Feet

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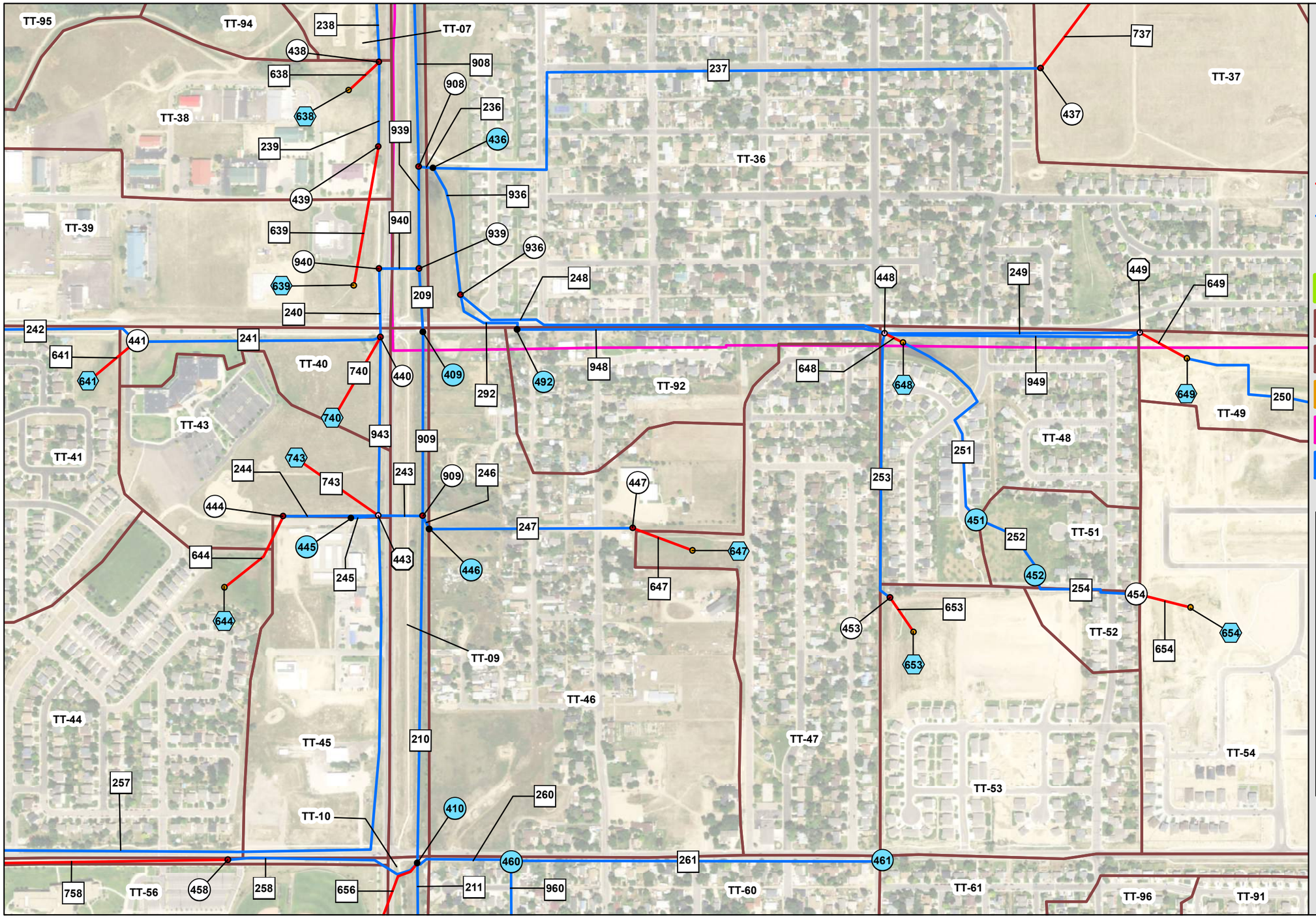
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/10/21	
SHEET: TT	INDEX: PI-2



Legend

- Junction
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- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement Subbasin
- Subbasin
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- Dacono Planning Boundary
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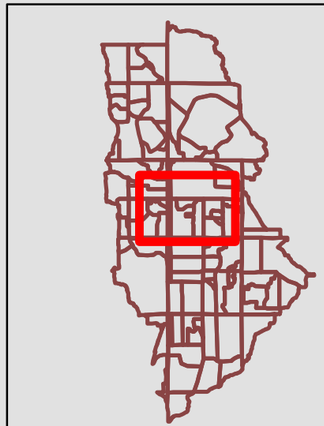
- Tri-Town Basin Not Studied

Key Map



N

0 250 500 1,000
Feet

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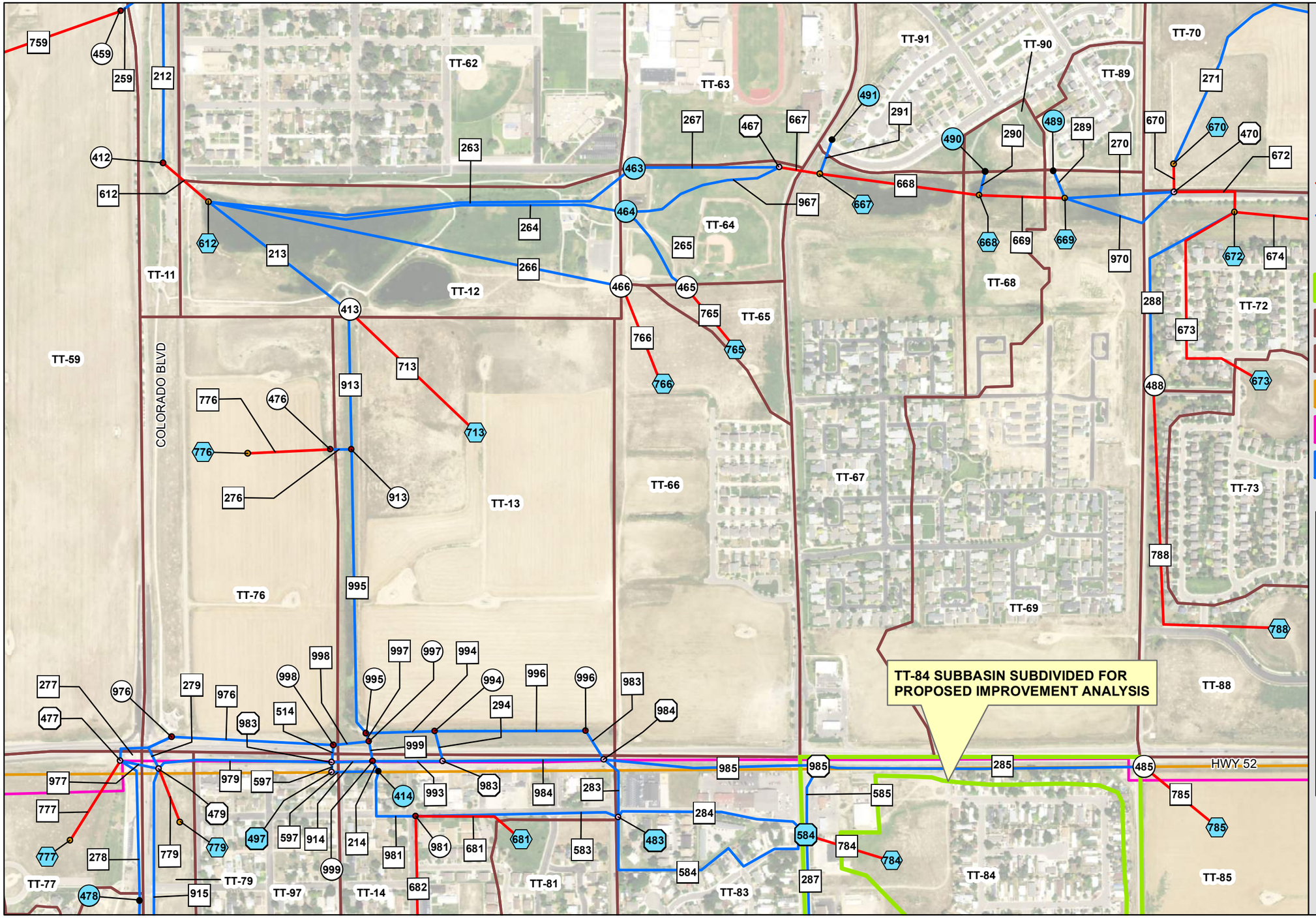
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

TRI-TOWN
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/10/21	
SHEET: TT	INDEX: PI-3



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OUTFALL SYSTEM PLAN

TRI-TOWN
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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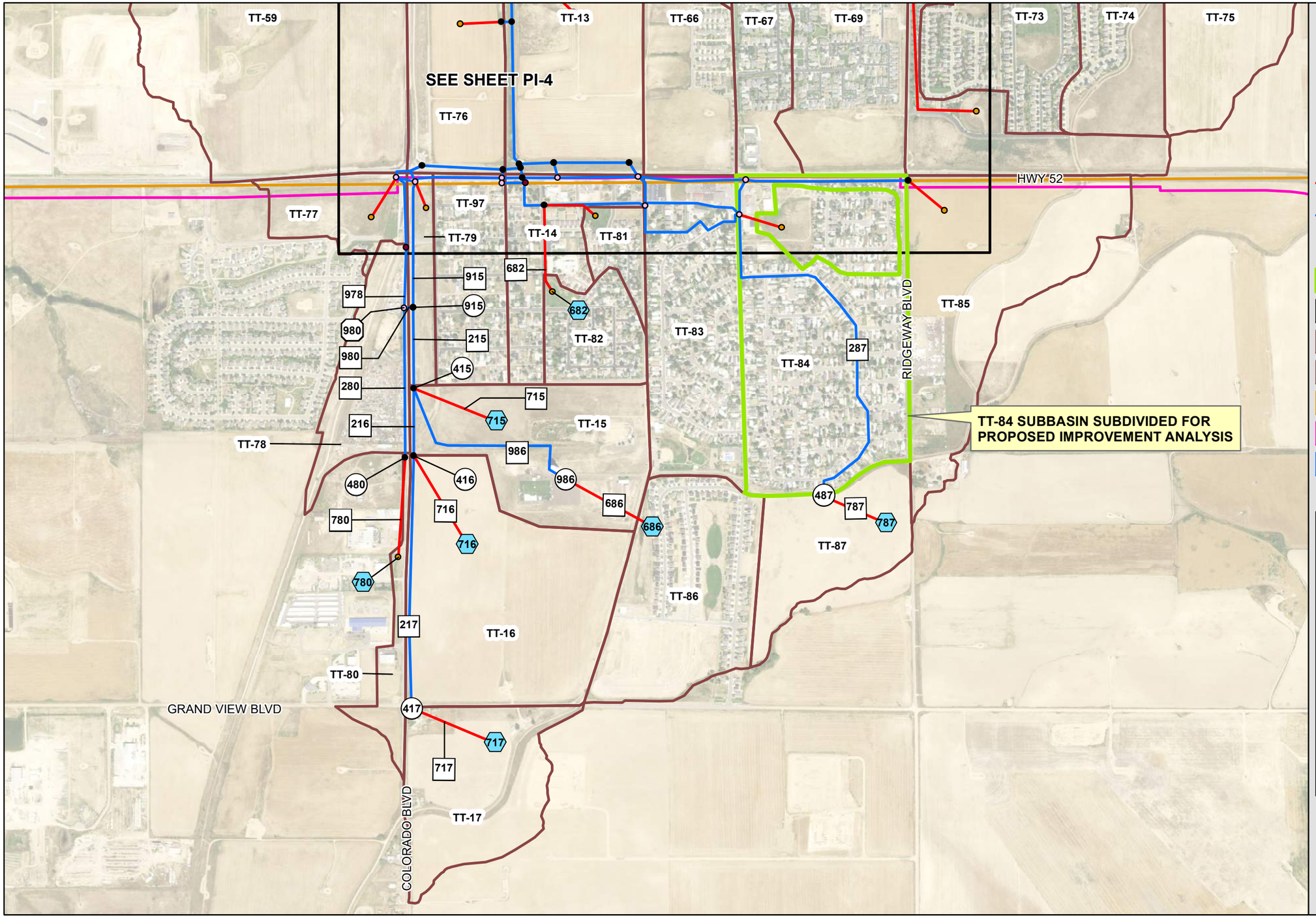
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/10/21	
SHEET: TT	INDEX: PI-4



Legend

- Junction
- Flow Diversion Node
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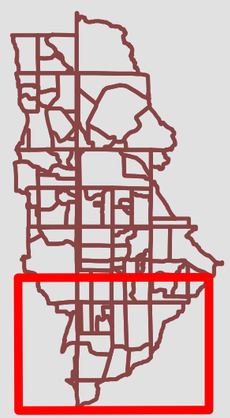
Key Map



N

0 500 1,000 2,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

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DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 11/10/21	
SHEET: TT	INDEX: PI-5

Table C.3.1: Tri-Town Basin Peak Discharge Comparison: Future Conditions 2022 OSP and Proposed Improvements 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Difference (Proposed Improvements - Future Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	401	5030	148	234	347	1360	2061	148	233	347	1349	2044	0	0	0	-11	-17	
County Road 20/Bella Rosa Parkway	404	4366	142	218	324	1121	1647	142	218	324	1108	1627	0	0	0	-13	-20	Proposed crossing improvement to eliminate overtopping of Bella Rosa Parkway.
No Name Creek Tributary	904	4281	142	216	320	1082	1580	138	212	316	1061	1551	-4	-4	-5	-20	-29	
County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	407	3183	118	176	255	701	1016	118	176	255	701	1012	0	0	0	0	-4	
Upstream Side of County Road 13/Colorado Blvd	408	3085	118	176	255	701	976	118	176	255	701	972	0	0	0	0	-3	New culvert crossing of Colorado Blvd and Godding Hollow Parkway built in 2004.
McClure Avenue	409	2808	74	112	167	417	569	74	112	167	416	566	0	0	0	-1	-3	New culvert crossing of McClure Avenue built in 2018.
County Road 16/Tipple Parkway/ First Street	410	2203	58	88	131	299	394	58	88	131	298	393	0	0	0	-1	-1	
Eighth Street/Main Street (Outlet of Regional Detention Pond at Centennial Park)	412/612	1652	31	46	68	142	192	32	48	72	144	191	1	1	4	2	-1	Regional Detention Pond Built in 2003.
State Highway 52 Frederick/Dacono Boundary	999	792	107	173	249	548	736	23	39	60	155	223	-84	-134	-188	-393	-513	Proposed Forest Avenue storm sewer and crossing of HWY 52 reduces flow tributary to this main channel crossing of HWY 52.
Second Street, East of Colorado Blvd	415	287	4	5	6	12	16	4	5	6	12	16	0	0	0	0	0	

*Milavec Reservoir considered non-contributing area due to surrounding berms isolating it from the watershed. Total non-contributing area ~ 67 acres.

Table C.3.2: Tri-Town Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
TT-C1	Wetland Loop	402	(4) 4' H x 14' W RCBC	4901.9	2500	> 100-Year	> 100-Year	147	225	335	1156	1707	148	226	335	1143	1687	
TT-C2	County Road 20/Bella Rosa Parkway	404	(3) 5' H x 9' W RCBC	4906.4	1730	< 2-Year	> 100-Year	142	218	324	1121	1647	142	218	324	1108	1627	Proposed crossing and road raising improvements to eliminate overtopping of Bella Rosa Parkway.
TT-C3	County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	407	(2) 8' H x 12' W RCBC	4943.2	1560	> 100-Year	> 100-Year	118	176	255	701	1016	118	176	255	701	1012	
TT-C4	McClure Avenue	409	Bridge Crossing (Approximated as 3' H x 53.5' W RCBC)	4953.7	1070	> 100-Year	> 100-Year	74	112	167	417	569	74	112	167	416	566	
TT-C5	County Road 16/Tipple Parkway/ First Street	410	6' H x 10' W RCBC	4963.7	740	> 100-Year	> 100-Year	58	88	131	299	394	58	88	131	298	393	
TT-C6	Fifth Street	411	6' H x 13' W RCBC	4971.7	650	> 100-Year	> 100-Year	32	48	70	147	199	33	49	74	149	197	
TT-C7	Eighth Street/Main Street (Outlet of Regional Detention Pond)	412/612	8' H x 6' W RCBC	4982.9	420	> 100-Year	> 100-Year	31	46	68	142	192	32	48	72	144	191	
TT-C8	Access Road Crossing North of Highway 52	997	Existing Crossing Proposed to be Removed and Replaced With Low Flow Crossing	5006.1	N/A	< 2-Year	> 100-Year	135	208	292	624	826	50	72	99	231	311	Existing undersized crossing proposed to be removed and replaced with concrete low flow crossing.
TT-C9	Highway 52	999	3' H x 10' W RCBC	5007.8	230	< 50-Year	> 100-Year	107	173	249	548	736	23	39	60	155	223	Proposed crossing improvement to eliminate overtopping of HWY 52 and provide 100-year protection for low lying properties south of Eighth Street.
TT-C10	Eighth Street	414	3' H x 10' W RCBC	5008.2	230	< 5-Year	> 100-Year	107	168	244	543	731	23	34	55	150	218	Proposed crossing improvement to eliminate overtopping of Eighth Street and provide 100-year protection for low lying properties south of Eighth Street.
TT-C11	Sixth Street, East of Colorado Blvd	915	(2) 24" H x 38" W HERCP	5020.2	55	> 100-Year	> 100-Year	5	7	8	14	19	5	7	8	14	19	
TT-C12	Second Street, East of Colorado Blvd	415	(2) 20" H x 30" W HERCP	5030.2	50	> 100-Year	> 100-Year	4	5	6	12	16	4	5	6	12	16	
Other County Road 13/Colorado Blvd Crossings																		
TT-C13	Colorado Blvd, North of County Road 20/Bella Rosa Parkway	426	(2) 24" H x 38" W HERCP	4900.6	90	< 50-Year	< 50-Year	5	7	9	163	267	5	7	9	163	267	Crossing located outside Frederick's planning boundary. No improvements proposed for this study.
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	428	29" H x 45" W HERCP/ 36" HDPE	4917.9	50	< 2-Year	> 100-Year	4	5	6	212	331	4	5	6	8	10	Existing 29" x 45" HERCP to be unburied with proposed 36" pipe extension west through golf course to eliminate overtopping of Colorado Blvd.

Table C.3.2: Tri-Town Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Other County Road 13/Colorado Blvd Crossings (Continued)																		
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	427	(4) 36" RCP 3' H x 11' W RCBC	4916.4	390	< 50-Year	> 100-Year	21	34	56	266	384	21	34	56	266	384	Existing four 36" RCPs to remain and proposed 3' H x 11' W RCBC to be added. Small berm proposed on north side of crossing to eliminate spill to north and overtopping of Colorado Blvd.
TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	940	(2) 19" H x 30" W HERCP	4956.1	40	< 100-Year	> 100-Year	2	2	3	14	35	2	2	3	14	34	Proposed additional 19" H x 30" W HERCP to eliminate overtopping of Colorado Blvd.
TT-C17	Colorado Blvd, North of Hurt Street	443	(2) 27" PVC Raise Existing Sump and Channel Overtopping Elev	4956.7	85	< 100-Year	> 100-Year	19	26	33	65	82	19	26	33	65	82	Proposed increase to existing sump and channel overtopping elevation to increase capacity of existing crossing. Localized improvements proposed for cross pan to eliminate ponding in street during larger rain events.
TT-C18	Colorado Blvd, HWY 52 Intersection	477	36" RCP	5018.5	50**	< 50-Year	< 50-Year	16	22	30	60	76	16	22	30	60	76	Crossing installed in 2018 as part of intersection updates. Anticipated overtopping depth of less than 0.5-feet adheres to City of Dacono criteria. No proposed improvements for this crossing.
TT-C19	Colorado Blvd, South of HWY 52	980	14" H x 23" W HERCP	5026.4	10**	> 100-Year	> 100-Year	1	2	2	2	3	1	2	2	2	3	
Other HWY 52 Crossings																		
TT-C20	HWY 52, East of Colorado Blvd Intersection	479	30" RCP	5017.5	30**	> 100-Year	> 100-Year	5	7	8	15	29	5	7	8	15	29	
TT-C21	HWY 52, West of Birch Avenue	914	24" RCP	5009.9	15	< 5-Year	< 5-Year	14	20	20	20	20	14	20	20	20	20	Crossing installed in 2018. Serves as initial outfall for Basin TT-97. Excess flow reaching this area will continue east along roadside swale to TT-C9 crossing. Excess flow can be conveyed without inundating low lying properties south of Eighth Street. No proposed improvements for this crossing.
TT-C22	HWY 52, East of Cherry Street	983	24" RCP	5011.7	25**	> 100-Year	> 100-Year	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
TT-C23	HWY 52, West of Forest Avenue	984	(2) 3' H x 12' W RCBC	5019.8	590	> 100-Year	> 100-Year	41	42	42	44	44	119	164	214	405	504	Proposed crossing improvement to capture and convey flow originating from the east side of Forest Avenue, across HWY 52, to eliminate flows overtopping Forest Avenue and continuing west to TT-C10 crossing.

Table C.3.2: Tri-Town Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Other Tributary & Storm Sewer Crossings																		
TT-C24	McClure Avenue Storm Sewer	448	36" RCP	4973.6	70**	< 50-Year	> 100-Year	2	5	10	33	65	2	5	10	33	65	Proposed upsizing of eastern portion of storm sewer system to 36" to eliminate excess flow along McClure Street.
TT-C25	Majestic Street, West of Colorado Blvd	440	14" H x 23" W HERCP 24" H x 38" W HERCP	4956.6	40**	< 50-Year	> 100-Year	2	2	3	14	35	2	2	3	14	35	Installed in 2018 as part of the McClure Avenue Extension Project by Firestone. Erosion beginning to occur near asphalt at flared end sections. Proposed additional culvert crossing and riprap protection to eliminate overtopping of Majestic Street.
TT-C26	Tipple Parkway/First Street Storm Sewer	460	4' H x 10' W RCBC	4965.0	300	> 100-Year	> 100-Year	24	37	57	184	272	24	37	57	184	272	
TT-C27	Fifth Street Storm Sewer	462	24" RCP (2) 36" RCP	4974.7 4972.6	100	< 50-Year	< 50-Year	34	51	73	158	200	34	51	73	158	200	Storm sewer improvements conducted in 2016. Excess flow heads north in Elm Street and Oak Street to Tipple Parkway Storm Sewer (TT-C26). Street capacity is sufficient to convey excess flow and Tipple Storm Sewer has sufficient capacity to capture and convey flow to Tri-Town drainageway. No proposed improvements for this crossing.
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	470	24" RCP 36" RCP	5013.1	70**	< 50-Year	> 100-Year	9	12	15	25	61	9	12	15	25	61	Existing 24" RCP to remain and proposed 36" RCP to be added to convey overtopping spills from Savannah Pond, and eastern roadside drainage, across Ridgeway Blvd to eliminate overtopping.
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	467/667	36" RCP Pond 3 Outlet with Orifice Plate to tie into proposed upsized 36" RCP outfall	4995.1	60**	< 10-Year	> 100-Year	13	17	21	29	47	15	22	29	45	51	Proposed Prairie Green Pond improvements will eliminate overtopping of Frederick Way. Existing 36" outlet of Prairie Green Pond 3 to remain. Remainder of existing outfall system proposed to be upsized to 36" to eliminate spills through school property.
TT-C30	Centennial Park Access Road	464	3' H x 10' W RCBC	4988.7	250	> 100-Year	> 100-Year	1	1	4	13	28	1	1	4	13	18	
TT-C31	County Road 15/Ridgeway Blvd, South of Highway 52	485	18" CMP	5045.8	5**	> 100-Year	> 100-Year	2	2	2	3	4	2	2	2	3	4	
TT-C32	Glen Creighton Drive, South of Highway 52	985	18" CMP	5037.2	5**	> 100-Year	> 100-Year	2	2	2	3	4	2	2	2	3	4	

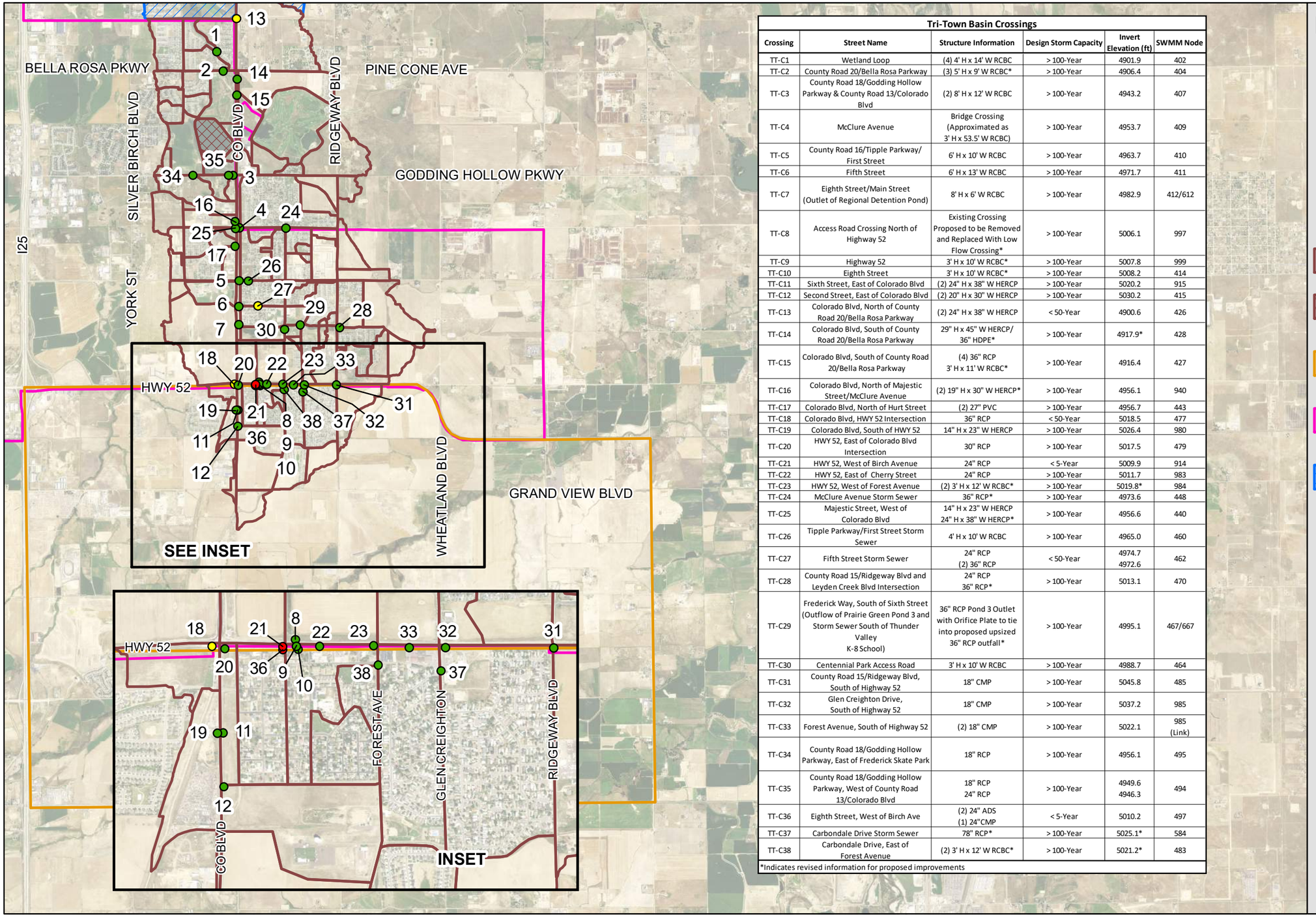
Table C.3.2: Tri-Town Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Other Tributary & Storm Sewer Crossings (Continued)																		
TT-C33	Forest Avenue, South of Highway 52	985 (Link)	(2) 18" CMP	5022.1	20**	> 100-Year	> 100-Year	2	2	2	3	4	2	2	2	3	4	
TT-C34	County Road 18/Godding Hollow Parkway, East of Frederick Skate Park	495	18" RCP	4956.1	10**	> 100-Year	> 100-Year	1	2	2	3	4	1	2	2	3	4	
TT-C35	County Road 18/Godding Hollow Parkway, West of County Road 13/Colorado Blvd	494	18" RCP 24" RCP	4949.6 4946.3	35**	> 100-Year	> 100-Year	1	1	1	2	2	1	1	1	2	2	
TT-C36	Eighth Street, West of Birch Ave	497	(2) 24" ADS (1) 24"CMP	5010.2	20	< 5-Year	< 5-Year	14	22	32	70	91	14	22	32	70	91	ADS pipes appear to have been recently installed. Serves as initial outfall for Basin TT-97. Excess flow reaching this area will continue east along roadside swale to TT-C10 crossing. Excess flow can be conveyed without inundating low lying properties south of Eighth Street. No proposed improvements for this crossing.
TT-C37	Carbondale Drive Storm Sewer	584	78" RCP	5025.1	340	< 2-Year	> 100-Year	87	121	158	301	378	79	108	139	256	319	Proposed crossing improvement to capture and convey flow originating from the east side of Glen Creighton Drive, to eliminate flows overtopping Glen Creighton Drive and inundating properties to the west.
TT-C38	Carbondale Drive, East of Forest Avenue	483	(2) 3' H x 12' W RCBC	5021.2	590	< 2-Year	> 100-Year	97	148	205	414	532	119	164	214	405	504	Proposed crossing improvement to capture and convey flow originating from the east side of Forest Avenue, across HWY 52, to eliminate flows overtopping Forest Avenue and continuing west to TT-C10 crossing.

*HY-8 Program used to evaluate capacities unless otherwise noted

**Capacities evaluated in EPA-SWMM or StormCAD

Indicates revised information for proposed improvements



Tri-Town Basin Crossings

Crossing	Street Name	Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
TT-C1	Wetland Loop	(4) 4' H x 14' W RCBC	> 100-Year	4901.9	402
TT-C2	County Road 20/Bella Rosa Parkway	(3) 5' H x 9' W RCBC*	> 100-Year	4906.4	404
TT-C3	County Road 18/Godding Hollow Parkway & County Road 13/Colorado Blvd	(2) 8' H x 12' W RCBC	> 100-Year	4943.2	407
TT-C4	McClure Avenue	Bridge Crossing (Approximated as 3' H x 53.5' W RCBC)	> 100-Year	4953.7	409
TT-C5	County Road 16/Tipple Parkway/ First Street	6' H x 10' W RCBC	> 100-Year	4963.7	410
TT-C6	Fifth Street	6' H x 13' W RCBC	> 100-Year	4971.7	411
TT-C7	Eighth Street/Main Street (Outlet of Regional Detention Pond)	8' H x 6' W RCBC	> 100-Year	4982.9	412/612
TT-C8	Access Road Crossing North of Highway 52	Existing Crossing Proposed to be Removed and Replaced With Low Flow Crossing*	> 100-Year	5006.1	997
TT-C9	Highway 52	3' H x 10' W RCBC*	> 100-Year	5007.8	999
TT-C10	Eighth Street	3' H x 10' W RCBC*	> 100-Year	5008.2	414
TT-C11	Sixth Street, East of Colorado Blvd	(2) 24" H x 38" W HERCP	> 100-Year	5020.2	915
TT-C12	Second Street, East of Colorado Blvd	(2) 20" H x 30" W HERCP	> 100-Year	5030.2	415
TT-C13	Colorado Blvd, North of County Road 20/Bella Rosa Parkway	(2) 24" H x 38" W HERCP	< 50-Year	4900.6	426
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	29" H x 45" W HERCP/ 36" HDPE*	> 100-Year	4917.9*	428
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	(4) 36" RCP 3' H x 11' W RCBC*	> 100-Year	4916.4	427
TT-C16	Colorado Blvd, North of Majestic Street/McClure Avenue	(2) 19" H x 30" W HERCP*	> 100-Year	4956.1	940
TT-C17	Colorado Blvd, North of Hurt Street	(2) 27" PVC	> 100-Year	4956.7	443
TT-C18	Colorado Blvd, HWY 52 Intersection	36" RCP	< 50-Year	5018.5	477
TT-C19	Colorado Blvd, South of HWY 52	14" H x 23" W HERCP	> 100-Year	5026.4	980
TT-C20	HWY 52, East of Colorado Blvd Intersection	30" RCP	> 100-Year	5017.5	479
TT-C21	HWY 52, West of Birch Avenue	24" RCP	< 5-Year	5009.9	914
TT-C22	HWY 52, East of Cherry Street	24" RCP	> 100-Year	5011.7	983
TT-C23	HWY 52, West of Forest Avenue	(2) 3' H x 12' W RCBC*	> 100-Year	5019.8*	984
TT-C24	McClure Avenue Storm Sewer	36" RCP*	> 100-Year	4973.6	448
TT-C25	Majestic Street, West of Colorado Blvd	14" H x 23" W HERCP 24" H x 38" W HERCP*	> 100-Year	4956.6	440
TT-C26	Tipple Parkway/First Street Storm Sewer	4' H x 10' W RCBC	> 100-Year	4965.0	460
TT-C27	Fifth Street Storm Sewer	24" RCP (2) 36" RCP	< 50-Year	4974.7 4972.6	462
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP 36" RCP*	> 100-Year	5013.1	470
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate to tie into proposed upsized 36" RCP outfall*	> 100-Year	4995.1	467/667
TT-C30	Centennial Park Access Road	3' H x 10' W RCBC	> 100-Year	4988.7	464
TT-C31	County Road 15/Ridgeway Blvd, South of Highway 52	18" CMP	> 100-Year	5045.8	485
TT-C32	Glen Creighton Drive, South of Highway 52	18" CMP	> 100-Year	5037.2	985
TT-C33	Forest Avenue, South of Highway 52	(2) 18" CMP	> 100-Year	5022.1	985 (Link)
TT-C34	County Road 18/Godding Hollow Parkway, East of Frederick Skate Park	18" RCP	> 100-Year	4956.1	495
TT-C35	County Road 18/Godding Hollow Parkway, West of County Road 13/Colorado Blvd	18" RCP 24" RCP	> 100-Year	4949.6 4946.3	494
TT-C36	Eighth Street, West of Birch Ave	(2) 24" ADS (1) 24"CMP	< 5-Year	5010.2	497
TT-C37	Carbondale Drive Storm Sewer	78" RCP*	> 100-Year	5025.1*	584
TT-C38	Carbondale Drive, East of Forest Avenue	(2) 3' H x 12' W RCBC*	> 100-Year	5021.2*	483

*Indicates revised information for proposed improvements

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Tri-Town Basin Not Studied

N

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

TRI-TOWN PROPOSED CONDITION CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/18/2021	
SHEET: TT	INDEX: PI-CROSS

Appendix C.4. Tri-Town Cost Estimate Documentation

Table C.4.1: Tri-Town Basin Proposed Improvement Cost Summary

Crossing	Street Name	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
Town of Frederick								
TT-C2	County Road 20/Bella Rosa Parkway	$682,000	$0	$102,000	$34,000	$68,000	$171,000	$1,057,000
TT-C8	Access Road Crossing North of Highway 52	$38,000	$0	$6,000	$2,000	$4,000	$9,000	$59,000
TT-C9	Highway 52 - Main Channel (Frederick Portion)	$160,000	$0	$24,000	$8,000	$16,000	$40,000	$248,000
TT-C14	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	$143,000	$0	$21,000	$7,000	$14,000	$36,000	$221,000
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway (Frederick Portion)	$100,000	$0	$15,000	$5,000	$10,000	$25,000	$155,000
TT-C16	Colorado Blvd, North of Majestic Street/ McClure Avenue (Frederick Portion)	$38,000	$0	$6,000	$2,000	$4,000	$9,000	$59,000
TT-C17	Hurt St	$21,000	$0	$3,000	$1,000	$2,000	$5,000	$33,000
TT-C23	Highway 52, West of Forest Avenue (Frederick Portion)	$265,000	$0	$40,000	$13,000	$26,000	$66,000	$411,000
TT-C24	McClure Avenue Storm Sewer (Frederick Portion)	$292,000	$0	$44,000	$15,000	$29,000	$73,000	$452,000
TT-C25	Majestic Street, West of Colorado Blvd	$88,000	$0	$13,000	$4,000	$9,000	$22,000	$137,000
TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	$88,000	$0	$13,000	$4,000	$9,000	$22,000	$137,000
TT-C29	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	$269,000	$0	$40,000	$13,000	$27,000	$67,000	$417,000
TT Ponds 667 & 668	Prairie Green Ponds 2 & 3	$70,000	$0	$10,000	$3,000	$7,000	$17,000	$108,000
Total Cost		**$2,254,000**	**$0**	**$337,000**	**$111,000**	**$225,000**	**$562,000**	**$3,494,000**
City of Dacono								
TT-C9 & TT-C10	Highway 52 and Eighth Street - Main Channel (Dacono Portion)	$194,000	$0	$29,000	$10,000	$19,000	$49,000	$301,000
TT-C23	Highway 52, West of Forest Avenue (Dacono Portion)	$200,000	$0	$30,000	$10,000	$20,000	$50,000	$310,000
TT-C37	Carbondale Drive Storm Sewer	$1,157,000	$0	$174,000	$58,000	$116,000	$289,000	$1,793,000
TT-C38	Forest Avenue Storm Sewer	$916,000	$0	$137,000	$46,000	$92,000	$229,000	$1,420,000
TT Pond 784	East of Glenn Creighton Drive, South of Highway 52	$191,000	$0	$29,000	$10,000	$19,000	$48,000	$296,000
Total Cost		**$2,658,000**	**$0**	**$399,000**	**$134,000**	**$266,000**	**$665,000**	**$4,120,000**
Town of Firestone								
TT-C15	Colorado Blvd, South of County Road 20/Bella Rosa Parkway (Firestone Portion)	$100,000	$0	$15,000	$5,000	$10,000	$25,000	$155,000
TT-C16	Colorado Blvd, North of Majestic Street/ McClure Avenue (Firestone Portion)	$54,000	$0	$8,000	$3,000	$5,000	$14,000	$84,000
TT-C24	McClure Avenue Storm Sewer (Firestone Portion)	$292,000	$0	$44,000	$15,000	$29,000	$73,000	$452,000
Total Cost		**$446,000**	**$0**	**$67,000**	**$23,000**	**$44,000**	**$112,000**	**$691,000**

TT-C2 County Road 20/Bella Rosa Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	5	3	76	L.F.	$2,995.99	$227,696.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
9	3	30.00	2	EA	$2,748.15	$5,496.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
9	5	3	2	EA	$17,201.29	$34,402.60	
Channel Improvements							
18-inch Riprap, Type H			100	C.Y.	$108.00	$10,800.00	
Removals							
Removal of culvert pipe (D<48")			76	L.F.	$27.00	$2,052.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		1860	S.Y.	$100.00	$186,000.00	760'Lx22'W
Road Base Fill	**<----User Defined Items**		310	C.Y.	$80.00	$24,800.00	760'Lx22'Wx0.5'D
Other Embankment Fill	**<----User Defined Items**		1000	C.Y.	$33.00	$33,000.00	1620 CY minus 706'Lx22'Wx1'D

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$267,595.00	
Hydraulic Structures						$0.00	
Channel Improvements						$10,800.00	
Detention/Water Quality Facilities						$0.00	
Removals						$2,052.00	
Landscaping and Maintenance Improvements						$1,355.00	
Special Items (User Defined)						$243,800.00	
Subtotal Capital Improvement Costs						**$525,602.00**	
Additional Capital Improvement Costs							
Dewatering			$26,000.00	L.S.		$26,000.00	
Mobilization			5%			$26,280.00	
Traffic Control			$26,000.00	L.S.		$26,000.00	
Utility Coordination/Relocation			$52,000.00	L.S.		$52,000.00	
Stormwater Management/Erosion Control			5%			$26,280.00	
Subtotal Additional Capital Improvement Costs						**$156,560.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$102,324.00	
Legal/Administrative			5%			$34,108.00	
Contract Admin/Construction Management			10%			$68,216.00	
Contingency			25%			$170,541.00	
Subtotal Other Costs						**$375,189.00**	
Total Capital Improvement Costs						**$1,057,351.00**	

TT-C8 Access Road Crossing North of Highway 52

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
Excavation, Low Range		965	C.Y.	$15.00	$14,475.00	Cut to create channel, assumed excess material wasted on site
Excavation, Low Range		40	C.Y.	$15.00	$600.00	Fill from cut material
Removals						
Concrete Box Culvert		44	L.F./CELL	$136.00	$5,984.00	4'Hx5'W RCBC removal
Landscaping and Maintenance Improvements						
Reclamation & seeding (native grasses)		1	ACRE	$1,355.00	$1,355.00	Reseeding of area Impacted by channel grading
Special Items (User Defined)						
Concrete Low Flow Channel	**<----User Defined Items**	42	S.Y.	$70.00	$2,940.00	25' L by 15' W Low Flow Crossing.

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$15,075.00	
Detention/Water Quality Facilities					$0.00	
Removals					$5,984.00	
Landscaping and Maintenance Improvements					$1,355.00	
Special Items (User Defined)					$2,940.00	
Subtotal Capital Improvement Costs					**$25,354.00**	
Additional Capital Improvement Costs						
Dewatering		$5,000.00	L.S.		$5,000.00	
Mobilization		5%			$1,268.00	
Traffic Control		$2,000.00	L.S.		$2,000.00	
Utility Coordination/Relocation		$3,000.00	L.S.		$3,000.00	
Stormwater Management/Erosion Control		5%			$1,268.00	
Subtotal Additional Capital Improvement Costs					**$12,536.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$5,684.00	
Legal/Administrative		5%			$1,895.00	
Contract Admin/Construction Management		10%			$3,789.00	
Contingency		25%			$9,473.00	
Subtotal Other Costs					**$20,841.00**	
Total Capital Improvement Costs					**$58,731.00**	

TT-C9 Highway 52 - Main Channel (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	3	1	70	L.F.	$916.77	$64,174.00	Portion of crossing located in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	1	12.00	1	EA	$1,167.66	$1,168.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	3	1	1	EA	$7,567.75	$7,567.80	
Channel Improvements							
18-inch Riprap, Type H			13	C.Y.	$108.00	$1,404.00	Riprap for Outlet in Frederick
Removals							
Removal of culvert pipe (D<48")			150	L.F.	$27.00	$4,050.00	Removal of Existing Pipe Crossings in Frederick
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		170	S.Y.	$100.00	$17,000.00	70'L x 22'W Trench in Frederick

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$72,910.00	
Hydraulic Structures					$0.00	
Channel Improvements					$1,404.00	
Detention/Water Quality Facilities					$0.00	
Removals					$4,050.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$17,000.00	
Subtotal Capital Improvement Costs					**$95,364.00**	
Additional Capital Improvement Costs						
Dewatering		$10,000.00	L.S.		$10,000.00	
Mobilization		5%			$4,768.00	
Traffic Control		$25,000.00	L.S.		$25,000.00	
Utility Coordination/Relocation		$20,000.00	L.S.		$20,000.00	
Stormwater Management/Erosion Control		5%			$4,768.00	
Subtotal Additional Capital Improvement Costs					**$64,536.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$23,985.00	
Legal/Administrative		5%			$7,995.00	
Contract Admin/Construction Management		10%			$15,990.00	
Contingency		25%			$39,975.00	
Subtotal Other Costs					**$87,945.00**	
Total Capital Improvement Costs					**$247,845.00**	

TT-C9 & C10 Highway 52 and Eighth Street - Main Channel (Dacono Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	3	1	90	L.F.	$916.77	$82,509.00	Half of crossing located in Dacono
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	1	12.00	1	EA	$1,167.66	$1,168.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	3	1	1	EA	$7,567.75	$7,567.80	
Channel Improvements							
18-inch Riprap, Type H			13	C.Y.	$108.00	$1,404.00	Riprap for Inlet in Dacono
Removals							
Removal of culvert pipe (D<48")			270	L.F.	$27.00	$7,290.00	Removal of Existing Pipe Crossings in Dacono
Special Items (User Defined)							
Asphalt	<----User Defined Items		220	S.Y.	$100.00	$22,000.00	90'L x 22'W Trench in Dacono

Master Plan Capital Improvement Cost Summary		
Capital Improvement Costs		
Pipe Culverts and Storm Drains	$0.00	
Concrete Box Culverts	$91,245.00	
Hydraulic Structures	$0.00	
Channel Improvements	$1,404.00	
Detention/Water Quality Facilities	$0.00	
Removals	$7,290.00	
Landscaping and Maintenance Improvements	$0.00	
Special Items (User Defined)	$22,000.00	
Subtotal Capital Improvement Costs	**$121,939.00**	
Additional Capital Improvement Costs		
Dewatering	$10,000.00 L.S.	$10,000.00
Mobilization	5%	$6,097.00
Traffic Control	$25,000.00 L.S.	$25,000.00
Utility Coordination/Relocation	$25,000.00 L.S.	$25,000.00
Stormwater Management/Erosion Control	5%	$6,097.00
Subtotal Additional Capital Improvement Costs		**$72,194.00**
Land Acquisition Costs		
ROW/Easements		$0.00
Subtotal Land Acquisition Costs		**$0.00**
Other Costs (percentage of Capital Improvement Costs)		
Engineering	15%	$29,120.00
Legal/Administrative	5%	$9,707.00
Contract Admin/Construction Management	10%	$19,413.00
Contingency	25%	$48,533.00
Subtotal Other Costs		**$106,773.00**
Total Capital Improvement Costs		**$300,906.00**

TT-C14 Colorado Blvd, South of County Road 20/Bella Rosa Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	374	1	374	L.F.	$146.00	$54,604.00	HDPE pipe, not RCP
Manholes and Inlets							
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$6,233.00	$12,466.00	
Channel Improvements							
18-inch Riprap, Type H			16	C.Y.	$108.00	$1,728.00	Riprap for HDPE Pipe
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			37	ACRE	$1,355.00	$50,135.00	Estimated Turf & Irrigation Reclamation of Golf Course

Master Plan Capital Improvement Cost Summary		
Capital Improvement Costs		
Pipe Culverts and Storm Drains	$67,070.00	
Concrete Box Culverts	$0.00	
Hydraulic Structures	$0.00	
Channel Improvements	$1,728.00	
Detention/Water Quality Facilities	$0.00	
Removals	$0.00	
Landscaping and Maintenance Improvements	$50,135.00	
Special Items (User Defined)	$0.00	
Subtotal Capital Improvement Costs	**$118,933.00**	
Additional Capital Improvement Costs		
Dewatering	$5,000.00 L.S.	$5,000.00
Mobilization	5%	$5,947.00
Traffic Control	$5,000.00 L.S.	$5,000.00
Utility Coordination/Relocation	$2,000.00 L.S.	$2,000.00
Stormwater Management/Erosion Control	5%	$5,947.00
Subtotal Additional Capital Improvement Costs		**$23,894.00**
Land Acquisition Costs		
ROW/Easements		$0.00
Subtotal Land Acquisition Costs		**$0.00**
Other Costs (percentage of Capital Improvement Costs)		
Engineering	15%	$21,424.00
Legal/Administrative	5%	$7,141.00
Contract Admin/Construction Management	10%	$14,283.00
Contingency	25%	$35,707.00
Subtotal Other Costs		**$78,555.00**
Total Capital Improvement Costs		**$221,382.00**

TT-C15 Colorado Blvd, South of County Road 20/Bella Rosa Parkway (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	3	1	43	L.F.	$979.17	$42,104.00	Half of crossing located in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	1	13.00	1	EA	$1,264.97	$1,265.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	3	1	1	EA	$7,790.51	$7,790.50	
Channel Improvements							
18-inch Riprap, Type H			15	C.Y.	$108.00	$1,620.00	Riprap for Outlet in Frederick
Special Items (User Defined)							
Asphalt	<----User Defined Items		65	S.Y.	$100.00	$6,500.00	25'L x 23' W Trench in Frederick

Master Plan Capital Improvement Cost Summary		
Capital Improvement Costs		
Pipe Culverts and Storm Drains	$0.00	
Concrete Box Culverts	$51,160.00	
Hydraulic Structures	$0.00	
Channel Improvements	$1,620.00	
Detention/Water Quality Facilities	$0.00	
Removals	$0.00	
Landscaping and Maintenance Improvements	$0.00	
Special Items (User Defined)	$6,500.00	
Subtotal Capital Improvement Costs	**$59,280.00**	
Additional Capital Improvement Costs		
Dewatering	$10,000.00 L.S.	$10,000.00
Mobilization	5%	$2,964.00
Traffic Control	$10,000.00 L.S.	$10,000.00
Utility Coordination/Relocation	$15,000.00 L.S.	$15,000.00
Stormwater Management/Erosion Control	5%	$2,964.00
Subtotal Additional Capital Improvement Costs		**$40,928.00**
Land Acquisition Costs		
ROW/Easements		$0.00
Subtotal Land Acquisition Costs		**$0.00**
Other Costs (percentage of Capital Improvement Costs)		
Engineering	15%	$15,031.00
Legal/Administrative	5%	$5,010.00
Contract Admin/Construction Management	10%	$10,021.00
Contingency	25%	$25,052.00
Subtotal Other Costs		**$55,114.00**
Total Capital Improvement Costs		**$155,322.00**

TT-C15 Colorado Blvd, South of County Road 20/Bella Rosa Parkway (Firestone Portion)

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts						
Box Culvert Pipe						
Individual Box Span (ft)	Box Height (ft) / No. of Barrels	Length (ft)				
11	3 / 1	43	L.F.	$979.17	$42,104.00	Half of crossing located in Firestone
Headwall and Toewalls						
Individual Box Span (ft)	No. of Barrels / Total Span (ft)					
11	1 / 13.00	1	EA	$1,264.97	$1,265.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)						
Individual Box Span (ft)	Box Rise (ft) / No. of Barrels					
11	3 / 1	1	EA	$7,790.51	$7,790.50	
Channel Improvements						
18-inch Riprap, Type H		15	C.Y.	$108.00	$1,620.00	Riprap for Inlet in Firestone
Special Items (User Defined)						
Asphalt	<----User Defined Items	65	S.Y.	$100.00	$6,500.00	25'L x 23' W Trench in Firestone

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$51,160.00
Hydraulic Structures				$0.00
Channel Improvements				$1,620.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$6,500.00
Subtotal Capital Improvement Costs				**$59,280.00**
Additional Capital Improvement Costs				
Dewatering	$10,000.00	L.S.		$10,000.00
Mobilization	5%			$2,964.00
Traffic Control	$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation	$15,000.00	L.S.		$15,000.00
Stormwater Management/Erosion Control	5%			$2,964.00
Subtotal Additional Capital Improvement Costs				**$40,928.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$15,031.00
Legal/Administrative	5%			$5,010.00
Contract Admin/Construction Management	10%			$10,021.00
Contingency	25%			$25,052.00
Subtotal Other Costs				**$55,114.00**
Total Capital Improvement Costs				**$155,322.00**

TT-C16 Colorado Blvd, North of Majestic Street/McClure Avenue (Frederick Portion)

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	Length (ft) / No. of Barrels					
24-inch	60 / 1	60	L.F.	$98.00	$5,880.00	Add 19"Hx30"W equivalent is a 24" pipe. Portion of crossing in Frederick
Flare End Sections						
Diameter (in)	Applicable / No. of Barrels					
24-inch	Yes / 1	1	EA	$1,314.00	$1,314.00	Inlet in Frederick
Channel Improvements						
18-inch Riprap, Type H		4	C.Y.	$108.00	$432.00	Riprap for Inlet in Frederick
Special Items (User Defined)						
Asphalt	<----User Defined Items	40	S.Y.	$100.00	$4,000.00	25' L x 15' W trench width in Frederick

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$7,194.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$432.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$4,000.00
Subtotal Capital Improvement Costs				**$11,626.00**
Additional Capital Improvement Costs				
Dewatering	$5,000.00	L.S.		$5,000.00
Mobilization	5%			$581.00
Traffic Control	$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation	$10,000.00	L.S.		$10,000.00
Stormwater Management/Erosion Control	5%			$581.00
Subtotal Additional Capital Improvement Costs				**$26,162.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$5,668.00
Legal/Administrative	5%			$1,889.00
Contract Admin/Construction Management	10%			$3,779.00
Contingency	25%			$9,447.00
Subtotal Other Costs				**$20,783.00**
Total Capital Improvement Costs				**$58,571.00**

TT-C16 Colorado Blvd, North of Majestic Street/McClure Avenue (Firestone Portion)

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	Length (ft) / No. of Barrels					
24-inch	140 / 1	140	L.F.	$98.00	$13,720.00	Add 19"Hx30"W equivalent is a 24" pipe. Portion of crossing in Firestone
Flare End Sections						
Diameter (in)	Applicable / No. of Barrels					
24-inch	Yes / 1	1	EA	$1,314.00	$1,314.00	Outlet in Firestone
Channel Improvements						
18-inch Riprap, Type H		4	C.Y.	$108.00	$432.00	Riprap for Outlet in Firestone
Landscaping and Maintenance Improvements						
Reclamation & seeding (native grasses)		0.5	ACRE	$1,355.00	$678.00	
Trail/Path, Concrete (10' Width)		30	L.F.	$60.00	$1,800.00	Trail replacement
Special Items (User Defined)						
Asphalt	<----User Defined Items	40	S.Y.	$100.00	$4,000.00	25' L x 15' W trench width in Firestone

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$15,034.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$432.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$2,478.00
Special Items (User Defined)				$4,000.00
Subtotal Capital Improvement Costs				**$21,944.00**
Additional Capital Improvement Costs				
Dewatering	$5,000.00	L.S.		$5,000.00
Mobilization	5%			$1,097.00
Traffic Control	$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation	$15,000.00	L.S.		$15,000.00
Stormwater Management/Erosion Control	5%			$1,097.00
Subtotal Additional Capital Improvement Costs				**$32,194.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$8,121.00
Legal/Administrative	5%			$2,707.00
Contract Admin/Construction Management	10%			$5,414.00
Contingency	25%			$13,535.00
Subtotal Other Costs				**$29,777.00**
Total Capital Improvement Costs				**$83,915.00**

TT-C17 Hurt St

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
18-inch Riprap, Type H		33	C.Y.	$108.00	$3,564.00	Assumed 300 sq ft for surface area, 1 yd down.
Excavation, Mid Range		33	C.Y.	$33.00	$1,089.00	Assumed to be same as riprap
Concrete Low Flow Channel		15	L.F.	$54.00	$810.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$5,463.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$0.00
Subtotal Capital Improvement Costs				**$5,463.00**
Additional Capital Improvement Costs				
Dewatering	$5,000.00	L.S.		$5,000.00
Mobilization	5%			$273.00
Traffic Control	$5,000.00	L.S.		$5,000.00
Utility Coordination/Relocation	$5,000.00	L.S.		$5,000.00
Stormwater Management/Erosion Control	5%			$273.00
Subtotal Additional Capital Improvement Costs				**$15,546.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$3,151.00
Legal/Administrative	5%			$1,050.00
Contract Admin/Construction Management	10%			$2,101.00
Contingency	25%			$5,252.00
Subtotal Other Costs				**$11,554.00**
Total Capital Improvement Costs				**$32,563.00**

TT-C23 Highway 52, West of Forest Avenue (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	3	2	50	L.F.	$1,958.34	$97,917.00	Actual size is 3'Hx12'W. Portion of crossing in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
11	2	25.00	1	EA	$2,432.63	$2,433.00	Outlet in Frederick
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
11	3	2	1	EA	$10,463.60	$10,463.60	Outlet in Frederick
Channel Improvements							
18-inch Riprap, Type H			25	C.Y.	$108.00	$2,700.00	Riprap for Outlet in Frederick
Excavation, Low Range			575	C.Y.	$15.00	$8,625.00	Cut placed on site
Excavation, Mid Range			1300	C.Y.	$33.00	$42,900.00	Offsite Fill for channel widening & freeboard
Removals							
Removal of culvert pipe (D<48")			100	L.F.	$27.00	$2,700.00	Removal of existing CMPs in Frederick
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			3	ACRE	$1,355.00	$4,065.00	Restoration of Channel
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		190	S.Y.	$100.00	$19,000.00	50'L x 34'W for trench in Frederick

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$110,814.00
Hydraulic Structures				$0.00
Channel Improvements				$54,225.00
Detention/Water Quality Facilities				$0.00
Removals				$2,700.00
Landscaping and Maintenance Improvements				$4,065.00
Special Items (User Defined)				$19,000.00
Subtotal Capital Improvement Costs				**$190,804.00**
Additional Capital Improvement Costs				
Dewatering	$10,000.00	L.S.		$10,000.00
Mobilization	5%			$9,540.00
Traffic Control	$25,000.00	L.S.		$25,000.00
Utility Coordination/Relocation	$20,000.00	L.S.		$20,000.00
Stormwater Management/Erosion Control	5%			$9,540.00
Subtotal Additional Capital Improvement Costs				**$74,080.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$39,733.00
Legal/Administrative	5%			$13,244.00
Contract Admin/Construction Management	10%			$26,488.00
Contingency	25%			$66,221.00
Subtotal Other Costs				**$145,686.00**
Total Capital Improvement Costs				**$410,570.00**

TT-C23 Highway 52, West of Forest Avenue (Dacono Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Manholes and Inlets							
Storm Inlet, Type R/Type 14, 5-foot			2	EA	$6,233.00	$12,466.00	Inlets to Capture Street Flow
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	3	2	50	L.F.	$1,958.34	$97,917.00	Actual size is 3'Hx12'W. Portion of crossing in Dacono
Removals							
Removal of culvert pipe (D<48")			100	L.F.	$27.00	$2,700.00	Removal of existing CMPs in Dacono
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		190	S.Y.	$100.00	$19,000.00	50'L x 34'W for trench in Frederick

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$12,466.00
Concrete Box Culverts				$97,917.00
Hydraulic Structures				$0.00
Channel Improvements				$0.00
Detention/Water Quality Facilities				$0.00
Removals				$2,700.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$19,000.00
Subtotal Capital Improvement Costs				**$132,083.00**
Additional Capital Improvement Costs				
Dewatering	$10,000.00	L.S.		$10,000.00
Mobilization	5%			$6,604.00
Traffic Control	$25,000.00	L.S.		$25,000.00
Utility Coordination/Relocation	$20,000.00	L.S.		$20,000.00
Stormwater Management/Erosion Control	5%			$6,604.00
Subtotal Additional Capital Improvement Costs				**$68,208.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$30,044.00
Legal/Administrative	5%			$10,015.00
Contract Admin/Construction Management	10%			$20,029.00
Contingency	25%			$50,073.00
Subtotal Other Costs				**$110,161.00**
Total Capital Improvement Costs				**$310,452.00**

TT-C24 McClure Avenue Storm Sewer (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	700	1	700	L.F.	$146.00	$102,200.00	Half Assumed for Frederick
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	$5,285.00	$5,285.00	
Removals							
Removal of culvert pipe (D<48")			700	L.F.	$27.00	$18,900.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		935	S.Y.	$100.00	$93,500.00	700'Lx12'W Trench Assumed for Frederick

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$107,485.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$0.00	
Removals						$18,900.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$93,500.00	
Subtotal Capital Improvement Costs						**$219,885.00**	
Additional Capital Improvement Costs							
Dewatering			$10,000.00	L.S.		$10,000.00	
Mobilization			5%			$10,994.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00	
Stormwater Management/Erosion Control			5%			$10,994.00	
Subtotal Additional Capital Improvement Costs						**$71,988.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$43,781.00	
Legal/Administrative			5%			$14,594.00	
Contract Admin/Construction Management			10%			$29,187.00	
Contingency			25%			$72,968.00	
Subtotal Other Costs						**$160,530.00**	
Total Capital Improvement Costs						**$452,403.00**	

TT-C24 McClure Avenue Storm Sewer (Firestone Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	700	1	700	L.F.	$146.00	$102,200.00	Half Assumed for Firestone
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	$5,285.00	$5,285.00	
Removals							
Removal of culvert pipe (D<48")			700	L.F.	$27.00	$18,900.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		935	S.Y.	$100.00	$93,500.00	700'Lx12'W Trench Assumed for Frederick

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$107,485.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$0.00	
Removals						$18,900.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$93,500.00	
Subtotal Capital Improvement Costs						**$219,885.00**	
Additional Capital Improvement Costs							
Dewatering			$10,000.00	L.S.		$10,000.00	
Mobilization			5%			$10,994.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00	
Stormwater Management/Erosion Control			5%			$10,994.00	
Subtotal Additional Capital Improvement Costs						**$71,988.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$43,781.00	
Legal/Administrative			5%			$14,594.00	
Contract Admin/Construction Management			10%			$29,187.00	
Contingency			25%			$72,968.00	
Subtotal Other Costs						**$160,530.00**	
Total Capital Improvement Costs						**$452,403.00**	

TT-C25 Majestic Street, West of Colorado Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
30-inch	150	1	150	L.F.	$122.00	$18,300.00	The equivalent to a 24"Hx38"W HERCP
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
30-inch	Yes	1	2	EA	$2,127.00	$4,254.00	
Channel Improvements							
18-inch Riprap, Type H			10	C.Y.	$108.00	$1,080.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			0.5	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		60	S.Y.	$100.00	$6,000.00	35'Lx15'W (Trench)

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$22,554.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$1,080.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$6,000.00	
Subtotal Capital Improvement Costs						**$30,312.00**	
Additional Capital Improvement Costs							
Dewatering			$10,000.00	L.S.		$10,000.00	
Mobilization			5%			$1,516.00	
Traffic Control			$20,000.00	L.S.		$20,000.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,516.00	
Subtotal Additional Capital Improvement Costs						**$58,032.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$13,252.00	
Legal/Administrative			5%			$4,417.00	
Contract Admin/Construction Management			10%			$8,834.00	
Contingency			25%			$22,086.00	
Subtotal Other Costs						**$48,589.00**	
Total Capital Improvement Costs						**$136,933.00**	

TT-C28 County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	100	1	100	L.F.	$146.00	$14,600.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	$2,182.00	$4,364.00	
Channel Improvements							
18-inch Riprap, Type H			16	C.Y.	$108.00	$1,728.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		50	S.Y.	$100.00	$5,000.00	30'Wx15'L (Width of road and 15' wide trench)

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$18,964.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$1,728.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$5,000.00	
Subtotal Capital Improvement Costs						**$25,692.00**	
Additional Capital Improvement Costs							
Dewatering			$15,000.00	L.S.		$15,000.00	
Mobilization			5%			$1,285.00	
Traffic Control			$20,000.00	L.S.		$20,000.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,285.00	
Subtotal Additional Capital Improvement Costs						**$62,570.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$13,239.00	
Legal/Administrative			5%			$4,413.00	
Contract Admin/Construction Management			10%			$8,826.00	
Contingency			25%			$22,066.00	
Subtotal Other Costs						**$48,544.00**	
Total Capital Improvement Costs						**$136,806.00**	

TT-C29 Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	745	1	745	L.F.	$146.00	$108,770.00	
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	$5,285.00	$5,285.00	
Storm Inlet, Type R/Type 14, 5-foot			3	EA	$6,233.00	$18,699.00	Assumed to be equal cost of Type D inlets
Removals							
Removal of culvert pipe (D<48")			745	L.F.	$27.00	$20,115.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Trail/Path, Concrete (10' Width)			745	L.F.	$60.00	$44,700.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$132,754.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$0.00	
Removals						$20,115.00	
Landscaping and Maintenance Improvements						$46,055.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$198,924.00**	
Additional Capital Improvement Costs							
Dewatering			$20,000.00	L.S.		$20,000.00	
Mobilization			5%			$9,946.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$20,000.00	L.S.		$20,000.00	
Stormwater Management/Erosion Control			5%			$9,946.00	
Subtotal Additional Capital Improvement Costs						**$69,892.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$40,322.00	
Legal/Administrative			5%			$13,441.00	
Contract Admin/Construction Management			10%			$26,882.00	
Contingency			25%			$67,204.00	
Subtotal Other Costs						**$147,849.00**	
Total Capital Improvement Costs						**$416,665.00**	

TT Ponds 667 & 668 - Prairie Green Ponds 2 & 3

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements							
18-inch Riprap, Type H			250	C.Y.	$108.00	$27,000.00	Assume Spillway is raised with riprap
Excavation, Mid Range			770	C.Y.	$33.00	$25,410.00	Fill from offsite to raise berm between ponds
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	Reseeding of disturbed areas
Special Items (User Defined)							
Orifice Plate Modification	<----User Defined Items		1	EA	$5,000.00	$5,000.00	Lump sum to modify Pond 3 Orifice Plate

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$52,410.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$1,355.00	
Special Items (User Defined)						$5,000.00	
Subtotal Capital Improvement Costs						**$58,765.00**	
Additional Capital Improvement Costs							
Dewatering			$0.00	L.S.		$0.00	
Mobilization			5%			$2,938.00	
Traffic Control			$5,000.00	L.S.		$5,000.00	
Utility Coordination/Relocation			$0.00	L.S.		$0.00	
Stormwater Management/Erosion Control			5%			$2,938.00	
Subtotal Additional Capital Improvement Costs						**$10,876.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$10,446.00	
Legal/Administrative			5%			$3,482.00	
Contract Admin/Construction Management			10%			$6,964.00	
Contingency			25%			$17,410.00	
Subtotal Other Costs						**$38,302.00**	
Total Capital Improvement Costs						**$107,943.00**	

TT-C37 Carbondale Drive Storm Sewer

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
78-inch	980	1	980	L.F.	$528.00	$517,440.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
78-inch	Yes	1	2	EA	$2,834.43	$5,669.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
78-inch		1	2	EA	$17,879.96	$35,760.00	
Manholes and Inlets							
Storm Inlet, Type R/Type 14, 5-foot			10	EA	$6,233.00	$62,330.00	
Removals							
Removal of culvert pipe (D<48")			980	L.F.	$27.00	$26,460.00	Existing 36" RCP assumed to be equal length of proposed pipe.
Special Items (User Defined)							
Custom build junction box	<----User Defined Items		1	L.S.	$70,000.00	$70,000.00	
Asphalt	<----User Defined Items		2400	S.Y.	$100.00	$240,000.00	980'L x 22'W

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$621,199.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$0.00
Removals					$26,460.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$310,000.00
Subtotal Capital Improvement Costs					**$957,659.00**
Additional Capital Improvement Costs					
Dewatering		$19,000.00	L.S.		$19,000.00
Mobilization		5%			$47,883.00
Traffic Control		$29,000.00	L.S.		$29,000.00
Utility Coordination/Relocation		$55,500.00	L.S.		$55,500.00
Stormwater Management/Erosion Control		5%			$47,883.00
Subtotal Additional Capital Improvement Costs					**$199,266.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$173,539.00
Legal/Administrative		5%			$57,846.00
Contract Admin/Construction Management		10%			$115,693.00
Contingency		25%			$289,231.00
Subtotal Other Costs					**$636,309.00**
Total Capital Improvement Costs					**$1,793,234.00**

TT-C38 Forest Avenue Storm Sewer

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	3	2	320	L.F.	$1,958.34	$626,669.00	Actual size is 3'Hx12'W. From upstream of Carbondale Drive to Hwy 52
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	2	25.00	1	EA	$2,432.63	$2,433.00	Inlet Upstream of Forest Ave
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	3	2	1	EA	$10,463.60	$10,463.60	
Channel Improvements							
18-inch Riprap, Type H			25	C.Y.	$108.00	$2,700.00	Riprap for Inlet
Removals							
Removal of culvert pipe (D<48")			380	L.F.	$27.00	$10,260.00	Removal of existing CMP pipes and storm sewer
Special Items (User Defined)							
Asphalt	<----User Defined Items		1210	S.Y.	$100.00	$121,000.00	320'L x 34' W Trench

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$639,566.00
Hydraulic Structures					$0.00
Channel Improvements					$2,700.00
Detention/Water Quality Facilities					$0.00
Removals					$10,260.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$121,000.00
Subtotal Capital Improvement Costs					**$773,526.00**
Additional Capital Improvement Costs					
Dewatering		$10,000.00	L.S.		$10,000.00
Mobilization		5%			$38,676.00
Traffic Control		$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation		$45,000.00	L.S.		$45,000.00
Stormwater Management/Erosion Control		5%			$38,676.00
Subtotal Additional Capital Improvement Costs					**$142,352.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$137,382.00
Legal/Administrative		5%			$45,794.00
Contract Admin/Construction Management		10%			$91,588.00
Contingency		25%			$228,970.00
Subtotal Other Costs					**$503,734.00**
Total Capital Improvement Costs					**$1,419,612.00**

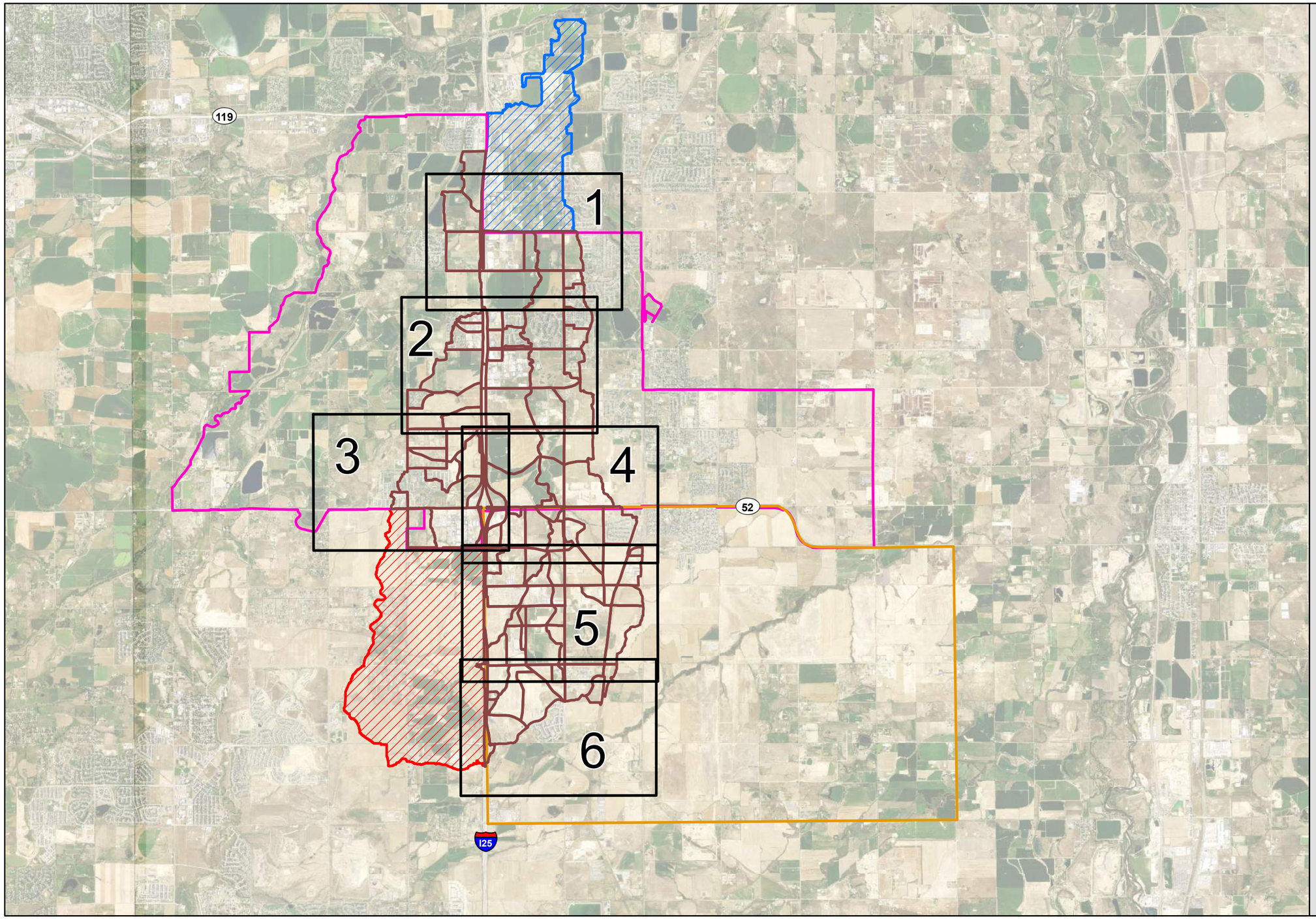
TT Pond 784 - East of Glenn Creighton Drive, South of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	215	1	215	L.F.	$73.00	$15,695.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
18-inch	Yes	1	2	EA	$1,247.00	$2,494.00	Assumed to be a headwall for the outlet structure
Detention/Water Quality Facilities							
Detention (User Entered Quantities)							
Excavation, Low Range			1458	C.Y.	$15.00	$21,870.00	Cut/Fill that can be placed on site
Excavation, Mid Range			2608	C.Y.	$33.00	$86,064.00	Additional cut to be hauled off.
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,762.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$18,189.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$0.00
Detention/Water Quality Facilities					$107,934.00
Removals					$0.00
Landscaping and Maintenance Improvements					$1,762.00
Special Items (User Defined)					$0.00
Subtotal Capital Improvement Costs					**$127,885.00**
Additional Capital Improvement Costs					
Dewatering		$25,000.00	L.S.		$25,000.00
Mobilization		5%			$6,394.00
Traffic Control		$12,500.00	L.S.		$12,500.00
Utility Coordination/Relocation		$12,500.00	L.S.		$12,500.00
Stormwater Management/Erosion Control		5%			$6,394.00
Subtotal Additional Capital Improvement Costs					**$62,788.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$28,601.00
Legal/Administrative		5%			$9,534.00
Contract Admin/Construction Management		10%			$19,067.00
Contingency		25%			$47,668.00
Subtotal Other Costs					**$104,870.00**
Total Capital Improvement Costs					**$295,543.00**

Appendix D. Godding Hollow Basin Documentation

Appendix D.1. Godding Hollow Existing Condition Documentation



Legend

- 1000 Foot Scale
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

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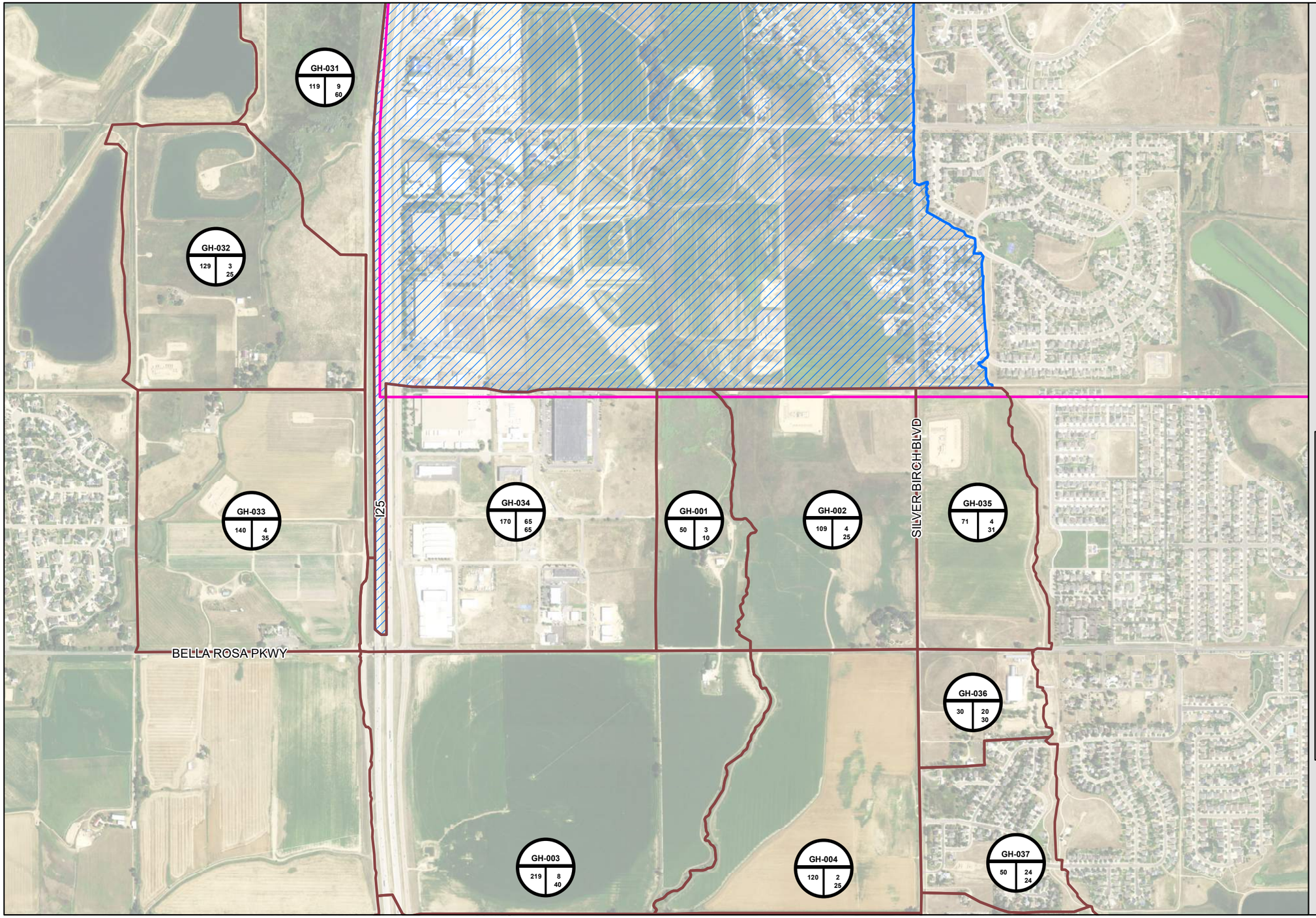
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-INDEX

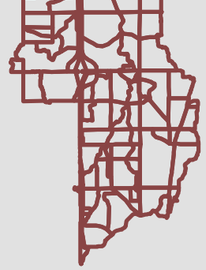


Legend

- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

XX — Subcatchment ID
XX X — % Impervousness (Existing Condition)
X — % Impervousness (Future Condition)
Acreage

Key Map



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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

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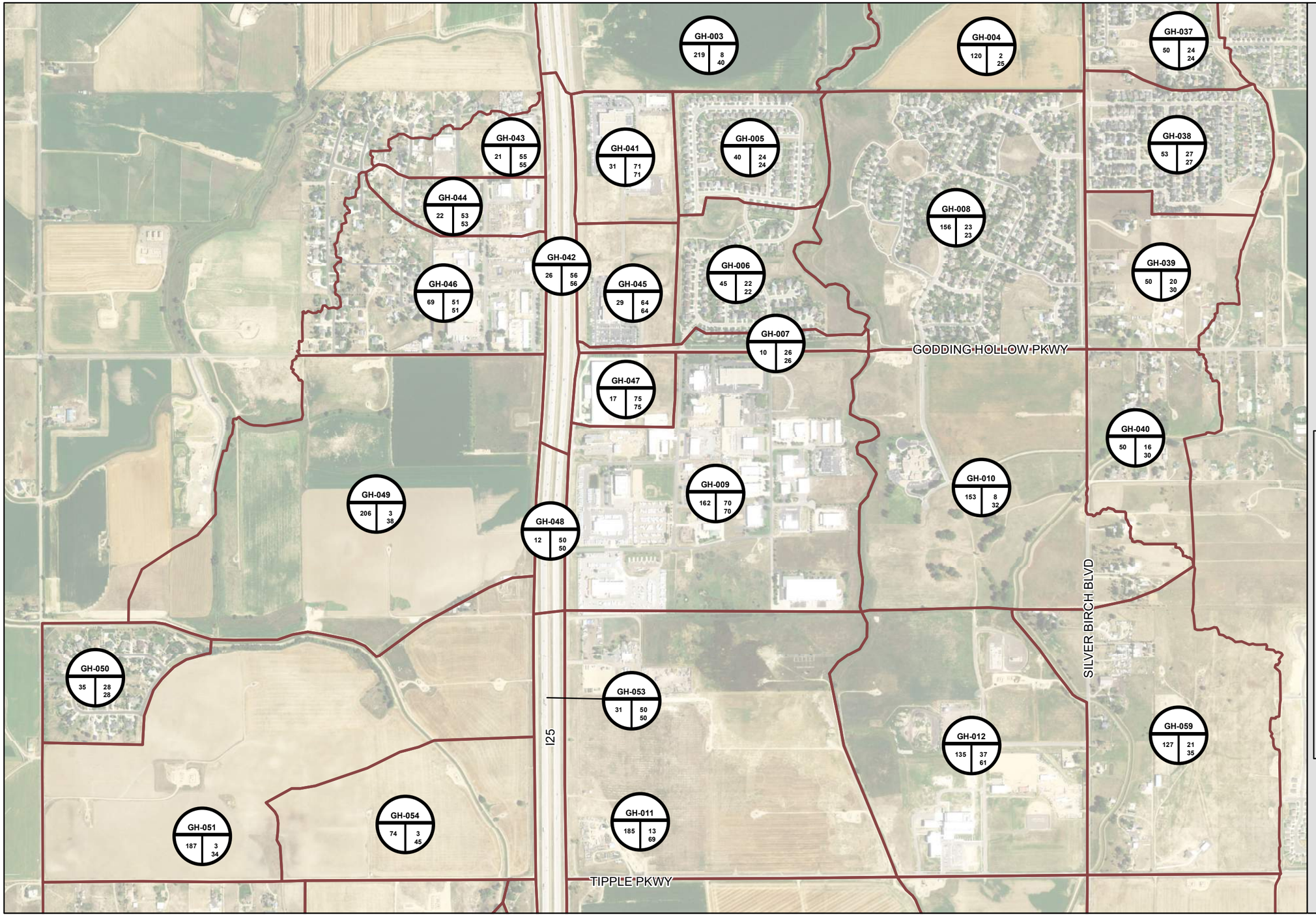
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-1

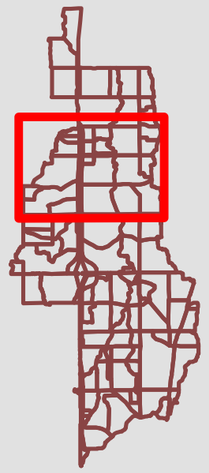


Legend

- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

XX — Subcatchment ID
XX X — % Impervousness (Existing Condition)
X — % Impervousness (Future Condition)
Acreage

Key Map



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GODDING HOLLOW
SUBBASIN MAPS

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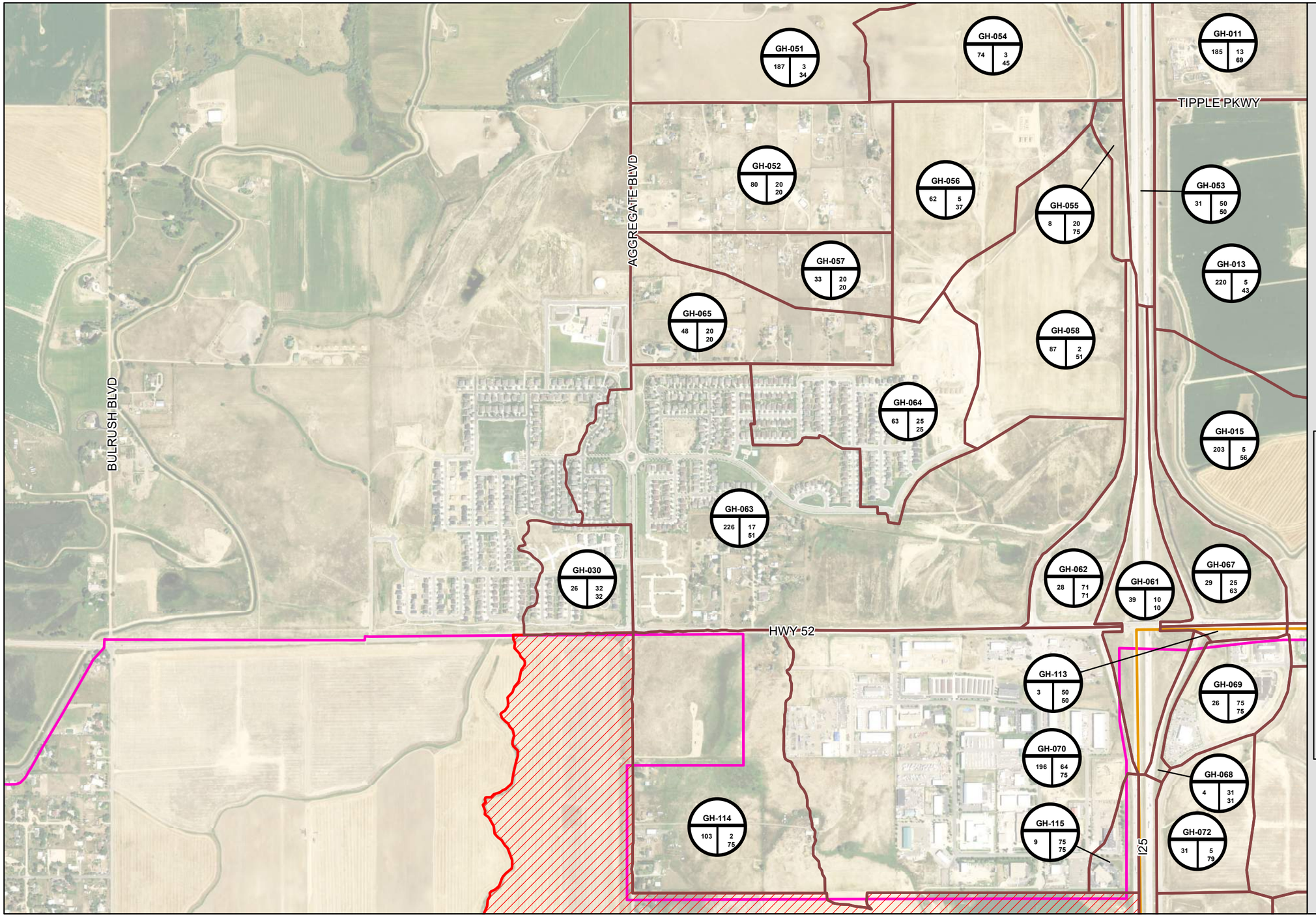
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-2



Legend

- Subbasin
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- Frederick Planning Boundary
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XX — Subcatchment ID
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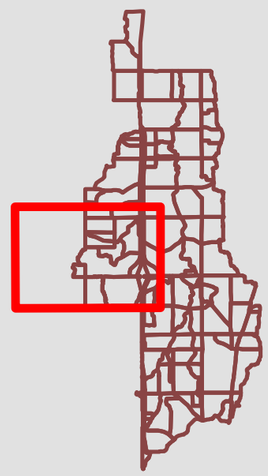
Key Map



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OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

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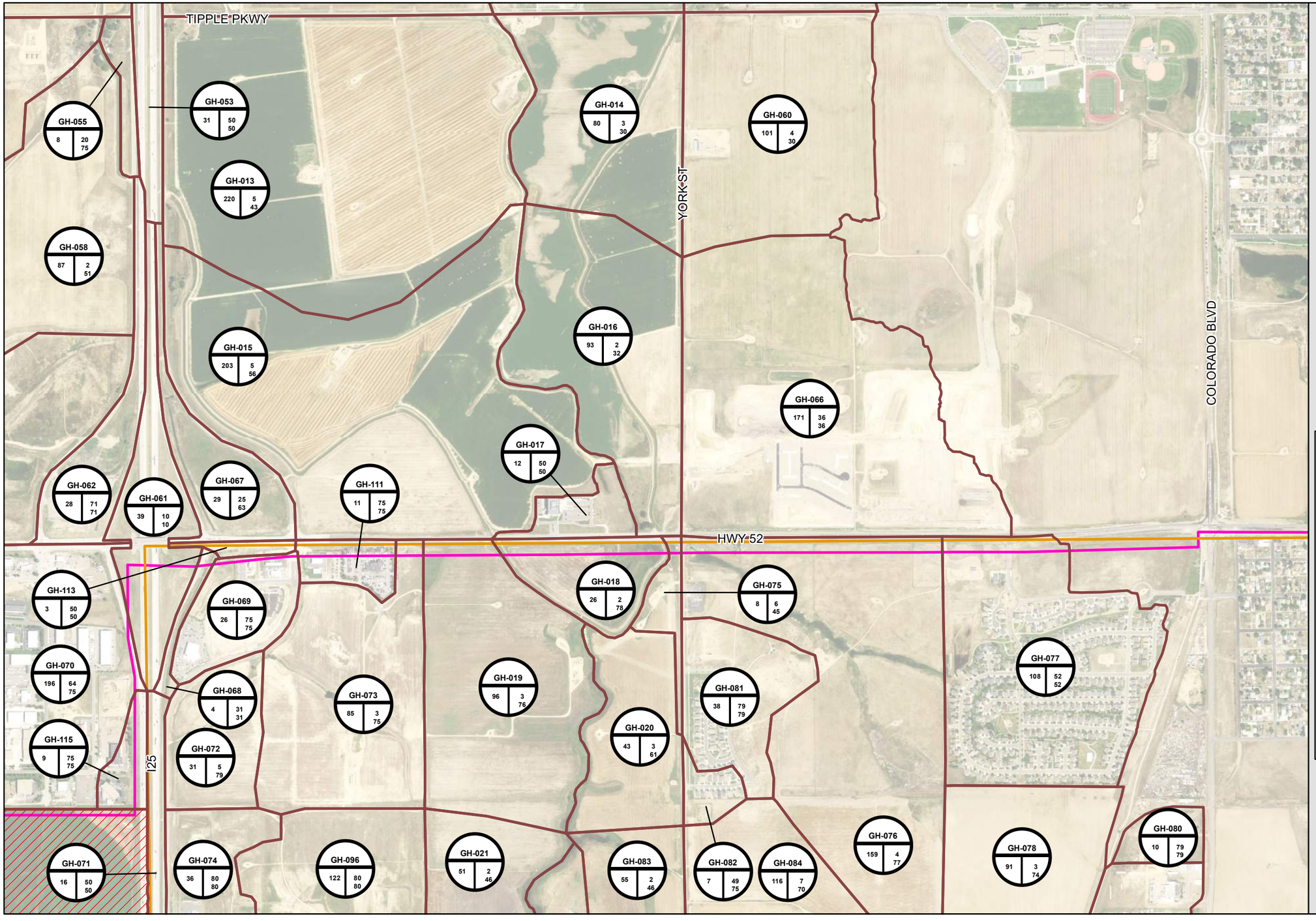
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-3



Legend

- Subbasin
- Godding Hollow Basin Studied By Erie OSP
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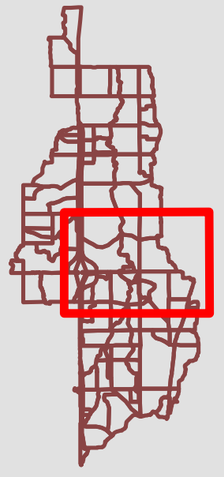
Key Map



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OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

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CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-4

GH-071 16 | 50 / 50
GH-074 36 | 80 / 80
GH-096 122 | 80 / 80
GH-021 51 | 2 / 46
GH-083 55 | 2 / 46
GH-082 7 | 49 / 75
GH-084 116 | 7 / 70
GH-076 159 | 4 / 77
GH-078 91 | 3 / 74
GH-080 10 | 79 / 79
GH-079 54 | 80 / 80
GH-022 42 | 5 / 45
GRAND VIEW BLVD
GH-086 31 | 80 / 80
GH-087 20 | 3 / 79
GH-088 57 | 3 / 77
GH-023 77 | 80 / 80
GH-024 60 | 75 / 80
GH-093 26 | 36 / 80
GH-101 12 | 2 / 80
GH-097 54 | 11 / 71
GH-094 26 | 6 / 79
GH-025 90 | 11 / 74
GH-026 18 | 3 / 80
GH-085 318 | 21 / 63
GH-089 133 | 4 / 57
GH-095 39 | 3 / 79
GH-102 11 | 50 / 80
GH-098 120 | 4 / 78
GH-027 69 | 49 / 80
GH-029 8 | 50 / 50
GH-028 51 | 5 / 77
YORK ST
COLORADO BLVD
SPEEDWAY BLVD
GH-104 114 | 2 / 56
GH-099 50 | 3 / 56
GH-100 18 | 23 / 23
GH-110 5 | 2 / 29
GH-090 110 | 20 / 20
GH-091 25 | 2 / 58
GH-112 12 | 50 / 50
GH-103 55 | 8 / 85
I25

Legend

- Subbasin
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Key Map

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OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

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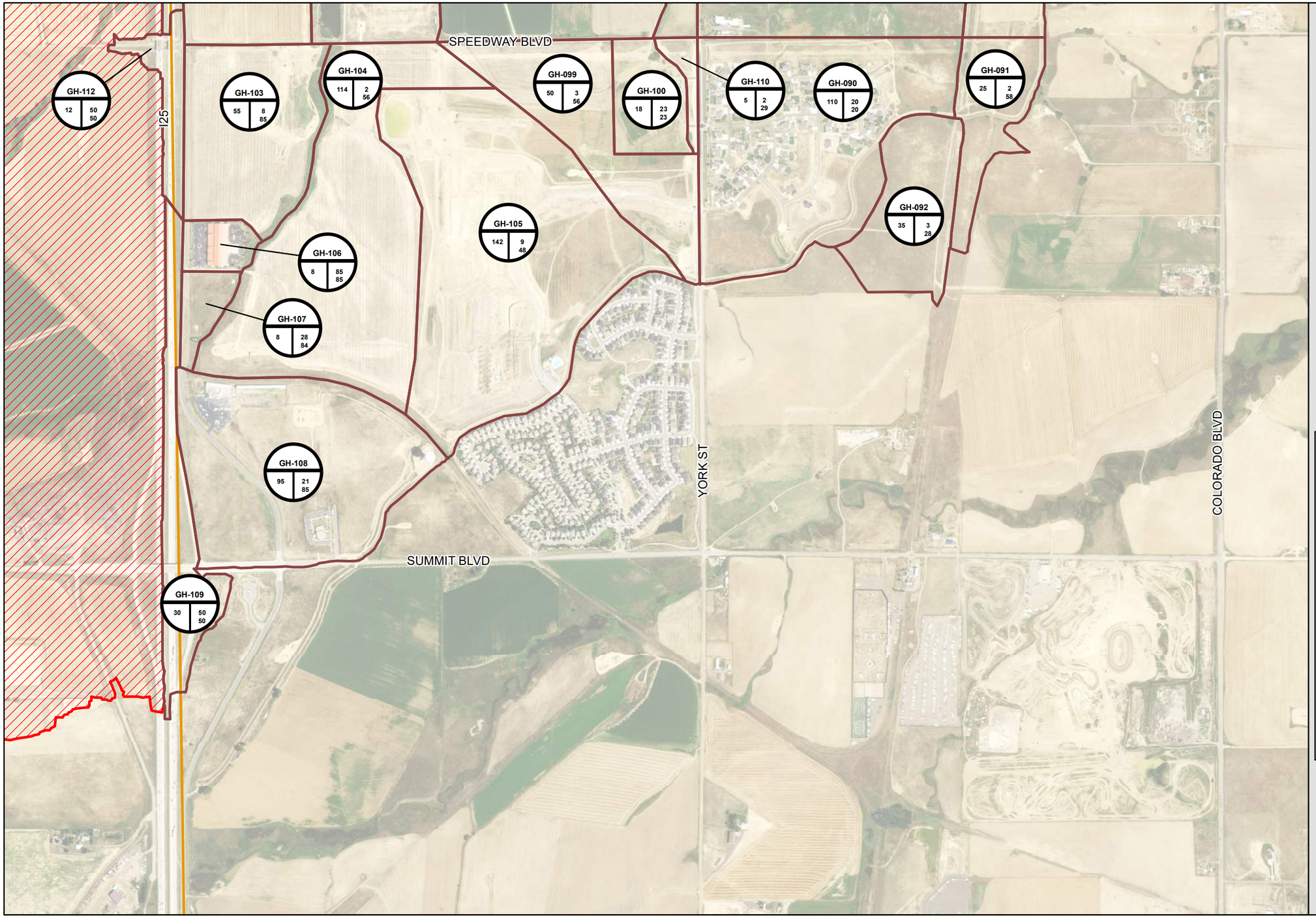
PROJECT NUMBER: COTOF.03	
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-5



Legend

- Subbasin
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- Frederick Planning Boundary
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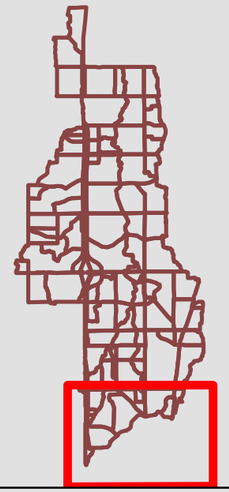
Acreage

Key Map



N

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Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
SUBBASIN MAPS

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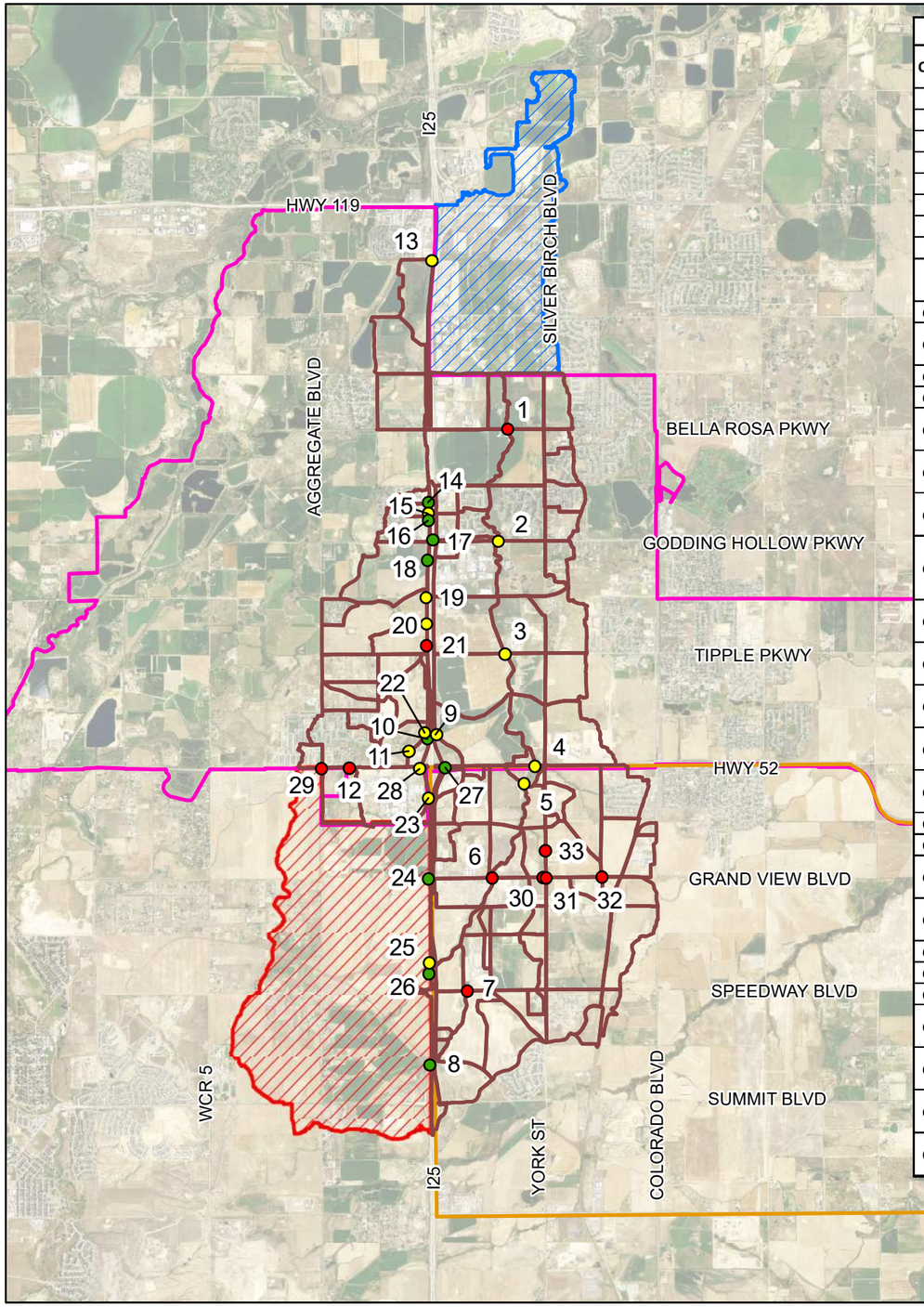
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/25/2021	
SHEET: GH	INDEX: SB-6

TABLE D.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
GODDING HOLLOW																				
GH-001	401	0.07869	50.4	0.28149	1486	0.50725	2678	0.0071	3	0.40	0.05	3.82	0.0014	0.67	43.96	0.87	29.27	2.34	0.65	0.26
GH-002	402	0.17091	109.4	0.39099	2064	0.58515	3090	0.0140	4	0.40	0.05	4.59	0.0015	0.72	116.51	1.07	77.19	3.55	2.18	0.84
GH-003	403	0.34210	218.9	0.52332	2763	0.79361	4190	0.0125	8	0.40	0.10	3.82	0.0018	0.55	257.47	1.18	182.06	37.85	10.53	5.23
GH-004	404	0.18744	120.0	0.30473	1609	0.50221	2652	0.0179	2	0.40	0.05	3.54	0.0018	0.54	182.29	1.52	128.81	24.22	2.13	1.07
GH-005	605	0.06291	40.3	0.21942	1159	0.26491	1399	0.0148	24	0.35	0.05	3.95	0.0018	0.56	69.16	1.72	51.95	17.30	9.50	5.44
GH-006	406	0.07109	45.5	0.20845	1101	0.31238	1649	0.0064	22	0.35	0.05	3.72	0.0018	0.55	67.19	1.48	49.83	16.21	8.83	4.86
GH-007	407	0.01550	9.9	0.22594	1193	0.45608	2408	0.0055	26	0.35	0.05	3.44	0.0018	0.53	7.61	0.77	5.48	1.84	1.09	0.60
GH-008	608	0.24347	155.8	0.37503	1980	0.59305	3131	0.0191	23	0.35	0.05	4.08	0.0017	0.59	262.72	1.69	194.91	61.26	31.69	19.37
GH-009	409	0.25288	161.8	0.35889	1895	0.64178	3389	0.0073	70	0.40	0.10	4.00	0.0018	0.58	488.27	3.02	386.72	188.19	141.32	99.58
GH-010	410	0.23840	152.6	0.47396	2503	0.75402	3981	0.0197	8	0.40	0.05	4.52	0.0012	0.79	151.19	0.99	97.43	8.59	5.02	1.63
GH-011	411	0.28844	184.6	0.44586	2354	0.67331	3555	0.0129	13	0.40	0.05	4.26	0.0013	0.76	208.07	1.13	139.52	19.25	12.50	5.79
GH-012	412	0.21051	134.7	0.40985	2164	0.56885	3004	0.0156	37	0.40	0.10	4.24	0.0016	0.64	270.51	2.01	202.88	68.32	45.64	28.89
GH-013	413	0.34368	220.0	0.41644	2199	0.69944	3693	0.0075	5	0.40	0.05	4.12	0.0015	0.67	241.07	1.10	162.69	16.97	5.95	2.51
GH-014	414	0.12545	80.3	0.31176	1646	0.49087	2592	0.0243	3	0.40	0.05	4.67	0.0012	0.81	86.17	1.07	53.73	1.93	1.09	0.27
GH-015	415	0.31768	203.3	0.55237	2916	0.76319	4030	0.0078	5	0.40	0.05	4.18	0.0013	0.75	174.14	0.86	110.89	6.36	3.73	1.28
GH-016	416	0.14518	92.9	0.35955	1898	0.47978	2533	0.0203	2	0.40	0.05	3.91	0.0014	0.69	111.84	1.20	74.14	3.77	1.13	0.44
GH-017	417	0.01902	12.2	0.14914	787	0.27867	1471	0.0103	50	0.40	0.10	4.77	0.0008	0.94	20.30	1.67	15.04	6.09	4.57	3.36
GH-018	418	0.04031	25.8	0.14305	755	0.20214	1067	0.0167	2	0.40	0.05	3.43	0.0016	0.61	38.69	1.50	27.03	3.85	0.44	0.20
GH-019	419	0.14993	96.0	0.36595	1932	0.45041	2378	0.0159	3	0.40	0.05	3.78	0.0014	0.69	114.66	1.19	76.36	4.83	1.73	0.68
GH-020	420	0.06764	43.3	0.26869	1419	0.33148	1750	0.0179	3	0.40	0.05	4.28	0.0011	0.82	41.89	0.97	25.56	0.93	0.51	0.11
GH-021	421	0.07901	50.6	0.22969	1213	0.29447	1555	0.0168	2	0.40	0.05	3.55	0.0015	0.64	70.09	1.39	47.94	5.39	0.76	0.33
GH-022	422	0.06494	41.6	0.34184	1805	0.50145	2648	0.0152	5	0.40	0.05	3.81	0.0016	0.63	38.43	0.92	26.19	3.42	0.97	0.43
GH-023	423	0.12069	77.2	0.34992	1848	0.56972	3008	0.0192	80	0.40	0.05	3.00	0.0018	0.50	259.95	3.37	210.97	114.71	88.85	63.86
GH-024	424	0.09371	60.0	0.29209	1542	0.40415	2134	0.0155	75	0.40	0.05	3.91	0.0013	0.73	198.73	3.31	158.04	81.43	64.34	45.91
GH-025	425	0.14093	90.2	0.36945	1951	0.47965	2533	0.0154	11	0.40	0.10	3.00	0.0018	0.50	125.95	1.40	91.50	24.87	9.04	3.93
GH-026	426	0.02763	17.7	0.17058	901	0.25456	1344	0.0187	3	0.40	0.05	3.00	0.0018	0.50	22.77	1.29	16.28	3.76	0.79	0.21
GH-027	427	0.10760	68.9	0.32445	1713	0.57466	3034	0.0184	49	0.40	0.05	3.00	0.0018	0.50	167.53	2.43	130.90	57.16	38.71	25.98
GH-028	428	0.07907	50.6	0.27374	1445	0.44067	2327	0.0153	5	0.40	0.05	3.00	0.0018	0.50	63.80	1.26	45.80	11.01	2.84	0.96
GH-029	429	0.01316	8.4	0.05480	289	0.21101	1114	0.0148	50	0.40	0.10	3.00	0.0018	0.50	24.66	2.93	19.12	8.55	5.64	3.76
GH-030	630	0.04082	26.1	0.13347	705	0.21656	1143	0.0091	32	0.35	0.05	3.96	0.0018	0.56	54.66	2.09	41.75	15.20	9.13	5.50
GH-031	431	0.18591	119.0	0.40109	2118	0.59196	3126	0.0021	9	0.40	0.05	3.42	0.0016	0.59	105.82	0.89	72.93	13.95	4.88	2.31
GH-032	432	0.20103	128.7	0.31863	1682	0.61598	3252	0.0101	3	0.40	0.05	4.17	0.0013	0.76	134.13	1.04	85.98	3.04	1.78	0.57
GH-033	433	0.21882	140.0	0.35645	1882	0.52453	2770	0.0301	4	0.40	0.05	4.56	0.0014	0.72	194.51	1.39	129.11	6.03	3.71	1.42
GH-034	434	0.26541	169.9	0.27234	1438	0.52254	2759	0.0101	65	0.40	0.10	4.59	0.0014	0.75	577.86	3.40	450.88	210.55	162.18	113.24
GH-035	435	0.11085	70.9	0.18342	968	0.37938	2003	0.0183	4	0.40	0.05	4.52	0.0017	0.64	110.74	1.56	75.98	9.47	2.38	1.05
GH-036	436	0.04720	30.2	0.17756	938	0.25563	1350	0.0183	20	0.40	0.05	4.20	0.0012	0.79	41.89	1.39	28.95	6.01	4.16	2.27
GH-037	637	0.07837	50.2	0.17220	909	0.29108	1537	0.0178	24	0.35	0.05	4.58	0.0014	0.75	90.20	1.80	65.12	15.97	10.79	6.49
GH-038	438	0.08298	53.1	0.20737	1095	0.37640	1987	0.0103	27	0.35	0.05	4.50	0.0018	0.60	87.91	1.66	64.88	21.36	11.74	7.39
GH-039	439	0.07759	49.7	0.21686	1145	0.32389	1710	0.0147	20	0.40	0.05	4.11	0.0018	0.57	79.80	1.61	57.96	16.16	8.30	5.00
GH-040	440	0.07735	49.5	0.15809	835	0.31450	1661	0.0164	16	0.40	0.05	4.61	0.0014	0.75	76.79	1.55	53.53	9.02	6.14	3.20
GH-041	441	0.04896	31.3	0.15926	841	0.28782	1520	0.0268	71	0.40	0.10	4.05	0.0018	0.57	116.37	3.71	91.30	46.66	35.06	24.68
GH-042	442	0.04128	26.4	0.17809	940	0.53694	2835	0.0044	56	0.40	0.10	4.17	0.0018	0.58	49.45	1.87	38.16	16.41	11.68	7.98
GH-043	443	0.03208	20.5	0.14955	790	0.24355	1286	0.0193	55	0.35	0.10	3.62	0.0018	0.54	62.01	3.02	48.45	22.55	15.78	10.41
GH-044	444	0.03379	21.6	0.17256	911	0.34362	1814	0.0186	53	0.35	0.10	4.03	0.0016	0.63	52.97	2.45	41.24	18.02	12.52	8.39
GH-045	645	0.04482	28.7	0.14971	790	0.24143	1275	0.0132	64	0.40	0.10	4.50	0.0018	0.60	96.66	3.37	75.42	36.07	26.74	18.43
GH-046	446	0.10733	68.7	0.25647	1354	0.42324	2235	0.0134	51	0.35	0.10	4.64	0.0015	0.72	176.44	2.57	134.98	55.43	40.41	26.73
GH-047	447	0.02730	17.5	0.13244	699	0.17977	949	0.0171	75	0.35	0.10	4.50	0.0018	0.60	64.20	3.67	50.74	26.76	20.20	14.42
GH-048	448	0.01817	11.6	0.14380	759	0.28044	1481	0.0039	50	0.40	0.10	3.30	0.0018	0.53	20.47	1.76	15.68	6.58	4.42	2.99
GH-049	649	0.32146	205.7	0.37885	2000	0.75233	3972	0.0093	3	0.40	0.05	3.90	0.0015	0.66	230.30	1.12	154.63	14.24	3.51	1.45
GH-050	450	0.05542	35.5	0.11462	605	0.24685	1303	0.0161	28	0.35	0.05	3.71	0.0018	0.55	80.99	2.28	61.42	22.00	12.75	7.37
GH-051	451	0.29285	187.4	0.77062	4069	0.93669	4946	0.0102	3	0.40	0.05	3.82	0.0014	0.68	144.22	0.77	93.61	6.66	2.06	0.81
GH-052	452	0.12508	80.0	0.29200	1542	0.38770	2047	0.0144	20	0.40	0.05	3.48	0.0018	0.53	131.56	1.64	96.40	29.01	13.70	8.52
GH-053	453	0.04919	31.5	0.41530	2193	0.70107	3702	0.0057	50	0.40	0.10	3.00	0.0018	0.50	42.14	1.34	32.28	13.54	9.14	6.02
GH-054	454	0.11598	74.2	0.23409	1236	0.44554	2352	0.0158	3	0.40	0.05	3.40	0.0016	0.60	103.00	1.39	71.94	11.06	1.73	0.81
GH-055	455	0.01215	7.8	0.13797	728	0.21856	1154	0.0082	20	0.40	0.05	3.00	0.0018	0.50	8.53	1.10	6.29	1.96	0.96	0.54
GH-056	456	0.09730	62.3	0.27228	1438	0.54075	2855	0.0106	5	0.40	0.05	3.15	0.0018	0.51	72.67	1.17	51.76	11.95	2.81	1.08
GH-057	457	0.05232	33.5	0.18466	975	0.23555	1244	0.0258	20	0.40	0.05	4.00	0.0018	0.57	61.34	1.83	45.52	13.01	6.51	3.92
GH-058	458	0.13531	86.6	0.24525	1295	0.36945	1951	0.0164	2	0.40	0.05	4.06	0.0018	0.57	136.15	1.57	95.62	16.00	1.54	0.74
GH-059	459	0.19875	127.2	0.24918	1316	0.44798	2365	0.0158	21	0.40	0.05	4.41	0.0016	0.65	229.65	1.81	167.12	42.40	25.11	14.58
GH-060	460	0.15829	101.3	0.24130	1274	0.43301	2286	0.0203	4	0.40	0.05	4.16	0.0018	0.58	166.57	1.64	117.22	20.93	3.73	1.80
GH-061	461	0.06125	39.2	0.27221	1437	0.60092	3173	0.0075	10	0.40	0.10	3.24	0.0018	0.52	36.17	0.92	25.54	6.27	2.04	0.93
GH-062	462	0.04350	27.8	0.11048	583	0.22272	1176	0.0119	71	0.40	0.10	3.79	0.0018	0.55	106.09	3.81	83.15	42.83	32.05	22.63
GH-063	663	0.35345	226.2	0.41123	2171	0.88581	4677	0.0117	17	0.40	0.05	3.48	0.0018	0.53	304.39	1.35	221.64	62.15	27.14	16.23
GH-064	664	0.09778	62.6	0.15687	828	0.41229	2177	0.0067	25	0.35	0.05	4.15	0.0018	0.58	105.63	1.69	78.45	26.03	14.21	8.49
GH-065	465	0.07473	47.8	0.31026	1638	0.37547	1982	0.0056	20	0.40	0.05	4.21	0.0018	0.58	53.38	1.12	38.61	10.32	5.37	3.21
GH-066	666	0.26795	171.5	0.30149	1592	0.51975	2744	0.0151	36	0.40	0.05	3.12	0.0018	0.52	430.42	2.51	328.49	126.04	75.80	49.31
GH-067	467	0.04586	29.4	0.20906	1104	0.26352	1391	0.0073	25	0.40	0.10	3.61	0.0016	0.62	39.34	1.34	28.62	8.03	4.67	2.87
GH-068	468	0.00661	4.2	0.11261	595	0.24376	1287	0.0095	31	0.40	0.10	3.00	0.0018	0.50	4.95	1.17	3.70	1.29	0.73	0.43
GH-069	669	0.03997	25.6	0.12053	636	0.20037	1058	0.0267	75	0.40	0.10	3.00	0.0018	0.50	107.53	4.20	89.13	45.41	34.17	24.55
GH-070	470	0.30703	196.5	0.35435	1871	0.62988	3326	0.0170	64	0.40	0.10	3.40	0.0017	0.55	672.87	3.42	533.65	253.54	186.04	127.20
GH-071	471	0.02512	16.1	0.37731	1992	0.68139	3598	0.0140	50	0.40	0.10	3.00	0.0018	0.50	20.89	1.30	16.06	6.72	4.53	2.98
GH-072	472	0.04841	31.0	0.12941	683	0.26752	1412	0.0136	5	0.40	0.05	3.00	0.0018	0.50	49.85	1.61	35.80	8.90	2.32	0.79
GH-073	473	0.13214	84.6	0.21789	1150	0.41558	2194	0.0132	3	0.40	0.05	3.12	0.0018	0.52	133.41	1.58	95.32	20.80	3.03	1.23
GH-074	674	0.05656	36.2	0.17508	924	0.31685	1673	0.0175	80	0.40	0.10	3.25	0.0017	0.56	136.10	3.76	108.27	58.35	45.03	32.20
GH-075	475	0.01305	8.3	0.15525	820	0.21503	1135	0.0274	6	0.40	0.05	3.00	0.0018	0.50	9.98	1.20	7.18	1.75	0.50	0.18
GH-076	676	0.24903	159.4	0.48638	2568	0.95581	5047	0.0129	4	0.40	0.05	3.00	0.0018	0.50	171.79	1.08	121.30	27.89	6.50	2.01
GH-077	677	0.16887	108.1	0.19105	1009	0.41268	2179	0.0090	52	0.35	0.05	3.00	0.0018	0.50	370.68	3.43	291.66	138.11	96.48	62.26
GH-078	478	0.14249	91.2	0.29000	1531	0.44274	2338	0.0128	3	0.40	0.05	3.00	0.0018	0.50	131.90	1.45	94.40	21.94	4.60	1.23
GH-079	479	0.08475	54.2	0.20686	1092	0.34733	1834	0.0228	80	0.40	0.10	3.00	0.0018	0.50	217.44	4.01	172.90	94.48	72.34	51.81
GH-080	480	0.01552	9.9	0.10879	574	0.14676	775	0.0072	79	0.40	0.05	3.00	0.0018	0.50	33.36	3.36	26.75	14.60	11.28	8.16
GH-081	681	0.05869	37.6	0.16097	850	0.33016	1743	0.0101	79	0.40	0.05	3.00	0.0018	0.50	137.51	3.66	110.28	60.34	46.61	33.69
GH-082	482	0.01152	7.4	0.05148	272	0.10932	577	0.0204	49	0.40	0.05	3.00	0.0018	0.50	25.72	3.49	19.78	9.11	6.01	4.11
GH-083	483	0.08579	54.9	0.32887	1736	0.52937	2795	0.0146	2	0.40	0.05	3.77	0.0014	0.69	51.48	0.94	33.87	1.90	0.51	0.20
GH-084	484	0.18087	115.8	0.24786	1309	0.50344	2658	0.0139	7	0.40	0.05	3.28	0.0018	0.52	187.69	1.62	135.31	32.79	8.55	3.99
GH-085	485	0.49645	317.7	0.56447	2980	1.00455	5304	0.0136	21	0.40	0.05	3.47	0.0016	0.61	405.76	1.28	292.65	78.05	43.14	25.83
GH-086	486	0.04885	31.3	0.18602	982	0.31416	1659	0.0148	80	0.40	0.05	3.43	0.0018	0.53	112.25	3.59	89.97	49.21	38.30	27.72
GH-087	487	0.03095	19.8	0.15304	808	0.25410	1342	0.0128	3	0.40	0.05	3.00	0.0018	0.50	25.78	1.30	18.43	4.26	0.90	0.24
GH-088	488	0.08851	56.6	0.22566	1191	0.38114	2012	0.0243	3	0.40	0.05	3.00	0.0018	0.50	89.53	1.58	64.36	15.18	3.18	0.85
GH-089	489	0.20838	133.4	0.36710	1938	0.65032	3434	0.0110	4	0.40	0.05	3.13	0.0018	0.51	168.33	1.26	119.86	27.22	5.76	2.02
GH-090	690	0.17156	109.8	0.40687	2148	0.63849	3371	0.0122	20	0.40	0.05	3.00	0.0018	0.50	149.80	1.36	110.59	34.80	17.15	9.67
GH-091	491	0.03864	24.7	0.15263	806	0.37474	1979	0.0102	2	0.40	0.05	3.15	0.0018	0.51	28.76	1.16	20.41	4.33	0.65	0.17
GH-092	492	0.05456	34.9	0.22714	1199	0.47316	2498	0.0110	3	0.40	0.05	3.29	0.0018	0.52	36.89	1.06	25.91	5.39	0.82	0.32
GH-093	493	0.04062	26.0	0.17182	907	0.25774	1361	0.0209	36	0.40	0.05	4.14	0.0012	0.78	51.33	1.97	37.47	12.01	8.77	5.49
GH-094	494	0.04117	26.3	0.16031	846	0.24218	1279	0.0186	6	0.40	0.05	3.07	0.0018	0.52	40.53	1.54	28.97	6.97	1.69	0.74
GH-095	495	0.06053	38.7	0.22534	1190	0.48235	2547	0.0192	3	0.40	0.05	3.16	0.0017	0.54	46.21	1.19	32.55	6.42	0.78	0.40
GH-096	696	0.19138	122.5	0.35590	1879	0.44035	2325	0.0171	80	0.40	0.10	3.14	0.0017	0.54	486.79	3.97	390.73	210.28	161.44	114.67
GH-097	497	0.08441	54.0	0.22095	1167	0.34004	1795	0.0257	11	0.40	0.05	3.70	0.0014	0.68	81.69	1.51	56.96	9.21	4.64	2.15
GH-098	498	0.18818	120.4	0.37286	1969	0.58656	3097	0.0217	4	0.40	0.05	3.34	0.0016	0.58	163.42	1.36	114.14	19.39	3.63	1.73
GH-099	499	0.07760	49.7	0.24779	1308	0.54786	2893	0.0191	3	0.40	0.05	3.02	0.0018	0.51	61.12	1.23	43.61	9.81	1.92	0.55
GH-100	500	0.02873	18.4	0.10767	568	0.20721	1094	0.0091	23	0.40	0.10	3.37	0.0016	0.59	29.65	1.61	21.90	6.30	3.37	2.03
GH-101	501	0.01868	12.0	0.12278	648	0.23959	1265	0.0216	2	0.40	0.05	3.00	0.0018	0.50	15.76	1.32	11.23	2.55	0.47	0.10
GH-102	502	0.01730	11.1	0.15009	792	0.29328	1549	0.0144	50	0.40	0.05	3.00	0.0018	0.50	23.46	2.12	18.40	8.02	5.49	3.69
GH-103	503	0.08667	55.5	0.22082	1166	0.34759	1835	0.0194	8	0.40	0.05	3.00	0.0018	0.50	89.43	1.61	64.80	17.11	5.50	2.24
GH-104	504	0.17784	113.8	0.36992	1953	0.64333	3397	0.0203	2	0.40	0.05	3.07	0.0018	0.50	154.41	1.36	110.26	24.30	4.07	0.94
GH-105	6105	0.22233	142.3	0.45500	2402	0.58955	3113	0.0278	9	0.40	0.05	3.17	0.0018	0.51	211.48	1.49	152.48	39.12	12.49	5.72
GH-106	506	0.01327	8.5	0.08718	460	0.14767	780	0.0294	85	0.40	0.10	3.00	0.0018	0.50	34.36	4.05	28.21	15.35	11.98	8.70
GH-107	507	0.01311	8.4	0.11305	597	0.13626	719	0.0315	28	0.40	0.05	3.00	0.0018	0.50	16.87	2.01	12.80	4.52	2.52	1.51
GH-108	508	0.14785	94.6	0.28388	1499	0.42732	2256	0.0293	21	0.40	0.10	3.82	0.0018	0.55	178.37	1.88	132.44	38.75	18.99	11.37
GH-109	509	0.04724	30.2	0.41357	2184	0.78090	4123	0.0235	50	0.40	0.10	3.36	0.0018	0.52	48.68	1.61	37.40	15.61	10.50	7.09
GH-110	510	0.00734	4.7	0.08836	467	0.20125	1063	0.0091	2	0.40	0.05	3.07	0.0018	0.52	4.55	0.97	3.21	0.66	0.08	0.03
GH-111	511	0.01710	10.9	0.07871	416	0.16611	877	0.0141	75	0.35	0.10	3.72	0.0015	0.66	40.17	3.67	31.62	16.62	12.66	9.02
GH-112	512	0.01918	12.3	0.14630	772	0.27692	1462	0.0239	50	0.40	0.10	3.00	0.0018	0.50	29.41	2.40	22.98	9.99	6.63	4.39
GH-113	513	0.00524	3.4	0.05468	289	0.14352	758	0.0112	50	0.40	0.10	3.00	0.0018	0.50	7.95	2.37	6.21	2.73	1.81	1.19
GH-114	514	0.16069	102.8	0.33470	1767	0.53461	2823	0.0083	2	0.40	0.05	3.06	0.0018	0.51	125.99	1.23	89.04	18.93	2.70	0.75
GH-115	515	0.01431	9.2	0.15502	819	0.21665	1144	0.0142	75	0.35	0.10	3.00	0.0018	0.50	25.80	2.82	20.71	10.89	8.25	5.67
Totals/Averages			**8218.7**						**27**						**122.16**	**1.71**	**90.13**	**29.27**	**17.99**	**11.79**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3



Godding Hollow Basin Crossings

Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
GH-C1	County Road 20/Bella Rosa Parkway	6' H x 8' W Arch CMP	< 2-Year	4890.4	404
GH-C2	County Road 18/Godding Hollow Parkway	(7) 6' H x 10' W RCBC	< 50-Year	4916.4	410
GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC	< 50-Year	4939.9	414
GH-C4	Highway 52	8' H x 8' W RCBC	< 50-Year	4964.0	418
GH-C5	Lower Boulder Ditch	7' H x 7' W RCBC	< 50-Year	4966.2	419
GH-C6	County Road 12/Grandview Blvd	36" CMP (24" ADS Inside)	< 2-Year	5000.4	423
GH-C7	County Road 10/Speedway Blvd	60" CMP	< 10-Year	5047.7	503
GH-C8	Interstate 25, North of County Road 8	(2) 6' H x 10' W RCBC	> 100-Year	5089.9	P-970
GH-C9	Eastern I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 50-Year	4972.9	467
GH-C10	Interstate 25, North of Highway 52	(3) 6' H x 8' W RCBC	> 100-Year	4975.5	462
GH-C11	Western I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 100-Year	4982.00	463
GH-C12	Highway 52	(2) 36" CMP	< 10-Year	5009.5	P-675
GH-C13	I-25, South of HWY 119	4' H x 12' W RCBC	< 50-Year	4855.1	431
GH-C14	I-25, North of Rowe Street (Indians Peaks Crossing #1)	42" RCP	> 100-Year	4953.1	443
GH-C15	I-25, South of Rowe Street (Indians Peaks Crossing #2)	24" RCP	< 50-Year	4949.1	444
GH-C16	I-25, North of Gage Street (Indian Peaks Crossing #3)	(2) 42" RCP	> 100-Year	4947.0	446
GH-C17	I-25, North of County Road 18/ Godding Hollow Parkway (Indian Peaks Crossing #4)	34" H x 52" W HERCP	> 100-Year	4944.8	N/A
GH-C18	I-25, South of County Road 18/ Godding Hollow Parkway	48" RCP	> 100-Year	4946.4	449
GH-C19	I-25, South of Access Road Between County Road 18 and 16 #1	(2) 38" H x 60" W HERCP	< 50-Year	4957.6	451
GH-C20	I-25, South of Access Road Between County Road 18 and 16 #2	(2) 36" RCP	< 50-Year	4962.9	954
GH-C21	I-25, South of Access Road Between County Road 18 and 16 #3	42" RCP	< 10-Year	4968.2	454
GH-C22	I-25 & Western Frontage Road, North of Highway 52	24" RCP	< 50-Year	4978.9	958
GH-C23	I-25, South of Highway 52	4' H x 6' W RCBC	< 100-Year	5002.7	515
GH-C24	I-25, North of County Road 12	4' H x 8' W RCBC	> 100-Year	5043.9	P-1680
GH-C25	I-25, North of County Road 10 (Crossing #1)	(2) 36" RCP	< 100-Year	5049.8	P-679
GH-C26	I-25, North of County Road 10 (Crossing #2)	(2) 6' H x 8' W RCBC	> 100-Year	5050.9	P-1679
GH-C27	Highway 52, East of I-25 Frontage Road	6' H x 8' W RCBC	> 100-Year	4988.0	468
GH-C28	Highway 52, West of I-25 Frontage Road	(2) 48" RCP	< 50-Year	4992.6	470
GH-C29	Highway 52, West of County Road 7	24" RCP	< 10-Year	5017.1	P-669
GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	Road Overtopping Location	< 2-Year	5013.6	493
GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	Road Overtopping Location	< 2-Year	5014.2	485
GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	Road Overtopping Location	< 2-Year	5048.4	487
CH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(2) 18" RCP	< 2-Year	5006	484

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

N

Anderson Consulting Engineers, Inc.
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FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
EXISTING CONDITION
CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/27/21	
SHEET: GH	INDEX: EC-CROSS

Table D.1.2: Godding Hollow Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
GH-C1	County Road 20/Bella Rosa Parkway	404	6' H x 8' W Arch CMP	4890.4	270	< 2-Year	< 2-Year	295	496	1014	4343	6529	643	955	1420	5274	7574	Good Condition - some sediment blockage Appears to have been replaced after 2013 flood.
GH-C2	County Road 18/Godding Hollow Parkway	410	(7) 6' H x 10' W RCBC	4916.4	4050	< 50-Year	< 50-Year	289	484	963	4232	6400	641	924	1360	5168	7439	Good Condition - replaced in 2015 Heavy vegetation on upstream side.
GH-C3	County Road 16/Tipple Parkway	414	(3) 7' H x 14' W RCBC	4939.9	3400	< 50-Year	< 50-Year	265	432	881	3900	5885	561	798	1220	4718	6771	Good Condition - replaced in 2018 Heavy vegetation on upstream side.
GH-C4	Highway 52	418	8' H x 8' W RCBC	4964.0	990	< 50-Year	< 50-Year	194	316	662	2960	4450	430	612	915	3489	4960	Good Condition - Overtopping of roadway will occur west of culvert near Urgent Care.
GH-C5	Lower Boulder Ditch	419	7' H x 7' W RCBC	4966.2	720	< 50-Year	< 10-Year	151	249	564	2624	3904	372	528	785	3140	4444	Fair Condition - Overtopping of ditch bank will occur to west of culvert crossing location.
GH-C6	County Road 12/Grandview Blvd	423	36" CMP (24" ADS pipe inside)	5000.4	15	< 2-Year	< 2-Year	110	153	395	1581	2293	205	312	508	1898	2667	Poor Condition - 24" HDPE pipe has been inserted inside existing 36" CMP. Sediment build up at downstream end.
GH-C7	County Road 10/Speedway Blvd	503	60" CMP	5047.7	90	< 10-Year	< 2-Year	36	75	181	696	988	106	157	247	927	1272	Poor Condition - approximately 2' of sediment build up in bottom of culvert.
GH-C8	Interstate 25, North of County Road 8	P-970	(2) 6' H x 10' W RCBC	5089.9	1030	> 100-Year	> 100-Year	20	45	109	419	585	20	45	109	419	585	Good Condition - replaced in 2002-2003 as part of I-25 widening. Heavy vegetation on downstream side.
Erie Tributary																		
GH-C9	Eastern I-25 Frontage Road, North of Highway 52	467	(3) 4' H x 8' W RCBC	4972.9	840	< 50-Year	< 50-Year	154	224	329	1147	1715	202	279	357	1269	1878	Good Condition - added in 2002-2003 as part of I-25 widening. Heavy vegetation on both sides. Road overtopping occurs at frontage road low point south of crossing.
GH-C10	Interstate 25, North of Highway 52	462	(3) 6' H x 8' W RCBC	4975.5	1540	> 100-Year	< 100-Year	143	206	295	1005	1515	174	242	308	1095	1638	Good Condition - added in 2002-2003 as part of I-25 widening. Heavy vegetation on upstream side. Capacity reflects discharge when water will begin to pond on I-25.
GH-C11	Western I-25 Frontage Road, North of Highway 52	463	(3) 4' H x 8' W RCBC	4982.0	1030	< 100-Year	< 50-Year	20	46	194	967	1451	41	94	249	1041	1562	Good Condition - added in 2002-2003 as part of I-25 widening. Heavy vegetation on downstream side.
GH-C12	Highway 52	P-675	(2) 36" CMP	5009.5	110	< 10-Year	< 10-Year	19	55	167	765	1105	29	69	182	794	1192	Fair Condition - culverts partially crushed on upstream side.
Other I-25 Crossings																		
GH-C13	I-25, South of HWY 119	431	4' H x 12' W RCBC	4855.1	80	< 50-Year	< 50-Year	2	5	14	164	279	11	15	19	201	323	Good Condition - replaced in 2002-2003 as part of I-25 widening. Heavy vegetation on both sides. Due to low northern channel bank on upstream side, full capacity of culvert is not utilized. Excess flow will be conveyed north along roadside swale.
GH-C14	I-25, North of Rowe Street (Indians Peaks Crossing #1)	443	42" RCP	4953.1	80	> 100-Year	> 100-Year	10	16	23	48	62	10	16	23	48	62	Good Condition - replaced in 2002-2003 as part of I-25 widening.
GH-C15	I-25, South of Rowe Street (Indians Peaks Crossing #2)	444	24" RCP	4949.1	25	< 50-Year	< 50-Year	8	13	18	41	53	8	13	18	41	53	Good Condition - replaced in 2002-2003 as part of I-25 widening. Excess flow will be conveyed south in roadside swale to crossing GH-C16.

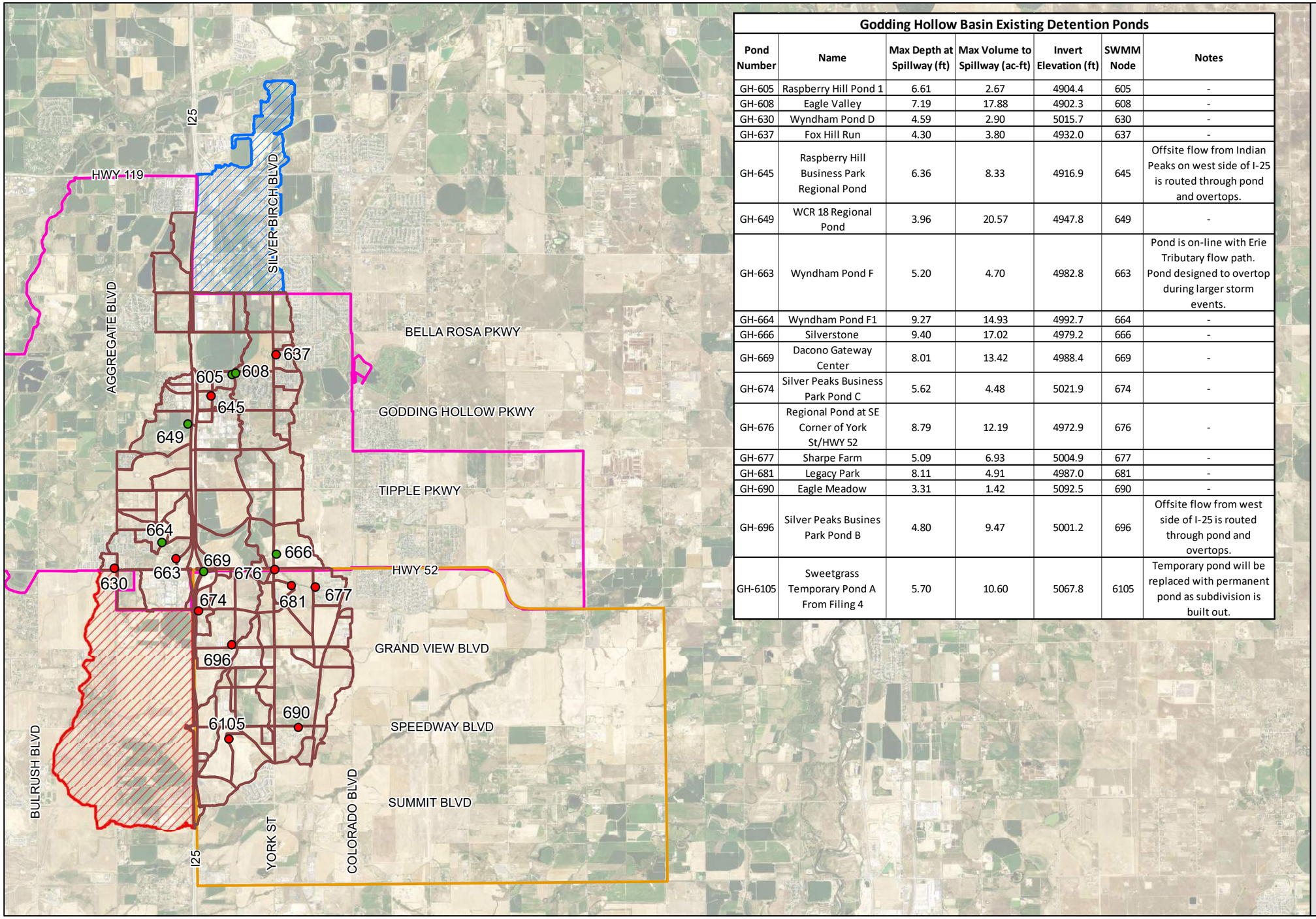
Table D.1.2: Godding Hollow Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other I-25 Crossings (Continued)																		
GH-C16	I-25, North of Gage Street (Indian Peaks Crossing #3)	446	(2) 42" RCP	4947.0	180	> 100-Year	> 100-Year	27	40	55	135	176	27	40	55	135	176	Good Condition - replaced in 2002-2003 as part of I-25 widening. Excess flow will be conveyed south in roadside swale to crossing GH-C17.
GH-C17	I-25, North of County Road 18/ Godding Hollow Parkway (Indian Peaks Crossing #4)	N/A	34" H x 52" W HERCP	4944.8	110	> 100-Year	> 100-Year	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Good Condition - replaced in 2002-2003 as part of I-25 widening. This crossing picks up overflow from GH-C16 and a small tributary area of localized flow that was not subdivided from Basin 46 in the SWMM model. Based on an area-weighted flow calculation, this crossing was determined to have sufficient capacity for the 100-year.
GH-C18	I-25, South of County Road 18/ Godding Hollow Parkway	449	48" RCP	4946.4	110	> 100-Year	> 100-Year	0	1	5	41	57	7	9	12	47	63	Good Condition - replaced in 2002-2003 as part of I-25 widening.
GH-C19	I-25, South of Access Road Between County Road 18 and 16 #1	451	(2) 38" H x 60" W HERCP	4957.6	220	< 50-Year	< 50-Year	8	14	25	268	437	25	37	53	241	353	Good Condition - replaced in 2002-2003 as part of I-25 widening.
GH-C20	I-25, South of Access Road Between County Road 18 and 16 #2	954	(2) 36" RCP	4962.9	70	< 50-Year	< 50-Year	N/A	N/A	8	204	308	N/A	N/A	13	171	250	Good Condition - replaced in 2002-2003 as part of I-25 widening. This crossing picks up small tributary area of localized flow that was not subdivided from Basin 54 in the SWMM model. Excess flow will be conveyed north along roadside swale to GH-C19 crossing.
GH-C21	I-25, South of Access Road Between County Road 18 and 16 #3	454	42" RCP	4968.2	50	< 10-Year	< 10-Year	12	22	59	254	359	27	39	63	221	300	Good Condition - replaced in 2002-2003 as part of I-25 widening. Excess flow will be conveyed north along roadside swale to GH-C20 crossing.
GH-C22	I-25 & Western Frontage Road, North of Highway 52	958	24" RCP	4978.9	20	< 50-Year	< 50-Year	0	1	12	87	127	10	13	16	94	133	Good Condition - replaced in 2002-2003 as part of I-25 widening. Excess flow will overtop frontage road and be conveyed to GH-C10 crossing.
GH-C23	I-25, South of Highway 52	515	4' H x 6' W RCBC	5002.7	120	< 100-Year	< 100-Year	6	11	27	99	139	6	11	27	99	139	Good Condition - replaced in 2002-2003 as part of I-25 widening. Heavy vegetation on both sides with sediment deposition. Due to low northern channel bank on upstream side, full capacity of culvert is not utilized. Excess flow will be conveyed north along roadside swale to GH-C28 crossing.
GH-C24	I-25, North of County Road 12	P-1680	4' H x 8' W RCBC	5043.9	230	> 100-Year	> 100-Year	2	7	33	151	214	2	7	33	151	214	Good Condition - replaced in 2002-2003 as part of I-25 widening. Orifice plate has been installed on upstream side reducing width to 3'. Reduced capacity with orifice plate is approximately 80 cfs. Excess flow will be conveyed north along roadside swale to GH-C20 crossing.
GH-C25	I-25, North of County Road 10 (Crossing #1)	P-679	(2) 36" RCP**	5049.8**	90**	< 100-Year	< 100-Year	1	4	19	82	115	1	4	19	82	115	Good Condition - replaced in 2002-2003 as part of I-25 widening.
GH-C26	I-25, North of County Road 10 (Crossing #2)	P-1679	(2) 6' H x 8' W RCBC	5050.9	790	> 100-Year	> 100-Year	7	23	84	367	517	7	23	84	367	517	Good Condition - replaced in 2002-2003 as part of I-25 widening.

Table D.1.2: Godding Hollow Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other Highway 52 Crossings																		
GH-C27	Highway 52, East of I-25 Frontage Road	468	6' H x 8' W RCBC	4988.0	600	> 100-Year	> 100-Year	23	36	65	209	278	28	42	66	214	283	Good Condition - Heavy vegetation on both sides.
GH-C28	Highway 52, West of I-25 Frontage Road	470	(2) 48" RCP	4992.6	270	< 50-Year	< 50-Year	127	186	254	534	673	147	200	253	545	672	Good Condition - Tree on upstream side blocking western inlet. Excess flow with overtop Highway 52.
GH-C29	Highway 52, West of County Road 7	P-669	24" RCP**	5017.1**	14**	< 10-Year	< 10-Year	2	5	22	100	145	2	5	22	100	145	Good Condition - Tree on upstream side blocking western inlet.
Other Tributary Crossings																		
GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	493	N/A	5013.6	N/A	< 2-Year	< 2-Year	55	84	148	609	892	105	136	173	671	942	Existing crossing culvert could not be located. Low area ponds until overtopping of Grandview Blvd occurs.
GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	485	N/A	5014.2	N/A	< 2-Year	< 2-Year	49	76	130	528	775	89	115	149	589	824	Existing crossing culvert could not be located. Low area at southeast corner of the intersection ponds until overtopping York Street occurs.
GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	487	N/A	5048.4	N/A	< 2-Year	< 2-Year	3	9	43	203	292	34	45	54	211	296	Existing crossing culvert is small and assumed to be ineffective for flood events due to significant amount of vegetation on upstream side. Excess flow will be conveyed west along roadside swale to GH-C32 crossing.
GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	484	(2) 18" RCPS	5004.0	15	< 10-Year	< 2-Year	4	9	33	135	188	22	27	33	141	187	Good Condition - appears to have been recently installed.

*HY-8 program used to evaluate capacitates unless noted otherwise
**Obtained from Erie OSP



Godding Hollow Basin Existing Detention Ponds

Pond Number	Name	Max Depth at Spillway (ft)	Max Volume to Spillway (ac-ft)	Invert Elevation (ft)	SWMM Node	Notes
GH-605	Raspberry Hill Pond 1	6.61	2.67	4904.4	605	-
GH-608	Eagle Valley	7.19	17.88	4902.3	608	-
GH-630	Wyndham Pond D	4.59	2.90	5015.7	630	-
GH-637	Fox Hill Run	4.30	3.80	4932.0	637	-
GH-645	Raspberry Hill Business Park Regional Pond	6.36	8.33	4916.9	645	Offsite flow from Indian Peaks on west side of I-25 is routed through pond and overtops.
GH-649	WCR 18 Regional Pond	3.96	20.57	4947.8	649	-
GH-663	Wyndham Pond F	5.20	4.70	4982.8	663	Pond is on-line with Erie Tributary flow path. Pond designed to overtop during larger storm events.
GH-664	Wyndham Pond F1	9.27	14.93	4992.7	664	-
GH-666	Silverstone	9.40	17.02	4979.2	666	-
GH-669	Dacono Gateway Center	8.01	13.42	4988.4	669	-
GH-674	Silver Peaks Business Park Pond C	5.62	4.48	5021.9	674	-
GH-676	Regional Pond at SE Corner of York St/HWY 52	8.79	12.19	4972.9	676	-
GH-677	Sharpe Farm	5.09	6.93	5004.9	677	-
GH-681	Legacy Park	8.11	4.91	4987.0	681	-
GH-690	Eagle Meadow	3.31	1.42	5092.5	690	-
GH-696	Silver Peaks Busines Park Pond B	4.80	9.47	5001.2	696	Offsite flow from west side of I-25 is routed through pond and overtops.
GH-6105	Sweetgrass Temporary Pond A From Filing 4	5.70	10.60	5067.8	6105	Temporary pond will be replaced with permanent pond as subdivision is built out.

Legend

- Detention Pond with Sufficient Volume for 100-Year Flow Event
- Detention Pond Anticipated to Overtop in 100-Year Flow Event
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

N

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FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

GODDING HOLLOW DETENTION POND MAP

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 4/20/2021	
SHEET: GH	INDEX: POND

GODDING HOLLOW EXISTING POND 605 - RASPBERRY HILL POND 1

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4904.39	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4905.00	790	0.02	0.61	161	0.00	0.00	0.00	0.00	
4906.00	6325	0.15	1.61	3278	0.08	0.00	0.00	0.00	
4907.00	11851	0.27	2.61	12222	0.28	0.00	0.00	0.00	
4907.20	13010	0.30	2.81	14708	0.34	0.00	0.00	0.00	Invert of 10-Year Opening
4908.00	15823	0.36	3.61	26222	0.60	3.17	0.00	3.17	Weir Flow Through 10-Year Opening
4909.00	20385	0.47	4.61	44278	1.02	7.87	0.00	7.87	Orifice Flow Through 10-Year Opening
4909.30	22387	0.51	4.91	50692	1.16	9.01	0.00	9.01	Top of Inlet Box for 100-Year Opening
4910.00	31119	0.71	5.61	69335	1.59	39.67	0.00	39.67	Orifice Flow Through 100-Year Opening
4911.00	64628	1.48	6.61	116199	2.67	43.63	0.00	43.63	Emergency Spillway Elevation
4912.00	96653	2.22	7.61	196304	4.51	47.25	715.00	762.25	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.92' wide x 1.67' high rectangular weir/orifice

[3]100-Year discharge based 30" outlet pipe with orifice plate located 20" above pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 608 - EAGLE VALLEY

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4902.31	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4903.00	1534	0.04	0.69	353	0.01	5.20	0.00	5.20	Normal Depth Flow Through Pipe
4904.00	16280	0.37	1.69	7957	0.18	20.77	0.00	20.77	Normal Depth Flow Through Pipe
4905.00	69849	1.60	2.69	47907	1.10	21.30	0.00	21.30	Orifice Flow Through 100-Year Opening
4906.00	107223	2.46	3.69	135778	3.12	26.88	0.00	26.88	
4907.00	149923	3.44	4.69	263755	6.05	31.48	0.00	31.48	
4908.00	192789	4.43	5.69	434663	9.98	35.49	0.00	35.49	
4909.00	240520	5.52	6.69	650878	14.94	39.09	0.00	39.09	
4909.50	271936	6.24	7.19	778911	17.88	40.77	0.00	40.77	Emergency Spillway Elevation
4910.00	318968	7.32	7.69	926481	21.27	42.39	367.70	410.09	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Rectangular orifice on front of box is 1.35' wide x 4.47' high (this area is bigger than 24" outlet pipe - no 10-year release computed)

[3]100-Year discharge based 24" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 630 - WYNDAM HILL POND D

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5015.71	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5016.00	1635	0.04	0.29	158	0.00	0.00	0.00	0.00	
5017.00	13050	0.30	1.29	6593	0.15	0.00	0.00	0.00	
5017.38	20988	0.48	1.67	13001	0.30	0.00	0.00	0.00	Invert of 10-Year Opening
5018.00	37248	0.86	2.29	30814	0.71	2.07	0.00	2.07	Weir Flow Through 10-Year Opening
5018.50	39388	0.90	2.79	49971	1.15	5.03	0.00	5.03	Top of Inlet Box for 100-Year Opening
5019.00	40736	0.94	3.29	70001	1.61	5.14	0.00	5.14	Orifice Flow Through 100-Year Opening
5020.00	44180	1.01	4.29	112447	2.58	5.92	0.00	5.92	
5020.30	47131	1.08	4.59	126142	2.90	6.14	0.00	6.14	Emergency Spillway Elevation
5021.00	49007	1.13	5.29	159788	3.67	6.61	79.06	85.67	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 1.6' wide x 1.6' high rectangular weir

[3]100-Year discharge based 24" outlet pipe with orifice plate located 5.5" above pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 637 - FOX HILL RUN

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4932.00	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4933.00	7069	0.16	1.00	2356	0.05	3.30	0.00	3.30	
4934.00	48344	1.11	2.00	26990	0.62	8.89	0.00	8.89	
4935.00	61452	1.41	3.00	81756	1.88	12.14	0.00	12.14	
4936.00	65920	1.51	4.00	145429	3.34	14.26	0.00	14.26	
4936.30	68516	1.57	4.30	165593	3.80	14.85	0.00	14.85	Emergency Spillway Elevation
4937.00	70640	1.62	5.00	214295	4.92	16.15	12.85	29.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 18" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 645 - RASPBERRY HILL BUSINESS PARK

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4916.89	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4917.00	1080	0.02	0.11	40	0.00	0.60	0.00	0.60	Normal Depth Through Low Flow Opening
4918.00	9569	0.22	1.11	4661	0.11	9.67	0.00	9.67	Orifice Flow Through Low Flow Opening
4919.00	17611	0.40	2.11	18048	0.41	15.41	0.00	15.41	
4919.33	36215	0.83	2.43	26615	0.61	16.86	0.00	16.86	
4920.00	40182	0.92	3.11	52387	1.20	21.00	0.00	21.00	Add Weir Flow Through 10-Year Opening
4921.00	60562	1.39	4.11	102412	2.35	28.67	0.00	28.67	Top of Inlet Box for 100-Year Opening
4922.00	103226	2.37	5.11	183364	4.21	50.37	0.00	50.37	Orifice Flow Through 100-Year Opening
4923.00	166883	3.83	6.11	317150	7.28	56.52	0.00	56.52	
4923.25	199443	4.58	6.36	362880	8.33	57.96	0.00	57.96	Emergency Spillway Elevation
4924.00	217561	4.99	7.11	519207	11.92	62.07	67.55	129.62	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Low flow discharge based on 2.5' wide x 0.92' high rectangular orifice at bottom of box

[3]10-Year discharge based on 1.0' wide x 1.63' high rectangular weir/orifice near top of box

[3]100-Year discharge based 30" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 649 - WCR 18 REGIONAL POND

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4947.84	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4948.00	40529	0.93	0.16	2162	0.05	0.18	0.00	0.18	
4949.00	82886	1.90	1.16	62620	1.44	8.75	0.00	8.75	
4950.00	238706	5.48	2.16	216704	4.97	27.65	0.00	27.65	
4951.00	424808	9.75	3.16	544022	12.49	50.75	0.00	50.75	
4951.80	455394	10.45	3.96	896032	20.57	71.74	0.00	71.74	Emergency Spillway Elevation
4952.00	488595	11.22	4.16	990412	22.74	76.93	34.32	111.25	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 48" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 663 - WYNDAM HILL POND F

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4982.80	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4983.00	716	0.02	0.20	48	0.00	0.30	0.00	0.30	Normal Depth Through Low Flow Opening
4984.00	3654	0.08	1.20	2043	0.05	2.01	0.00	2.01	Orifice Flow Through Low Flow Opening
4984.80	7356	0.17	2.00	6362	0.15	2.95	0.00	2.95	Top of Inlet Box for 100-Year Opening
4985.00	24234	0.56	2.20	9358	0.21	27.73	0.00	27.73	Orifice Flow Through 100-Year Opening
4986.00	36982	0.85	3.20	39742	0.91	38.18	0.00	38.18	
4987.00	67882	1.56	4.20	91398	2.10	46.33	0.00	46.33	
4988.00	165924	3.81	5.20	204710	4.70	53.24	0.00	53.24	Emergency Spillway Elevation
4989.00	218512	5.02	6.20	396326	9.10	59.36	551.55	610.91	
4990.00	293934	6.75	7.20	651619	14.96	64.90	1241.53	1306.43	
4991.00	357851	8.22	8.20	976988	22.43	70.00	3191.00	3261.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Low flow discharge based on 0.5' wide x 1.0' high rectangular orifice at bottom of box

[3]100-Year discharge based 36" outlet pipe with orifice plate located 26" above pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 664 - WYNDAM HILL POND F1

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4992.73	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4993.00	477	0.01	0.27	43	0.00	0.00	0.00	0.00	
4994.00	4873	0.11	1.27	2335	0.05	0.00	0.00	0.00	
4995.00	16385	0.38	2.27	12399	0.28	0.00	0.00	0.00	
4996.00	28099	0.65	3.27	34379	0.79	0.00	0.00	0.00	
4996.60	29405	0.68	3.87	51629	1.19	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
4997.00	52468	1.20	4.27	67783	1.56	53.89	0.00	53.89	Orifice Flow Through 100-Year Opening
4998.00	86534	1.99	5.27	136577	3.14	61.77	0.00	61.77	
4999.00	113174	2.60	6.27	236134	5.42	68.76	0.00	68.76	
5000.00	135890	3.12	7.27	360493	8.28	75.09	0.00	75.09	
5001.00	145026	3.33	8.27	500926	11.50	80.93	0.00	80.93	
5002.00	154128	3.54	9.27	650480	14.93	86.38	0.00	86.38	Emergency Spillway Elevation
5003.00	164952	3.79	10.27	809989	18.59	91.50	797.50	889.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]No 10-Year discharge opening

[3]100-Year discharge based 42" outlet pipe with orifice plate located 26" above pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 666 - SILVERSTONE									
Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4979.20	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4980.00	5633	0.13	0.80	1502	0.03	0.00	0.00	0.00	
4981.00	27496	0.63	1.80	16694	0.38	0.00	0.00	0.00	
4981.89	52113	1.20	2.69	51541	1.18	0.00	0.00	0.00	Invert of 10-Year Opening
4982.00	52361	1.20	2.80	57287	1.32	0.07	0.00	0.07	Weir Flow Through 10-Year Opening
4983.00	71443	1.64	3.80	118942	2.73	2.90	0.00	2.90	Orifice Flow Through 10-Year Opening
4983.75	90526	2.08	4.55	179540	4.12	4.13	0.00	4.13	Top of Inlet Box for 100-Year Opening
4984.00	91975	2.11	4.80	202352	4.65	12.87	0.00	12.87	Add Weir Flow Around Top of Box
4985.00	110050	2.53	5.80	303229	6.96	99.67	0.00	99.67	
4986.00	116486	2.67	6.80	416482	9.56	158.36	0.00	158.36	Orifice Flow Through 100-Year Opening
4987.00	123038	2.82	7.80	536229	12.31	173.21	0.00	173.21	
4988.00	129874	2.98	8.80	662670	15.21	186.89	0.00	186.89	
4988.60	133247	3.06	9.40	741604	17.02	194.63	0.00	194.63	Emergency Spillway Elevation
4989.00	136645	3.14	9.80	795581	18.26	199.63	28.08	227.71	
4990.00	143520	3.29	10.80	935650	21.48	211.60	206.18	417.78	
4991.00	150499	3.45	11.80	1082645	24.85	222.94	471.32	694.26	
4991.50	154028	3.54	12.30	1158776	26.60	228.39	628.77	857.16	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 0.75' wide x 0.75' high rectangular weir/orifice

[3]Discharge controlled by weir around 5.5' wide x 7.2' long top of box

[3]100-Year discharge based 48" outlet pipe with orifice plate located 41" above pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 669 - DACONO GATEWAY CENTER POND (310)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4988.39	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4989.00	732	0.02	0.61	149	0.00	1.73	0.00	1.73	Orifice Flow Through 100-Year Opening
4990.00	14606	0.34	1.61	6352	0.15	5.50	0.00	5.50	
4991.00	37780	0.87	2.61	31644	0.73	7.58	0.00	7.58	
4992.00	77703	1.78	3.61	88199	2.02	9.20	0.00	9.20	
4993.00	104030	2.39	4.61	178746	4.10	10.57	0.00	10.57	
4994.00	114015	2.62	5.61	287731	6.61	11.79	0.00	11.79	
4995.00	121472	2.79	6.61	405455	9.31	12.89	0.00	12.89	
4996.00	130623	3.00	7.61	531475	12.20	13.91	0.00	13.91	
4996.40	135453	3.11	8.01	584687	13.42	14.29	0.00	14.29	Emergency Spillway Elevation
4997.00	140918	3.24	8.61	667593	15.33	14.85	151.05	165.90	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]No 10-Year discharge opening

[3]100-Year discharge based 1.0' wide x 1.0' high rectangular orifice at bottom of box

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 674 - SILVER PEAKS BUSINESS PARK POND C

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5021.88	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5022.00	2781	0.06	0.12	111	0.00	0.00	0.00	0.00	
5023.00	9632	0.22	1.12	5974	0.14	0.00	0.00	0.00	
5024.00	37967	0.87	2.12	28215	0.65	0.00	0.00	0.00	
5024.10	38718	0.89	2.22	32049	0.74	0.00	0.00	0.00	Top of Inlet Box for 10-Year Opening
5025.00	45473	1.04	3.12	69894	1.60	6.54	0.00	6.54	Orifice Flow Through 10-Year Opening
5025.40	46858	1.08	3.52	88359	2.03	7.04	0.00	7.04	Top of Inlet Box for 100-Year Opening
5026.00	49083	1.13	4.12	117139	2.69	28.95	0.00	28.95	Orifice Flow Through 100-Year Opening
5027.00	52873	1.21	5.12	168105	3.86	33.26	0.00	33.26	
5027.50	55341	1.27	5.62	195157	4.48	35.22	0.00	35.22	Emergency Spillway Elevation
5028.00	58137	1.33	6.12	223524	5.13	37.08	27.33	64.41	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 1' diameter circular orifice in first box

[3]100-Year discharge based 30" outlet pipe with 24" circular orifice in front

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 676 - POND AT SE CORNER OF YORK ST/HWY 52

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4972.91	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4973.00	231	0.01	0.09	7	0.00	1.08	0.00	1.08	Normal Depth Through Opening
4974.00	1374	0.03	1.09	730	0.02	30.13	0.00	30.13	Orifice Flow Through Opening
4975.00	6734	0.15	2.09	4447	0.10	55.17	0.00	55.17	
4976.00	26001	0.60	3.09	19769	0.45	71.97	0.00	71.97	
4977.00	41376	0.95	4.09	53162	1.22	85.53	0.00	85.53	
4978.00	55436	1.27	5.09	101397	2.33	97.22	0.00	97.22	
4979.00	77635	1.78	6.09	167622	3.85	107.64	0.00	107.64	
4980.00	111840	2.57	7.09	261841	6.01	117.15	0.00	117.15	
4981.00	164032	3.77	8.09	398946	9.16	125.93	0.00	125.93	
4981.70	214938	4.93	8.79	531185	12.19	131.74	0.00	131.74	Emergency Spillway Elevation
4982.00	219843	5.05	9.09	596401	13.69	134.15	79.23	213.38	
4982.50	240362	5.52	9.59	711414	16.33	138.07	242.80	380.87	
4983.00	260881	5.99	10.09	836689	19.21	141.88	634.49	776.37	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 1.33' high x 6.67' wide orifice in front of dual 4' high x 8' wide RCBC

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 677 - SHARPE FARM

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5004.91	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5005.00	234	0.01	0.09	7	0.00	0.00	0.00	0.00	
5006.00	6536	0.15	1.09	2676	0.06	0.00	0.00	0.00	
5007.00	46402	1.07	2.09	26127	0.60	0.00	0.00	0.00	
5008.00	86449	1.98	3.09	91523	2.10	0.00	0.00	0.00	
5009.00	109058	2.50	4.09	189057	4.34	0.00	0.00	0.00	
5009.10	110630	2.54	4.19	200041	4.59	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
5010.00	115938	2.66	5.09	301988	6.93	65.16	0.00	65.16	Weir Flow Around Top of Box/ Emergency Spillway Elevation
5010.57	125464	2.88	5.66	370769	8.51	87.77	390.00	477.77	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Discharge controlled by weir around 7.3' wide x 7.3' long top of box

[3]100-Year discharge based 48" outlet pipe with 41" circular orifice in front

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 681 - LEGACY PARK

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4986.99	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4987.0	134	0.00	0.01	0	0.00	0.00	0.00	0.00	
4987.4	320	0.01	0.41	89	0.00	0.00	0.00	0.00	
4988.0	960	0.02	1.01	455	0.01	0.00	0.00	0.00	
4989.0	1583	0.04	2.01	1713	0.04	0.00	0.00	0.00	
4990.0	16307	0.37	3.01	9370	0.22	0.00	0.00	0.00	
4990.5	17947	0.41	3.51	17930	0.41	0.00	0.00	0.00	Top of Inlet Box for 10-Year Opening
4991.0	28997	0.67	4.01	29556	0.68	8.66	0.00	8.66	Orifice Flow Through 10-Year Opening
4992.0	40017	0.92	5.01	63916	1.47	9.98	0.00	9.98	
4992.7	41592	0.95	5.71	92477	2.12	10.80	0.00	10.80	Top of Inlet Box for 100-Year Opening
4993.0	46870	1.08	6.01	105739	2.43	13.72	0.00	13.72	Orifice Flow Through 100-Year Opening
4994.0	51497	1.18	7.01	154904	3.56	14.94	0.00	14.94	
4995.0	55584	1.28	8.01	208432	4.78	16.06	0.00	16.06	
4995.1	57434	1.32	8.11	214082	4.91	16.17	0.00	16.17	Emergency Spillway Elevation
4996.0	59755	1.37	9.01	266814	6.13	17.11	288.59	305.70	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 1.1' diameter circular orifice in first box

[3]100-Year discharge Year discharge based on 1.2' diameter circular orifice in second box

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 690 - EAGLE MEADOW

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5092.49	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
5093.00	1153	0.03	0.51	196	0.00	0.00	0.00	0.00	
5093.24	2489	0.06	0.75	623	0.01	0.00	0.00	0.00	Top of Orifice Plate
5093.50	3936	0.09	1.01	1451	0.03	0.53	0.00	0.53	Weir Flow Over Orifice Plate
5094.00	6719	0.15	1.51	4084	0.09	2.63	0.00	2.63	Orifice Flow Through 100-Year Opening
5095.00	30383	0.70	2.51	21214	0.49	4.99	0.00	4.99	
5095.80	73915	1.70	3.31	61663	1.42	6.26	0.00	6.26	Emergency Spillway Elevation
5096.00	75651	1.74	3.51	76620	1.76	6.54	17.44	23.98	
5097.00	120041	2.76	4.51	173615	3.99	7.80	273.77	281.57	
5098.00	169311	3.89	5.51	317587	7.29	8.87	917.24	926.11	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Discharge controlled by weir flow over orifice plate

[3]100-Year discharge based 18" outlet pipe with 9" high orifice plate located at pipe invert

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 696 - SILVER PEAKS BUSINESS PARK POND B

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5001.20	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5002.00	588	0.01	0.80	157	0.00	0.00	0.00	0.00	
5003.00	66518	1.53	1.80	24609	0.56	0.00	0.00	0.00	
5003.65	70770	1.62	2.45	69221	1.59	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
5004.00	128975	2.96	2.80	103670	2.38	7.13	0.00	7.13	Weir Flow Around Lower Wall of Box
5005.00	160689	3.69	3.80	248212	5.70	25.31	0.00	25.31	Orifice Flow Through 100-Year Opening
5006.00	168091	3.86	4.80	412589	9.47	29.49	0.00	29.49	Emergency Spillway Elevation
5007.00	175450	4.03	5.80	584346	13.41	33.14	206.00	239.14	
5008.00	184034	4.22	6.80	764071	17.54	36.43	735.40	771.83	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]Discharge controlled by 13' long weir wall along lower portion of box

[3]100-Year discharge based 42" outlet pipe with 24" circular orifice in front

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW EXISTING POND 6105 - SWEEETGRASS TEMPORARY POND A

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5067.80	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5068.00	70	0.00	0.20	5	0.00	0.00	0.00	0.00	
5069.00	17623	0.40	1.20	6272	0.14	0.00	0.00	0.00	
5070.00	58645	1.35	2.20	42411	0.97	0.00	0.00	0.00	
5071.00	112259	2.58	3.20	126425	2.90	0.00	0.00	0.00	
5072.00	135676	3.11	4.20	250208	5.74	0.00	0.00	0.00	
5073.00	142412	3.27	5.20	389238	8.94	0.00	0.00	0.00	
5073.25	145644	3.34	5.45	425244	9.76	0.00	0.00	0.00	Top of Inlet Box for 100-Year Opening
5073.50	147179	3.38	5.70	461847	10.60	7.95	0.00	7.95	Weir Flow Around Top of Box/ Emergency Spillway Elevation
5074.00	150249	3.45	6.20	536203	12.31	19.86	92.94	112.80	
5075.00	158626	3.64	7.20	690621	15.85	21.61	356.17	377.78	

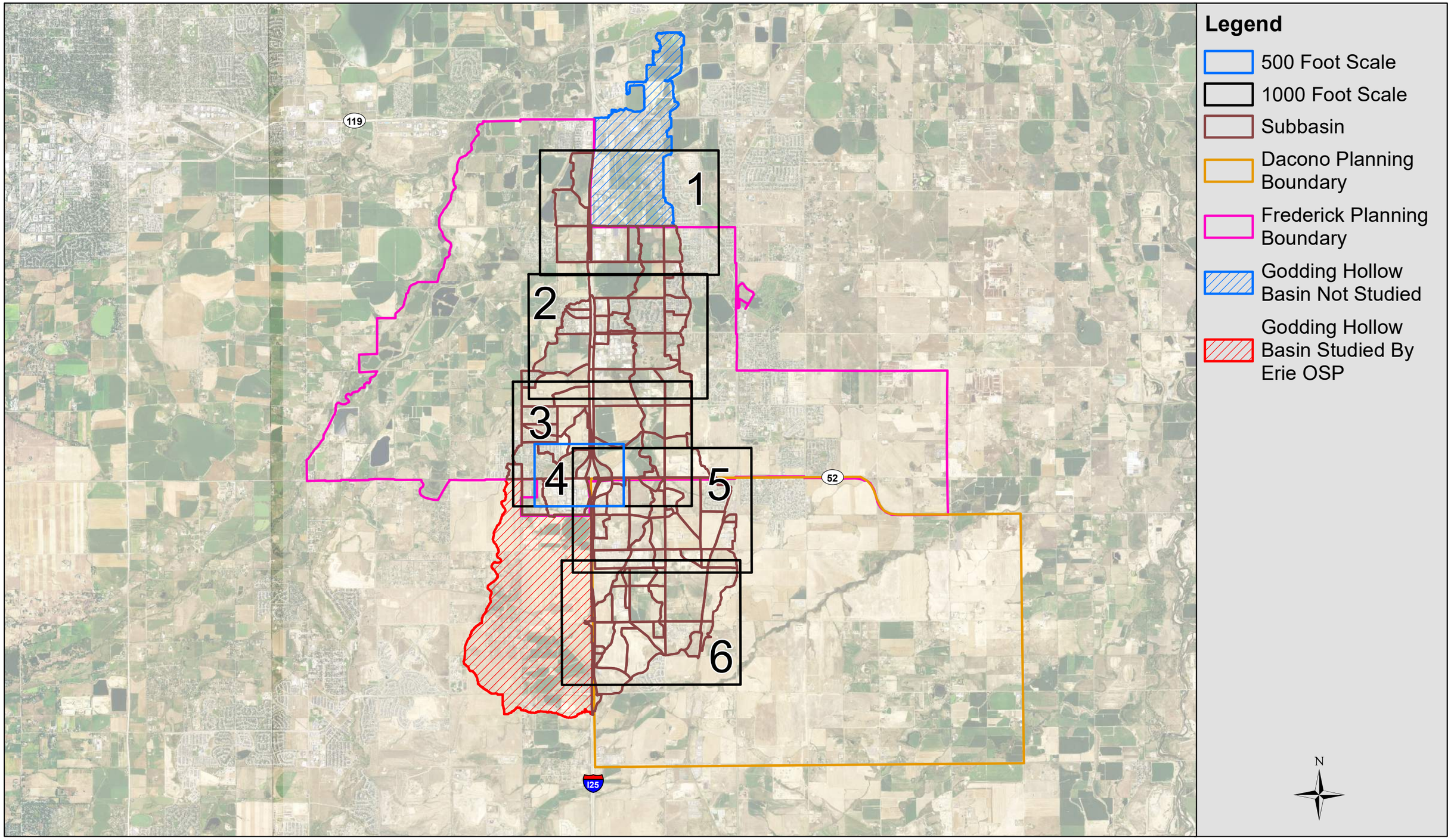
[1]Invert based on survey

[2]Based on temporary grading plan in drainage report

[3]Discharge controlled by weir around 6.0' wide x 6.0' long top of box

[3]100-Year discharge based 18" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir



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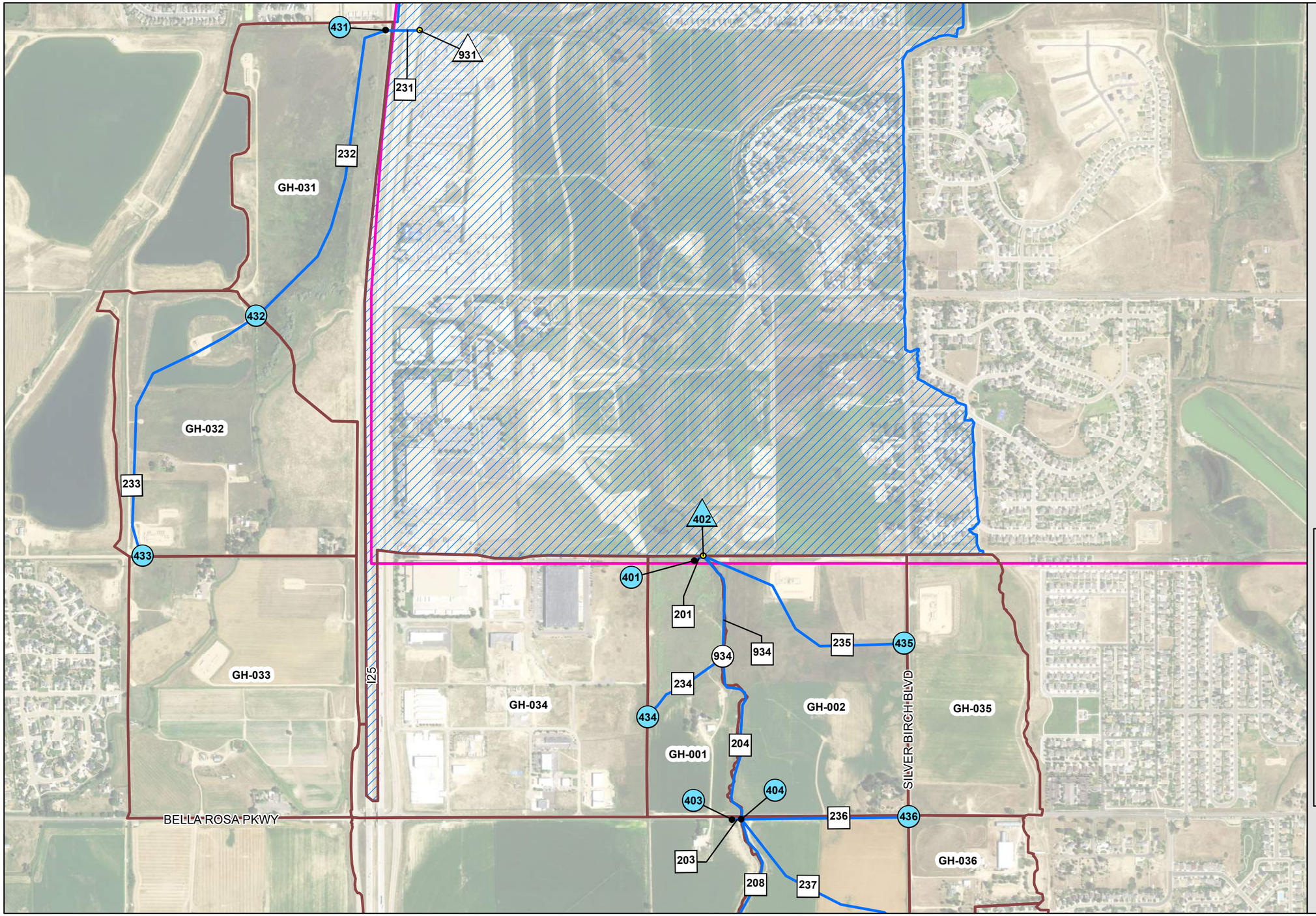
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: C-INDEX



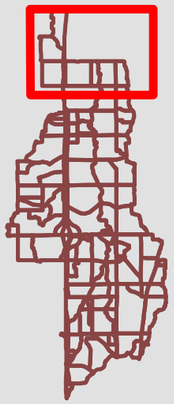
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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0 500 1,000 Feet 2,000

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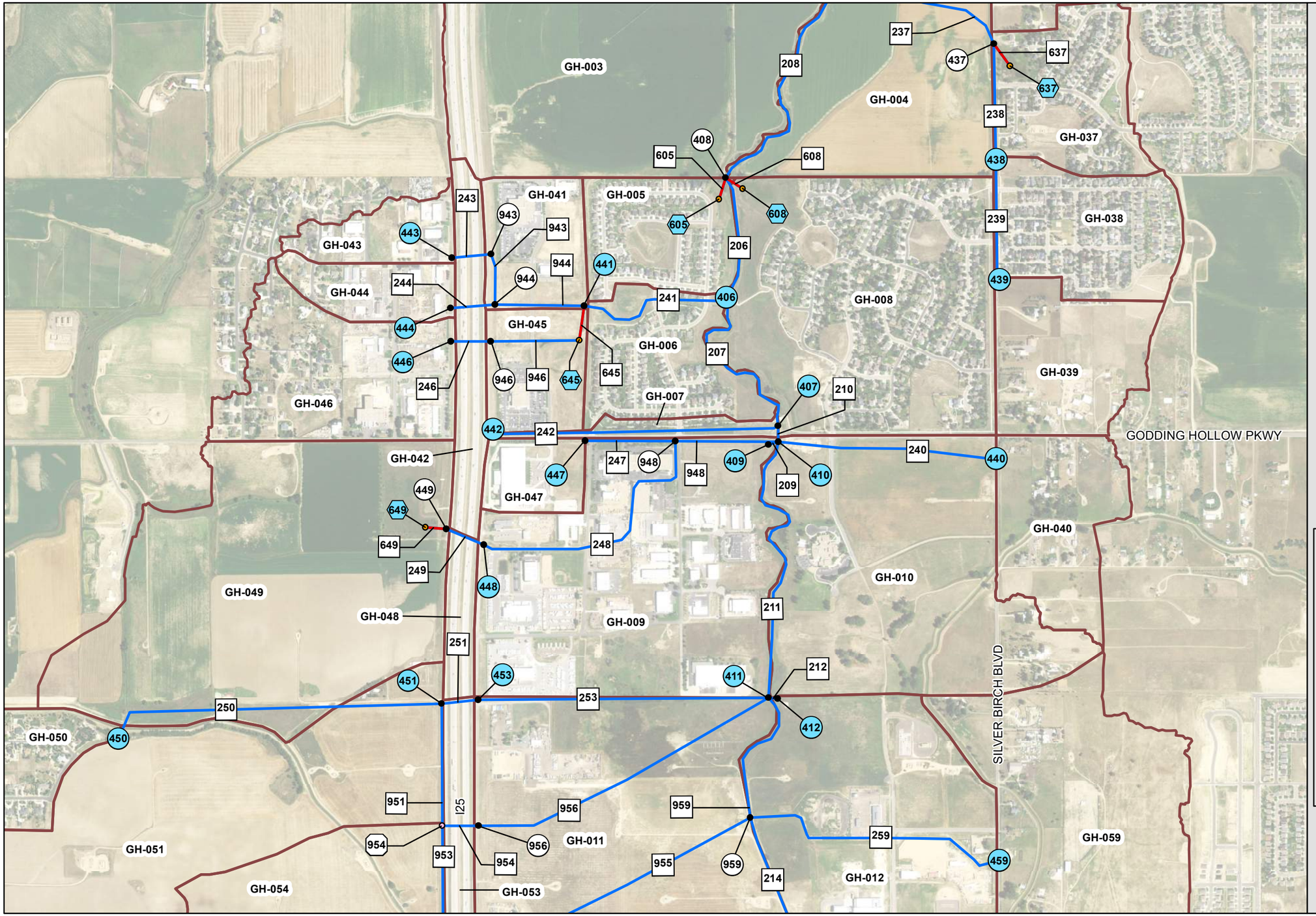
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

GODDING HOLLOW EXISTING CONDITION SWMM CONVEYANCE ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: EC-1



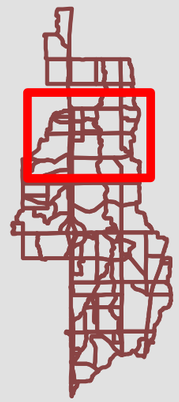
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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0 500 1,000 2,000 Feet

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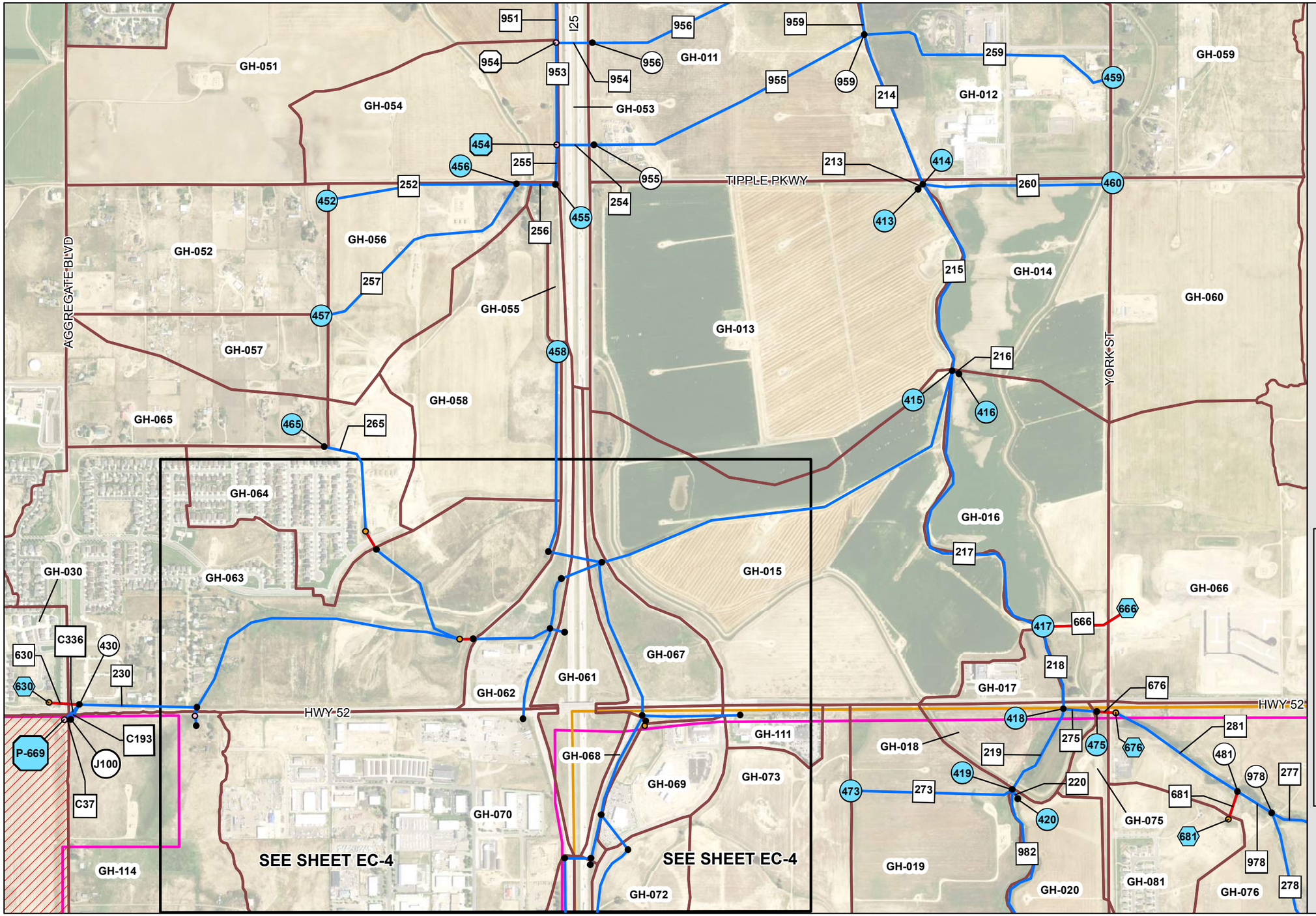
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: EC-2



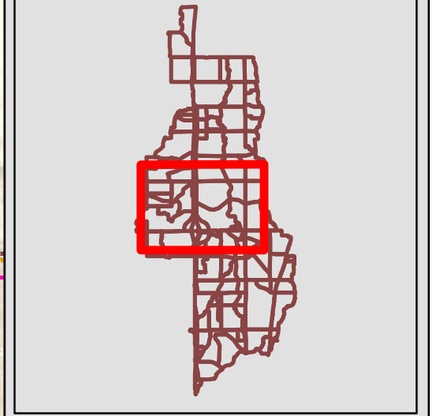
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



N

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Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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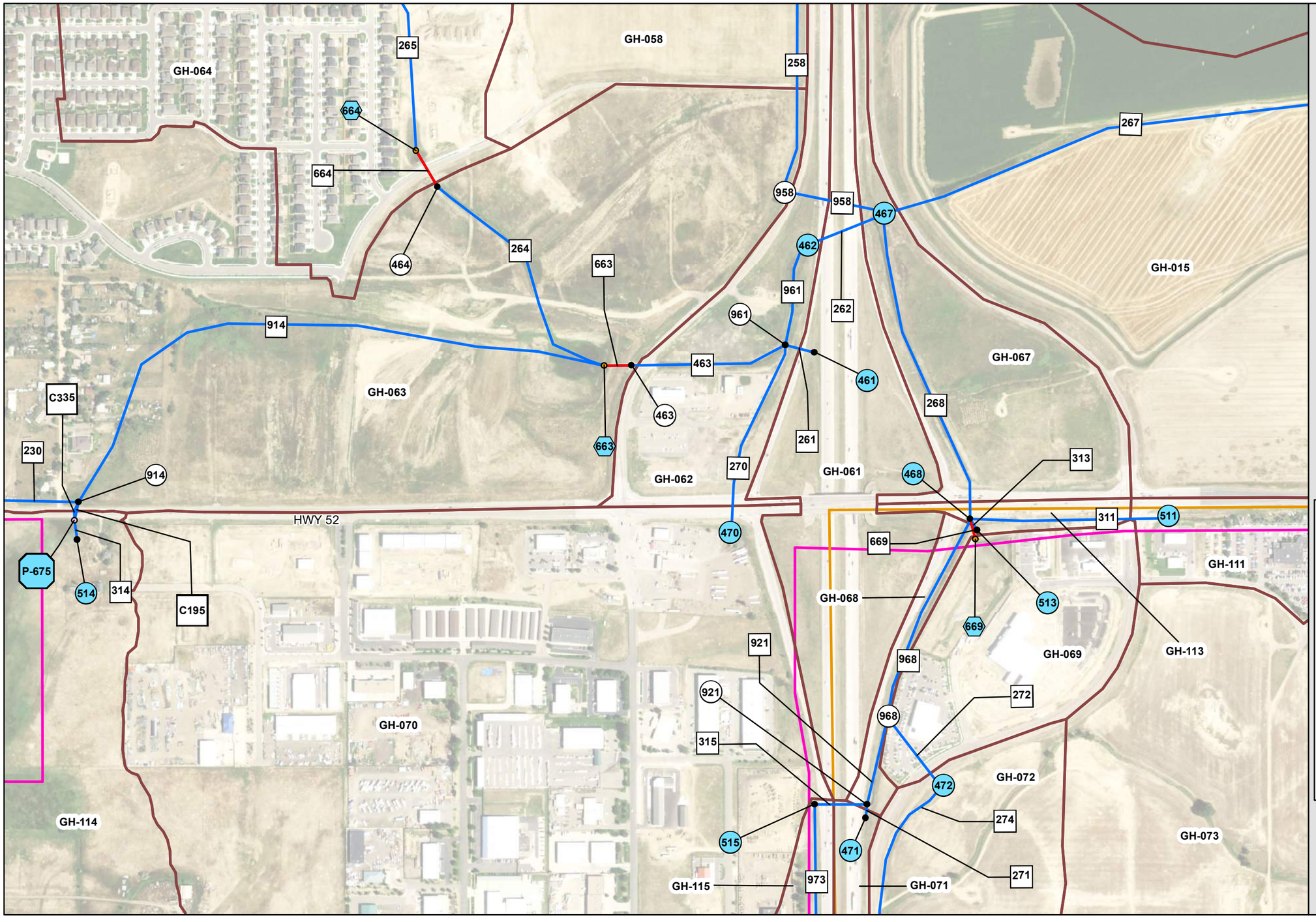
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: EC-3



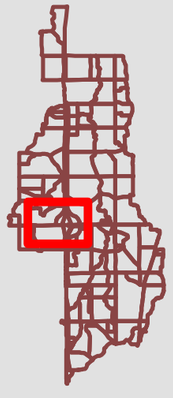
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

Key Map



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ELEMENT MAPS

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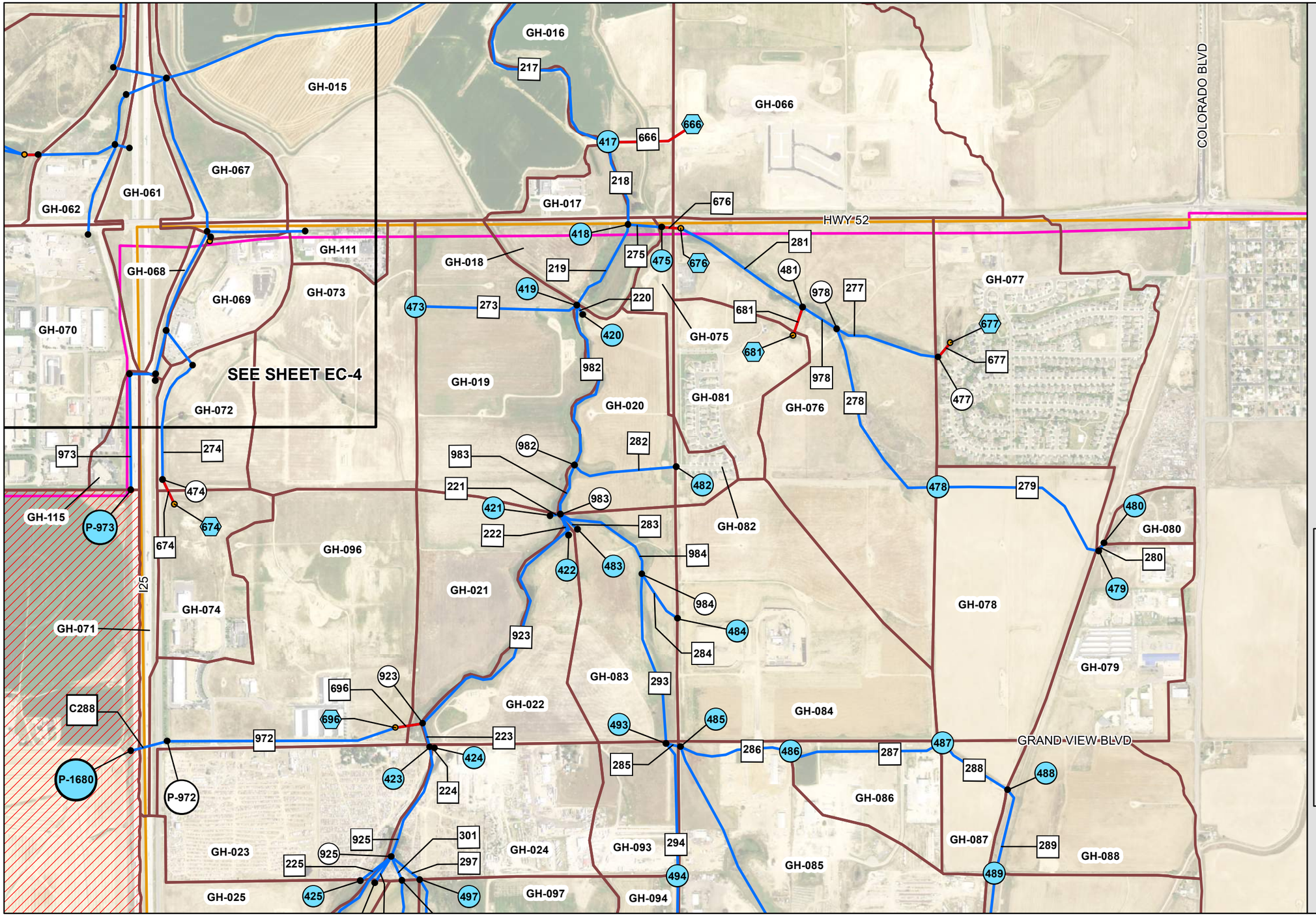
DATE: 8/5/21	
SHEET: GH	INDEX: EC-4



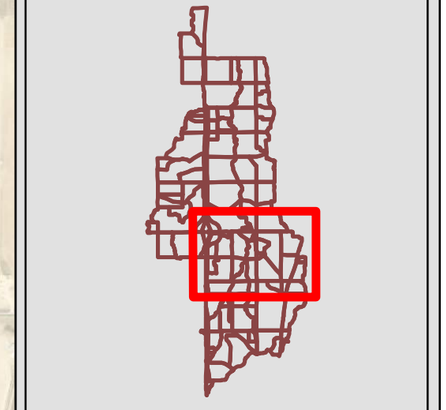
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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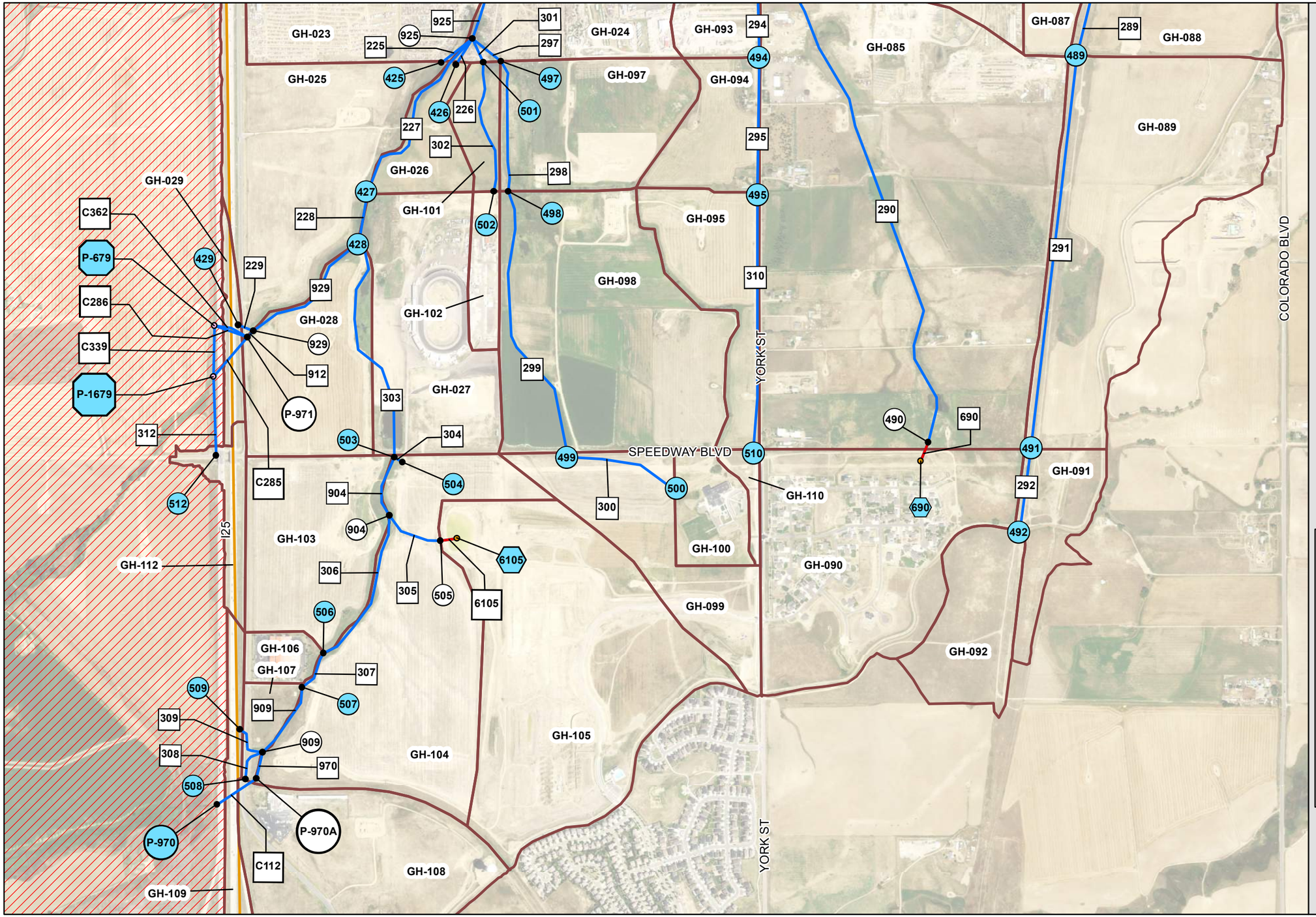
SHEET: GH	INDEX: EC-5



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SHEET: GH	INDEX: EC-6

Table D.1.3: Godding Hollow Basin Peak Discharge Comparison: Existing Conditions ACE 1999 Study and 2022 OSP

Location	SWMM Node	Drainage Area (acres)	ACE 1999 Study Existing Condition SWMM Model Peak Discharge (cfs)					2022 OSP Study Existing Condition SWMM Model Peak Discharge (cfs)					Difference (2022 OSP - ACE 1999 Study) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	402	10511	N/A	N/A	N/A	N/A	N/A	292	493	1011	4342	6550	N/A	N/A	N/A	N/A	N/A	
County Road 20/Bella Rosa Parkway	404	10111	286	689	975	3272	4583	295	496	1014	4343	6529	9	-193	39	1071	1946	
County Road 18/Godding Hollow Parkway	410	9140	298	699	957	3361	4727	289	484	963	4232	6400	-9	-215	6	871	1673	New culvert crossing of Godding Hollow Parkway built in 2015 due to previous culvert failure during 2013 flood.
County Road 16/Tipple Parkway	414	7583	253	621	855	3336	4735	265	432	881	3900	5885	12	-189	26	564	1150	New culvert crossing of Tipple Parkway built in 2018 due to previous culvert failure during 2013 flood.
Confluence with Erie Tributary	415	7181	238	588	821	3164	4439	266	432	872	3831	5753	28	-156	51	667	1314	
State Highway 52 Frederick/Dacono Boundary	418	4226	218	545	749	2919	4007	194	316	662	2960	4450	-24	-229	-87	41	443	1999 Study modeled significant inadvertent detention south of HWY 52. Existing Condition 2021 OSP model did not account for this inadvertent detention as this area has not officially been identified for detention purposes.
Lower Boulder Ditch	419	3732	202	603	1070	2851	3698	151	249	564	2624	3904	-51	-354	-506	-227	206	1999 Study modeled significant inadvertent detention south of Lower Boulder Ditch. Existing Condition 2021 OSP model did not account for this inadvertent detention as this area has not officially been identified for detention purposes.
Confluence with York Tributary	983	3501	215	610	1057	2784	3612	153	247	554	2517	3723	-62	-363	-503	-267	111	
County Road 12/Grandview Blvd	423	2107	182	456	776	2016	2618	110	153	395	1581	2293	-72	-303	-381	-435	-325	
Confluence with Southeastern Tributary	925	1969	144	426	731	1949	2531	54	123	350	1479	2150	-90	-303	-381	-470	-381	
Confluence with I-25 Tributary	428	1527	130	383	652	1738	2247	42	0	279	1159	1665	-88	-383	-373	-579	-582	
I-25 Tributary, East of I-25/ Dacono Planning Boundary	929	558	35	144	257	714	920	9	27	102	451	644	-26	-117	-155	-263	-276	1999 Study assumed flow on western side of I-25 would be conveyed through this crossing. 2021 OSP study incorporated an additional crossing of I-25 as constructed as part of I-25 widening project to reduce flows reaching this location. Existing condition flows are inflows from Erie OSP.
County Road 10/Speedway Blvd	503	919	78	221	366	938	1191	36	75	181	696	988	-42	-146	-185	-242	-203	
Interstate 25, North of County Road 8/ Dacono Planning Boundary	P-970	466	72	187	305	706	871	20	45	109	419	585	-52	-142	-196	-287	-286	Existing Condition inflows from Erie OSP.
Erie Tributary																		
Eastern I-25 Frontage Road, North of Highway 52	467	2475	45	68	102	886	1269	154	224	329	1147	1715	109	156	227	261	446	
West Side of Interstate 25, North of Highway 52	462	2172	5	28	62	849	1228	143	206	295	1005	1515	138	178	233	156	287	1999 Study modeled significant inadvertent detention west of I-25 due to a small crossing pipe of I-25. The I-25 widening project enlarged this crossing with three large box culverts that do not create inadvertent detention storage as part of the OSP study.
State Highway 52/ Frederick Planning Boundary	P-675	1270	9	37	227	757	1020	19	55	167	765	1158	10	18	-60	8	138	Existing Condition inflows from Erie OSP.
Western Tributary																		
West Side of I-25, South of HWY 119/ Frederick Planning Boundary	431	388	5	23	41	75	106	2	5	14	164	279	-3	-18	-27	89	173	

Appendix D.2. Godding Hollow Future Condition Documentation

TABLE D.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
GODDING HOLLOW																				
GH-001	701	0.07869	50.4	0.28149	1486	0.50725	2678	0.0071	10	0.40	0.05	3.82	0.0014	0.67	46.72	0.93	31.82	4.58	2.22	0.99
GH-002	702	0.17091	109.4	0.39099	2064	0.58515	3090	0.0140	25	0.35	0.05	4.59	0.0015	0.72	151.02	1.38	108.88	29.13	18.53	11.35
GH-003	703	0.34210	218.9	0.52332	2763	0.79361	4190	0.0125	40	0.35	0.10	3.82	0.0018	0.55	443.24	2.02	338.70	132.29	84.38	53.08
GH-004	704	0.18744	120.0	0.30473	1609	0.50221	2652	0.0179	25	0.35	0.05	3.54	0.0018	0.54	225.57	1.88	169.38	59.01	33.82	18.76
GH-005	605	0.06291	40.3	0.21942	1159	0.26491	1399	0.0148	24	0.35	0.05	3.95	0.0018	0.56	69.16	1.72	51.95	17.30	9.50	5.44
GH-006	406	0.07109	45.5	0.20845	1101	0.31238	1649	0.0064	22	0.35	0.05	3.72	0.0018	0.55	67.19	1.48	49.83	16.21	8.83	4.86
GH-007	407	0.01550	9.9	0.22594	1193	0.45608	2408	0.0055	26	0.35	0.05	3.44	0.0018	0.53	7.61	0.77	5.48	1.84	1.09	0.60
GH-008	608	0.24347	155.8	0.37503	1980	0.59305	3131	0.0191	23	0.35	0.05	4.08	0.0017	0.59	262.72	1.69	194.91	61.26	31.69	19.37
GH-009	409	0.25288	161.8	0.35889	1895	0.64178	3389	0.0073	70	0.40	0.10	4.00	0.0018	0.58	488.27	3.02	386.72	188.19	141.32	99.58
GH-010	710	0.23840	152.6	0.47396	2503	0.75402	3981	0.0197	32	0.35	0.05	4.52	0.0012	0.79	236.42	1.55	169.59	47.94	34.64	21.87
GH-011	711	0.28844	184.6	0.44586	2354	0.67331	3555	0.0129	69	0.35	0.10	4.26	0.0013	0.76	550.78	2.98	431.67	205.35	158.27	110.48
GH-012	712	0.21051	134.7	0.40985	2164	0.56885	3004	0.0156	61	0.35	0.10	4.24	0.0016	0.64	391.99	2.91	306.81	141.44	103.30	70.88
GH-013	713	0.34368	220.0	0.41644	2199	0.69944	3693	0.0075	43	0.35	0.10	4.12	0.0015	0.67	462.53	2.10	349.13	132.33	89.09	58.41
GH-014	714	0.12545	80.3	0.31176	1646	0.49087	2592	0.0243	30	0.35	0.05	4.67	0.0012	0.81	132.42	1.65	95.04	26.03	18.58	11.44
GH-015	715	0.31768	203.3	0.55237	2916	0.76319	4030	0.0078	56	0.35	0.10	4.18	0.0013	0.75	446.99	2.20	341.21	142.41	107.33	72.40
GH-016	716	0.14518	92.9	0.35955	1898	0.47978	2533	0.0203	32	0.35	0.05	3.91	0.0014	0.69	172.63	1.86	128.51	41.56	26.65	16.65
GH-017	417	0.01902	12.2	0.14914	787	0.27867	1471	0.0103	50	0.40	0.10	4.77	0.0008	0.94	20.30	1.67	15.04	6.09	4.57	3.36
GH-018	718	0.04031	25.8	0.14305	755	0.20214	1067	0.0167	78	0.35	0.10	3.43	0.0016	0.61	101.45	3.93	80.50	43.30	33.06	23.76
GH-019	719	0.14993	96.0	0.36595	1932	0.45041	2378	0.0159	76	0.35	0.10	3.78	0.0014	0.69	337.18	3.51	269.70	139.07	106.96	75.18
GH-020	720	0.06764	43.3	0.26869	1419	0.33148	1750	0.0179	61	0.35	0.05	4.28	0.0011	0.82	121.58	2.81	94.05	43.48	33.76	24.03
GH-021	721	0.07901	50.6	0.22969	1213	0.29447	1555	0.0168	46	0.35	0.05	3.55	0.0015	0.64	139.05	2.75	107.15	45.23	30.65	20.45
GH-022	722	0.06494	41.6	0.34184	1805	0.50145	2648	0.0152	45	0.35	0.05	3.81	0.0016	0.63	77.37	1.86	58.99	23.86	16.12	10.84
GH-023	423	0.12069	77.2	0.34992	1848	0.56972	3008	0.0192	80	0.40	0.05	3.00	0.0018	0.50	259.95	3.37	210.97	114.71	88.85	63.86
GH-024	724	0.09371	60.0	0.29209	1542	0.40415	2134	0.0155	80	0.35	0.10	3.91	0.0013	0.73	208.03	3.47	166.51	87.77	68.55	48.60
GH-025	725	0.14093	90.2	0.36945	1951	0.47965	2533	0.0154	74	0.35	0.10	3.00	0.0018	0.50	304.04	3.37	245.31	128.45	96.56	66.26
GH-026	726	0.02763	17.7	0.17058	901	0.25456	1344	0.0187	80	0.35	0.10	3.00	0.0018	0.50	60.88	3.44	48.88	26.54	20.45	14.34
GH-027	727	0.10760	68.9	0.32445	1713	0.57466	3034	0.0184	80	0.35	0.10	3.00	0.0018	0.50	225.93	3.28	183.30	98.57	75.50	52.62
GH-028	728	0.07907	50.6	0.27374	1445	0.44067	2327	0.0153	77	0.40	0.05	3.00	0.0018	0.50	165.95	3.28	133.89	71.77	55.08	39.44
GH-029	429	0.01316	8.4	0.05480	289	0.21101	1114	0.0148	50	0.40	0.10	3.00	0.0018	0.50	24.66	2.93	19.12	8.55	5.64	3.76
GH-030	630	0.04082	26.1	0.13347	705	0.21656	1143	0.0091	32	0.35	0.05	3.96	0.0018	0.56	54.66	2.09	41.75	15.20	9.13	5.50
GH-031	731	0.18591	119.0	0.40109	2118	0.59196	3126	0.0021	60	0.35	0.10	3.42	0.0016	0.59	252.89	2.13	198.17	89.85	64.18	44.19
GH-032	732	0.20103	128.7	0.31863	1682	0.61598	3252	0.0101	25	0.35	0.05	4.17	0.0013	0.76	178.19	1.38	127.02	31.66	21.77	13.13
GH-033	733	0.21882	140.0	0.35645	1882	0.52453	2770	0.0301	35	0.35	0.05	4.56	0.0014	0.72	320.32	2.29	237.72	77.49	52.90	34.21
GH-034	434	0.26541	169.9	0.27234	1438	0.52254	2759	0.0101	65	0.40	0.10	4.59	0.0014	0.75	577.86	3.40	450.88	210.55	162.18	113.24
GH-035	735	0.11085	70.9	0.18342	968	0.37938	2003	0.0183	31	0.35	0.05	4.52	0.0017	0.64	160.11	2.26	120.27	40.63	24.07	15.19
GH-036	736	0.04720	30.2	0.17756	938	0.25563	1350	0.0183	30	0.35	0.05	4.20	0.0012	0.79	53.04	1.76	38.27	10.35	7.41	4.57
GH-037	637	0.07837	50.2	0.17220	909	0.29108	1537	0.0178	24	0.35	0.05	4.58	0.0014	0.75	90.20	1.80	65.12	15.97	10.79	6.49
GH-038	438	0.08298	53.1	0.20737	1095	0.37640	1987	0.0103	27	0.35	0.05	4.50	0.0018	0.60	87.91	1.66	64.88	21.36	11.74	7.39
GH-039	739	0.07759	49.7	0.21686	1145	0.32389	1710	0.0147	30	0.35	0.05	4.11	0.0018	0.57	97.32	1.96	73.94	25.96	15.04	9.05
GH-040	740	0.07735	49.5	0.15809	835	0.31450	1661	0.0164	30	0.35	0.05	4.61	0.0014	0.75	100.43	2.03	73.40	20.98	14.19	8.86
GH-041	441	0.04896	31.3	0.15926	841	0.28782	1520	0.0268	71	0.40	0.10	4.05	0.0018	0.57	116.37	3.71	91.30	46.66	35.06	24.68
GH-042	442	0.04128	26.4	0.17809	940	0.53694	2835	0.0044	56	0.40	0.10	4.17	0.0018	0.58	49.45	1.87	38.16	16.41	11.68	7.98
GH-043	443	0.03208	20.5	0.14955	790	0.24355	1286	0.0193	55	0.35	0.10	3.62	0.0018	0.54	62.01	3.02	48.45	22.55	15.78	10.41
GH-044	444	0.03379	21.6	0.17256	911	0.34362	1814	0.0186	53	0.35	0.10	4.03	0.0016	0.63	52.97	2.45	41.24	18.02	12.52	8.39
GH-045	645	0.04482	28.7	0.14971	790	0.24143	1275	0.0132	64	0.40	0.10	4.50	0.0018	0.60	96.66	3.37	75.42	36.07	26.74	18.43
GH-046	446	0.10733	68.7	0.25647	1354	0.42324	2235	0.0134	51	0.35	0.10	4.64	0.0015	0.72	176.44	2.57	134.98	55.43	40.41	26.73
GH-047	447	0.02730	17.5	0.13244	699	0.17977	949	0.0171	75	0.35	0.10	4.50	0.0018	0.60	64.20	3.67	50.74	26.76	20.20	14.42
GH-048	448	0.01817	11.6	0.14380	759	0.28044	1481	0.0039	50	0.40	0.10	3.30	0.0018	0.53	20.47	1.76	15.68	6.58	4.42	2.99
GH-049	749	0.32146	205.7	0.37885	2000	0.75233	3972	0.0093	38	0.35	0.10	3.90	0.0015	0.66	405.77	1.97	303.88	107.63	69.16	44.94
GH-050	450	0.05542	35.5	0.11462	605	0.24685	1303	0.0161	28	0.35	0.05	3.71	0.0018	0.55	80.99	2.28	61.42	22.00	12.75	7.37
GH-051	751	0.29285	187.4	0.77062	4069	0.93669	4946	0.0102	34	0.35	0.05	3.82	0.0014	0.68	241.63	1.29	177.11	57.98	37.70	23.98
GH-052	452	0.12508	80.0	0.29200	1542	0.38770	2047	0.0144	20	0.40	0.05	3.48	0.0018	0.53	131.56	1.64	96.40	29.01	13.70	8.52
GH-053	453	0.04919	31.5	0.41530	2193	0.70107	3702	0.0057	50	0.40	0.10	3.00	0.0018	0.50	42.14	1.34	32.28	13.54	9.14	6.02
GH-054	754	0.11598	74.2	0.23409	1236	0.44554	2352	0.0158	45	0.35	0.10	3.40	0.0016	0.60	193.79	2.61	149.47	61.70	40.09	26.48
GH-055	755	0.01215	7.8	0.13797	728	0.21856	1154	0.0082	75	0.35	0.10	3.00	0.0018	0.50	19.79	2.55	15.92	8.23	6.23	4.28
GH-056	756	0.09730	62.3	0.27228	1438	0.54075	2855	0.0106	37	0.35	0.05	3.15	0.0018	0.51	118.78	1.91	90.47	36.52	23.61	14.01
GH-057	457	0.05232	33.5	0.18466	975	0.23555	1244	0.0258	20	0.40	0.05	4.00	0.0018	0.57	61.34	1.83	45.52	13.01	6.51	3.92
GH-058	758	0.13531	86.6	0.24525	1295	0.36945	1951	0.0164	51	0.35	0.05	4.06	0.0018	0.57	281.35	3.25	220.01	99.34	68.49	45.94
GH-059	759	0.19875	127.2	0.24918	1316	0.44798	2365	0.0158	35	0.35	0.05	4.41	0.0016	0.65	311.69	2.45	235.34	84.55	52.52	34.06
GH-060	760	0.15829	101.3	0.24130	1274	0.43301	2286	0.0203	30	0.35	0.05	4.16	0.0018	0.58	231.14	2.28	175.47	62.08	35.69	21.63
GH-061	461	0.06125	39.2	0.27221	1437	0.60092	3173	0.0075	10	0.40	0.10	3.24	0.0018	0.52	36.17	0.92	25.54	6.27	2.04	0.93
GH-062	462	0.04350	27.8	0.11048	583	0.22272	1176	0.0119	71	0.40	0.10	3.79	0.0018	0.55	106.09	3.81	83.15	42.83	32.05	22.63
GH-063	763	0.35345	226.2	0.41123	2171	0.88581	4677	0.0117	51	0.40	0.10	3.48	0.0018	0.53	562.46	2.49	437.87	186.91	126.81	84.88
GH-064	664	0.09778	62.6	0.15687	828	0.41229	2177	0.0067	25	0.35	0.05	4.15	0.0018	0.58	105.63	1.69	78.45	26.03	14.21	8.49
GH-065	465	0.07473	47.8	0.31026	1638	0.37547	1982	0.0056	20	0.40	0.05	4.21	0.0018	0.58	53.38	1.12	38.61	10.32	5.37	3.21
GH-066	666	0.26795	171.5	0.30149	1592	0.51975	2744	0.0151	36	0.40	0.05	3.12	0.0018	0.52	430.42	2.51	328.49	126.04	75.80	49.31
GH-067	767	0.04586	29.4	0.20906	1104	0.26352	1391	0.0073	63	0.35	0.10	3.61	0.0016	0.62	78.86	2.69	62.34	29.75	21.51	14.75
GH-068	468	0.00661	4.2	0.11261	595	0.24376	1287	0.0095	31	0.40	0.10	3.00	0.0018	0.50	4.95	1.17	3.70	1.29	0.73	0.43
GH-069	669	0.03997	25.6	0.12053	636	0.20037	1058	0.0267	75	0.40	0.10	3.00	0.0018	0.50	107.53	4.20	89.13	45.41	34.17	24.55
GH-070	770	0.30703	196.5	0.35435	1871	0.62988	3326	0.0170	75	0.35	0.10	3.40	0.0017	0.55	749.26	3.81	604.72	316.08	238.64	166.06
GH-071	471	0.02512	16.1	0.37731	1992	0.68139	3598	0.0140	50	0.40	0.10	3.00	0.0018	0.50	20.89	1.30	16.06	6.72	4.53	2.98
GH-072	772	0.04841	31.0	0.12941	683	0.26752	1412	0.0136	79	0.35	0.10	3.00	0.0018	0.50	121.46	3.92	96.60	53.05	40.92	28.75
GH-073	773	0.13214	84.6	0.21789	1150	0.41558	2194	0.0132	75	0.35	0.10	3.12	0.0018	0.52	328.61	3.89	263.82	140.80	106.74	74.30
GH-074	674	0.05656	36.2	0.17508	924	0.31685	1673	0.0175	80	0.40	0.10	3.25	0.0017	0.56	136.10	3.76	108.27	58.35	45.03	32.20
GH-075	775	0.01305	8.3	0.15525	820	0.21503	1135	0.0274	45	0.35	0.05	3.00	0.0018	0.50	18.46	2.21	14.44	6.26	4.29	2.67
GH-076	776	0.24903	159.4	0.48638	2568	0.95581	5047	0.0129	77	0.35	0.05	3.00	0.0018	0.50	466.16	2.92	376.57	199.64	154.56	109.66
GH-077	677	0.16887	108.1	0.19105	1009	0.41268	2179	0.0090	52	0.35	0.05	3.00	0.0018	0.50	370.68	3.43	291.66	138.11	96.48	62.26
GH-078	778	0.14249	91.2	0.29000	1531	0.44274	2338	0.0128	74	0.35	0.10	3.00	0.0018	0.50	333.64	3.66	268.16	141.41	106.48	73.23
GH-079	479	0.08475	54.2	0.20686	1092	0.34733	1834	0.0228	80	0.40	0.10	3.00	0.0018	0.50	217.44	4.01	172.90	94.48	72.34	51.81
GH-080	480	0.01552	9.9	0.10879	574	0.14676	775	0.0072	79	0.40	0.05	3.00	0.0018	0.50	33.36	3.36	26.75	14.60	11.28	8.16
GH-081	681	0.05869	37.6	0.16097	850	0.33016	1743	0.0101	79	0.40	0.05	3.00	0.0018	0.50	137.51	3.66	110.28	60.34	46.61	33.69
GH-082	782	0.01152	7.4	0.05148	272	0.10932	577	0.0204	75	0.35	0.05	3.00	0.0018	0.50	31.50	4.27	26.36	14.00	10.51	7.33
GH-083	783	0.08579	54.9	0.32887	1736	0.52937	2795	0.0146	46	0.35	0.05	3.77	0.0014	0.69	109.71	2.00	84.24	33.37	23.48	15.82
GH-084	784	0.18087	115.8	0.24786	1309	0.50344	2658	0.0139	70	0.35	0.10	3.28	0.0018	0.52	443.29	3.83	353.59	182.70	135.94	93.06
GH-085	785	0.49645	317.7	0.56447	2980	1.00455	5304	0.0136	63	0.35	0.10	3.47	0.0016	0.61	870.15	2.74	690.45	324.29	233.90	161.28
GH-086	486	0.04885	31.3	0.18602	982	0.31416	1659	0.0148	80	0.40	0.05	3.43	0.0018	0.53	112.25	3.59	89.97	49.21	38.30	27.72
GH-087	787	0.03095	19.8	0.15304	808	0.25410	1342	0.0128	79	0.35	0.10	3.00	0.0018	0.50	68.47	3.46	54.92	29.70	22.82	15.96
GH-088	788	0.08851	56.6	0.22566	1191	0.38114	2012	0.0243	77	0.35	0.10	3.00	0.0018	0.50	219.70	3.88	175.18	95.01	72.69	50.72
GH-089	789	0.20838	133.4	0.36710	1938	0.65032	3434	0.0110	57	0.35	0.10	3.13	0.0018	0.51	372.30	2.79	293.55	137.02	97.57	63.65
GH-090	690	0.17156	109.8	0.40687	2148	0.63849	3371	0.0122	20	0.40	0.05	3.00	0.0018	0.50	149.80	1.36	110.59	34.80	17.15	9.67
GH-091	791	0.03864	24.7	0.15263	806	0.37474	1979	0.0102	58	0.35	0.10	3.15	0.0018	0.51	64.11	2.59	50.62	23.93	16.99	11.09
GH-092	792	0.05456	34.9	0.22714	1199	0.47316	2498	0.0110	28	0.35	0.05	3.29	0.0018	0.52	49.23	1.41	36.75	13.06	7.77	4.33
GH-093	793	0.04062	26.0	0.17182	907	0.25774	1361	0.0209	80	0.35	0.10	4.14	0.0012	0.78	94.16	3.62	74.33	39.24	31.22	22.21
GH-094	794	0.04117	26.3	0.16031	846	0.24218	1279	0.0186	79	0.35	0.05	3.07	0.0018	0.52	100.57	3.82	80.18	44.50	34.71	24.88
GH-095	795	0.06053	38.7	0.22534	1190	0.48235	2547	0.0192	79	0.35	0.05	3.16	0.0017	0.54	127.84	3.30	103.25	56.29	43.69	31.19
GH-096	696	0.19138	122.5	0.35590	1879	0.44035	2325	0.0171	80	0.40	0.10	3.14	0.0017	0.54	486.79	3.97	390.73	210.28	161.44	114.67
GH-097	797	0.08441	54.0	0.22095	1167	0.34004	1795	0.0257	71	0.35	0.05	3.70	0.0014	0.68	201.25	3.73	158.21	82.12	62.85	45.03
GH-098	798	0.18818	120.4	0.37286	1969	0.58656	3097	0.0217	78	0.35	0.05	3.34	0.0016	0.58	447.94	3.72	361.83	195.69	151.09	108.10
GH-099	799	0.07760	49.7	0.24779	1308	0.54786	2893	0.0191	56	0.35	0.05	3.02	0.0018	0.51	132.82	2.67	104.83	49.34	35.56	23.50
GH-100	500	0.02873	18.4	0.10767	568	0.20721	1094	0.0091	23	0.40	0.10	3.37	0.0016	0.59	29.65	1.61	21.90	6.30	3.37	2.03
GH-101	801	0.01868	12.0	0.12278	648	0.23959	1265	0.0216	80	0.40	0.05	3.00	0.0018	0.50	41.65	3.48	33.38	18.35	14.23	10.32
GH-102	802	0.01730	11.1	0.15009	792	0.29328	1549	0.0144	80	0.35	0.10	3.00	0.0018	0.50	31.58	2.85	25.47	13.69	10.52	7.33
GH-103	803	0.08667	55.5	0.22082	1166	0.34759	1835	0.0194	85	0.35	0.10	3.00	0.0018	0.50	222.24	4.01	178.05	100.08	78.45	55.97
GH-104	804	0.17784	113.8	0.36992	1953	0.64333	3397	0.0203	56	0.35	0.10	3.07	0.0018	0.50	328.99	2.89	258.70	120.46	85.73	55.66
GH-105	805	0.22233	142.3	0.45500	2402	0.58955	3113	0.0278	48	0.35	0.05	3.17	0.0018	0.51	397.00	2.79	310.02	138.79	96.11	61.19
GH-106	506	0.01327	8.5	0.08718	460	0.14767	780	0.0294	85	0.40	0.10	3.00	0.0018	0.50	34.36	4.05	28.21	15.35	11.98	8.70
GH-107	807	0.01311	8.4	0.11305	597	0.13626	719	0.0315	84	0.35	0.10	3.00	0.0018	0.50	32.86	3.91	26.52	14.71	11.53	8.23
GH-108	808	0.14785	94.6	0.28388	1499	0.42732	2256	0.0293	85	0.35	0.10	3.82	0.0018	0.55	402.80	4.26	321.81	180.58	141.34	102.10
GH-109	509	0.04724	30.2	0.41357	2184	0.78090	4123	0.0235	50	0.40	0.10	3.36	0.0018	0.52	48.68	1.61	37.40	15.61	10.50	7.09
GH-110	810	0.00734	4.7	0.08836	467	0.20125	1063	0.0091	29	0.35	0.05	3.07	0.0018	0.52	6.31	1.34	4.73	1.71	1.03	0.57
GH-111	511	0.01710	10.9	0.07871	416	0.16611	877	0.0141	75	0.35	0.10	3.72	0.0015	0.66	40.17	3.67	31.62	16.62	12.66	9.02
GH-112	512	0.01918	12.3	0.14630	772	0.27692	1462	0.0239	50	0.40	0.10	3.00	0.0018	0.50	29.41	2.40	22.98	9.99	6.63	4.39
GH-113	513	0.00524	3.4	0.05468	289	0.14352	758	0.0112	50	0.40	0.10	3.00	0.0018	0.50	7.95	2.37	6.21	2.73	1.81	1.19
GH-114	814	0.16069	102.8	0.33470	1767	0.53461	2823	0.0083	75	0.35	0.10	3.06	0.0018	0.51	323.73	3.15	262.32	136.89	103.07	70.84
GH-115	515	0.01431	9.2	0.15502	819	0.21665	1144	0.0142	75	0.35	0.10	3.00	0.0018	0.50	25.80	2.82	20.71	10.89	8.25	5.67
Totals/Averages			**8218.7**						**54**						**186.41**	**2.61**	**145.31**	**66.00**	**47.62**	**32.48**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

CONCEPTUAL POND 701 FOR GODDING HOLLOW SUBBASIN GH-01

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4884.00	0	0.00	0.0	0	0.00	0.00	Bottom
4887.50	5500	0.13	3.50	9535	0.22	2.34	Top of 10-Year Detention Zone
4889.00	20000	0.46	5.00	28556	0.66	43.69	Top of 100-Year Detention Zone

CONCEPTUAL POND 702 FOR GODDING HOLLOW SUBBASIN GH-02

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4879.30	0	0.00	0.0	0	0.00	0.00	Bottom
4882.80	65000	1.49	3.50	112273	2.58	3.55	Top of 10-Year Detention Zone
4884.30	78000	1.79	5.00	217427	4.99	116.51	Top of 100-Year Detention Zone

CONCEPTUAL POND 703 FOR GODDING HOLLOW SUBBASIN GH-03

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4896.00	0	0.00	0.0	0	0.00	0.00	Bottom
4899.50	175000	4.02	3.50	299712	6.88	37.85	Top of 10-Year Detention Zone
4901.00	340000	7.81	5.00	686763	15.77	257.47	Top of 100-Year Detention Zone

CONCEPTUAL POND 704 FOR GODDING HOLLOW SUBBASIN GH-04

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4894.76	0	0.00	0.0	0	0.00	0.00	Bottom
4898.26	52000	1.19	3.50	90492	2.08	24.22	Top of 10-Year Detention Zone
4899.76	100000	2.30	5.00	202992	4.66	182.29	Top of 100-Year Detention Zone

CONCEPTUAL POND 710 FOR GODDING HOLLOW SUBBASIN GH-10

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4917.37	0	0.00	0.0	0	0.00	0.00	Bottom
4920.87	94000	2.16	3.50	162869	3.74	8.59	Top of 10-Year Detention Zone
4922.37	168000	3.86	5.00	359214	8.25	151.19	Top of 100-Year Detention Zone

CONCEPTUAL POND 711 FOR GODDING HOLLOW SUBBASIN GH-11

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4926.07	0	0.00	0.0	0	0.00	0.00	Bottom
4930.07	260000	5.97	4.00	517814	11.89	19.25	Top of 10-Year Detention Zone
4931.07	575000	13.20	5.00	930938	21.37	208.07	Top of 100-Year Detention Zone

CONCEPTUAL POND 712 FOR GODDING HOLLOW SUBBASIN GH-12

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4931.00	0	0.00	0.0	0	0.00	0.00	Bottom
4934.75	75000	1.72	3.75	137490	3.16	68.32	Top of 10-Year Detention Zone
4936.00	215000	4.94	5.00	320062	7.35	270.51	Top of 100-Year Detention Zone

CONCEPTUAL POND 713 FOR GODDING HOLLOW SUBBASIN GH-13

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4944.00	0	0.00	0.0	0	0.00	0.00	Bottom
4947.75	225000	5.17	3.75	395921	9.09	16.97	Top of 10-Year Detention Zone
4949.00	382500	8.78	5.00	796842	18.29	241.07	Top of 100-Year Detention Zone

CONCEPTUAL POND 714 FOR GODDING HOLLOW SUBBASIN GH-14

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4940.85	0	0.00	0.0	0	0.00	0.00	Bottom
4944.35	55000	1.26	3.50	93366	2.14	1.93	Top of 10-Year Detention Zone
4945.85	76000	1.74	5.00	193164	4.43	86.17	Top of 100-Year Detention Zone

CONCEPTUAL POND 715 FOR GODDING HOLLOW SUBBASIN GH-15

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4950.30	0	0.00	0.0	0	0.00	0.00	Bottom
4954.05	280000	6.43	3.75	517966	11.89	6.36	Top of 10-Year Detention Zone
4955.30	400000	9.18	5.00	948282	21.77	174.14	Top of 100-Year Detention Zone

CONCEPTUAL POND 716 FOR GODDING HOLLOW SUBBASIN GH-16

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4956.00	0	0.00	0.0	0	0.00	0.00	Bottom
4959.50	78000	1.79	3.50	133014	3.05	3.77	Top of 10-Year Detention Zone
4961.00	88000	2.02	5.00	259229	5.95	111.84	Top of 100-Year Detention Zone

CONCEPTUAL POND 718 FOR GODDING HOLLOW SUBBASIN GH-18

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4964.97	0	0.00	0.0	0	0.00	0.00	Bottom
4968.97	40000	0.92	4.00	79532	1.83	3.85	Top of 10-Year Detention Zone
4969.97	65000	1.49	5.00	131688	3.02	38.69	Top of 100-Year Detention Zone

CONCEPTUAL POND 719 FOR GODDING HOLLOW SUBBASIN GH-19

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4967.24	0	0.00	0.0	0	0.00	0.00	Bottom
4971.24	176000	4.04	4.00	344309	7.90	4.83	Top of 10-Year Detention Zone
4972.24	240000	5.51	5.00	556535	12.78	114.66	Top of 100-Year Detention Zone

CONCEPTUAL POND 720 FOR GODDING HOLLOW SUBBASIN GH-20

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4979.00	0	0.00	0.0	0	0.00	0.00	Bottom
4982.75	71000	1.63	3.75	126640	2.91	0.93	Top of 10-Year Detention Zone
4984.00	75000	1.72	5.00	223326	5.13	41.89	Top of 100-Year Detention Zone

CONCEPTUAL POND 721 FOR GODDING HOLLOW SUBBASIN GH-21

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4990.00	0	0.00	0.0	0	0.00	0.00	Bottom
4993.50	56500	1.30	3.50	97605	2.24	5.39	Top of 10-Year Detention Zone
4995.00	70000	1.61	5.00	192982	4.43	70.09	Top of 100-Year Detention Zone

CONCEPTUAL POND 722 FOR GODDING HOLLOW SUBBASIN GH-22

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4990.00	0	0.00	0.0	0	0.00	0.00	Bottom
4993.50	47000	1.08	3.50	81087	1.86	3.42	Top of 10-Year Detention Zone
4995.00	58000	1.33	5.00	160664	3.69	38.43	Top of 100-Year Detention Zone

CONCEPTUAL POND 724 FOR GODDING HOLLOW SUBBASIN GH-24

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5006.00	0	0.00	0.0	0	0.00	0.00	Bottom
5009.50	6000	0.14	3.50	10330	0.24	81.43	Top of 10-Year Detention Zone
5011.00	18000	0.41	5.00	27936	0.64	198.73	Top of 100-Year Detention Zone

CONCEPTUAL POND 725 FOR GODDING HOLLOW SUBBASIN GH-25

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5014.00	0	0.00	0.0	0	0.00	0.00	Bottom
5017.50	130000	2.98	3.50	223877	5.14	24.87	Top of 10-Year Detention Zone
5019.00	160000	3.67	5.00	443836	10.19	125.95	Top of 100-Year Detention Zone

CONCEPTUAL POND 726 FOR GODDING HOLLOW SUBBASIN GH-26

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5016.00	0	0.00	0.0	0	0.00	0.00	Bottom
5019.75	29000	0.67	3.75	53084	1.22	3.76	Top of 10-Year Detention Zone
5021.00	40000	0.92	5.00	96703	2.22	22.77	Top of 100-Year Detention Zone

CONCEPTUAL POND 727 FOR GODDING HOLLOW SUBBASIN GH-27

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5023.60	0	0.00	0.0	0	0.00	0.00	Bottom
5027.10	39500	0.91	3.50	68697	1.58	57.16	Top of 10-Year Detention Zone
5028.60	70000	1.61	5.00	150834	3.46	167.53	Top of 100-Year Detention Zone

CONCEPTUAL POND 728 FOR GODDING HOLLOW SUBBASIN GH-28

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5030.30	0	0.00	0.0	0	0.00	0.00	Bottom
5034.05	79500	1.83	3.75	148654	3.41	11.01	Top of 10-Year Detention Zone
5035.30	120000	2.75	5.00	272994	6.27	63.80	Top of 100-Year Detention Zone

CONCEPTUAL POND 731 FOR GODDING HOLLOW SUBBASIN GH-31

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4856.13	0	0.00	0.0	0	0.00	0.00	Bottom
4859.63	168000	3.86	3.50	292686	6.72	13.95	Top of 10-Year Detention Zone
4861.13	190000	4.36	5.00	560946	12.88	105.82	Top of 100-Year Detention Zone

CONCEPTUAL POND 732 FOR GODDING HOLLOW SUBBASIN GH-32

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4864.40	0	0.00	0.0	0	0.00	0.00	Bottom
4867.90	73000	1.68	3.50	125851	2.89	3.04	Top of 10-Year Detention Zone
4869.40	82000	1.88	5.00	243964	5.60	134.13	Top of 100-Year Detention Zone

CONCEPTUAL POND 733 FOR GODDING HOLLOW SUBBASIN GH-33

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4874.40	0	0.00	0.0	0	0.00	0.00	Bottom
4877.90	122500	2.81	3.50	211123	4.85	6.03	Top of 10-Year Detention Zone
4879.40	138000	3.17	5.00	408557	9.38	194.51	Top of 100-Year Detention Zone

CONCEPTUAL POND 735 FOR GODDING HOLLOW SUBBASIN GH-35

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4914.42	0	0.00	0.0	0	0.00	0.00	Bottom
4917.92	44000	1.01	3.50	76915	1.77	9.47	Top of 10-Year Detention Zone
4919.42	75000	1.72	5.00	165201	3.79	110.74	Top of 100-Year Detention Zone

CONCEPTUAL POND 736 FOR GODDING HOLLOW SUBBASIN GH-36

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4928.80	0	0.00	0.0	0	0.00	0.00	Bottom
4932.30	6250	0.14	3.50	10800	0.25	6.01	Top of 10-Year Detention Zone
4933.80	29000	0.67	5.00	36792	0.84	41.89	Top of 100-Year Detention Zone

CONCEPTUAL POND 739 FOR GODDING HOLLOW SUBBASIN GH-39

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4952.80	0	0.00	0.0	0	0.00	0.00	Bottom
4956.30	12400	0.28	3.50	21615	0.50	16.16	Top of 10-Year Detention Zone
4957.80	47000	1.08	5.00	65226	1.50	79.80	Top of 100-Year Detention Zone

CONCEPTUAL POND 740 FOR GODDING HOLLOW SUBBASIN GH-40

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4969.19	0	0.00	0.0	0	0.00	0.00	Bottom
4972.69	16000	0.37	3.50	27841	0.64	9.02	Top of 10-Year Detention Zone
4974.19	50000	1.15	5.00	76461	1.76	76.79	Top of 100-Year Detention Zone

CONCEPTUAL POND 749 FOR GODDING HOLLOW SUBBASIN GH-49

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4948.84	0	0.00	0.0	0	0.00	0.00	Bottom
4952.34	188000	4.32	3.50	328768	7.55	14.24	Top of 10-Year Detention Zone
4953.84	260000	5.97	5.00	663125	15.22	230.30	Top of 100-Year Detention Zone

CONCEPTUAL POND 751 FOR GODDING HOLLOW SUBBASIN GH-51

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4958.58	0	0.00	0.0	0	0.00	0.00	Bottom
4962.08	45000	1.03	3.50	76933	1.77	54.00	Top of 10-Year Detention Zone
4963.58	475000	10.90	5.00	461561	10.60	181.00	Top of 100-Year Detention Zone

CONCEPTUAL POND 754 FOR GODDING HOLLOW SUBBASIN GH-54

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4969.20	0	0.00	0.0	0	0.00	0.00	Bottom
4972.70	57000	1.31	3.50	98102	2.25	18.00	Top of 10-Year Detention Zone
4974.20	260000	5.97	5.00	330329	7.58	62.00	Top of 100-Year Detention Zone

CONCEPTUAL POND 755 FOR GODDING HOLLOW SUBBASIN GH-55

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4976.70	0	0.00	0.0	0	0.00	0.00	Bottom
4980.70	10000	0.23	4.00	19695	0.45	1.96	Top of 10-Year Detention Zone
4981.70	26500	0.61	5.00	37846	0.87	8.53	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run
Discharge Set to Match Values from Wildflower Drainage Report

CONCEPTUAL POND 756 FOR GODDING HOLLOW SUBBASIN GH-56

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4985.70	0	0.00	0.0	0	0.00	0.00	Bottom
4989.20	46500	1.07	3.50	80964	1.86	11.95	Top of 10-Year Detention Zone
4990.70	94000	2.16	5.00	185728	4.26	72.67	Top of 100-Year Detention Zone

CONCEPTUAL POND 758 FOR GODDING HOLLOW SUBBASIN GH-58

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4986.00	0	0.00	0.0	0	0.00	0.00	Bottom
4989.50	96000	2.20	3.50	167056	3.84	16.00	Top of 10-Year Detention Zone
4991.00	135000	3.10	5.00	339975	7.80	136.15	Top of 100-Year Detention Zone

CONCEPTUAL POND 759 FOR GODDING HOLLOW SUBBASIN GH-59

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4972.30	0	0.00	0.0	0	0.00	0.00	Bottom
4975.80	44250	1.02	3.50	77298	1.77	42.40	Top of 10-Year Detention Zone
4977.30	147000	3.37	5.00	220516	5.06	229.65	Top of 100-Year Detention Zone

CONCEPTUAL POND 760 FOR GODDING HOLLOW SUBBASIN GH-60

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4981.70	0	0.00	0.0	0	0.00	0.00	Bottom
4985.20	53250	1.22	3.50	92964	2.13	20.93	Top of 10-Year Detention Zone
4986.70	105000	2.41	5.00	211576	4.86	166.57	Top of 100-Year Detention Zone

CONCEPTUAL POND 763 FOR GODDING HOLLOW SUBBASIN GH-63

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4983.80	0	0.00	0.0	0	0.00	0.00	Bottom
4987.30	181250	4.16	3.50	317074	7.28	62.15	Top of 10-Year Detention Zone
4988.80	425000	9.76	5.00	765859	17.58	304.39	Top of 100-Year Detention Zone

CONCEPTUAL POND 767 FOR GODDING HOLLOW SUBBASIN GH-67

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4973.92	0	0.00	0.0	0	0.00	0.00	Bottom
4977.42	31000	0.71	3.50	53926	1.24	8.03	Top of 10-Year Detention Zone
4978.92	54000	1.24	5.00	116674	2.68	39.34	Top of 100-Year Detention Zone

CONCEPTUAL POND 770 FOR GODDING HOLLOW SUBBASIN GH-70

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4993.59	0	0.00	0.0	0	0.00	0.00	Bottom
4997.09	47000	1.08	3.50	81586	1.87	253.54	Top of 10-Year Detention Zone
4998.59	91000	2.09	5.00	185504	4.26	672.87	Top of 100-Year Detention Zone

CONCEPTUAL POND 772 FOR GODDING HOLLOW SUBBASIN GH-72

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5009.70	0	0.00	0.0	0	0.00	0.00	Bottom
5013.45	42500	0.98	3.75	79324	1.82	8.90	Top of 10-Year Detention Zone
5014.70	70000	1.61	5.00	148365	3.41	49.85	Top of 100-Year Detention Zone

CONCEPTUAL POND 773 FOR GODDING HOLLOW SUBBASIN GH-73

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5000.90	0	0.00	0.0	0	0.00	0.00	Bottom
5004.65	119000	2.73	3.75	221556	5.09	20.80	Top of 10-Year Detention Zone
5005.90	185000	4.25	5.00	411530	9.45	133.41	Top of 100-Year Detention Zone

CONCEPTUAL POND 775 FOR GODDING HOLLOW SUBBASIN GH-75

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4973.16	0	0.00	0.0	0	0.00	0.00	Bottom
4976.66	8000	0.18	3.50	13703	0.31	1.75	Top of 10-Year Detention Zone
4978.16	13500	0.31	5.00	30035	0.69	9.98	Top of 100-Year Detention Zone

CONCEPTUAL POND 776 FOR GODDING HOLLOW SUBBASIN GH-76

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4973.91	0	0.00	0.0	0	0.00	0.00	Bottom
4977.66	280000	6.43	3.75	512050	11.76	27.89	Top of 10-Year Detention Zone
4978.91	340000	7.81	5.00	911920	20.93	171.79	Top of 100-Year Detention Zone

CONCEPTUAL POND 778 FOR GODDING HOLLOW SUBBASIN GH-78

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5021.60	0	0.00	0.0	0	0.00	0.00	Bottom
5025.35	130000	2.98	3.75	242626	5.57	21.94	Top of 10-Year Detention Zone
5026.60	219000	5.03	5.00	459691	10.55	131.90	Top of 100-Year Detention Zone

CONCEPTUAL POND 782 FOR GODDING HOLLOW SUBBASIN GH-82

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5003.60	0	0.00	0.0	0	0.00	0.00	Bottom
5007.10	3100	0.07	3.50	5417	0.12	9.11	Top of 10-Year Detention Zone
5008.60	5000	0.11	5.00	11443	0.26	25.72	Top of 100-Year Detention Zone

CONCEPTUAL POND 783 FOR GODDING HOLLOW SUBBASIN GH-83

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4990.00	0	0.00	0.0	0	0.00	0.00	Bottom
4993.75	67000	1.54	3.75	121236	2.78	1.90	Top of 10-Year Detention Zone
4995.00	94000	2.16	5.00	225062	5.17	51.48	Top of 100-Year Detention Zone

CONCEPTUAL POND 784 FOR GODDING HOLLOW SUBBASIN GH-84

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5005.00	0	0.00	0.0	0	0.00	0.00	Bottom
5010.75	143000	3.28	3.75	267696	6.15	32.79	Top of 10-Year Detention Zone
5012.00	270000	6.20	5.00	525768	12.07	187.69	Top of 100-Year Detention Zone

CONCEPTUAL POND 785 FOR GODDING HOLLOW SUBBASIN GH-85

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5015.20	0	0.00	0.0	0	0.00	0.00	Bottom
5018.95	370000	8.49	3.75	633118	14.53	78.05	Top of 10-Year Detention Zone
5020.20	555000	12.74	5.00	1339145	30.74	405.76	Top of 100-Year Detention Zone

CONCEPTUAL POND 787 FOR GODDING HOLLOW SUBBASIN GH-87

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5049.40	0	0.00	0.0	0	0.00	0.00	Bottom
5053.15	31500	0.72	3.75	58385	1.34	4.26	Top of 10-Year Detention Zone
5054.40	46000	1.06	5.00	106845	2.45	25.78	Top of 100-Year Detention Zone

CONCEPTUAL POND 788 FOR GODDING HOLLOW SUBBASIN GH-88

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5059.70	0	0.00	0.0	0	0.00	0.00	Bottom
5063.45	79100	1.82	3.75	147482	3.39	15.18	Top of 10-Year Detention Zone
5064.70	125000	2.87	5.00	274767	6.31	89.53	Top of 100-Year Detention Zone

CONCEPTUAL POND 789 FOR GODDING HOLLOW SUBBASIN GH-89

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5070.50	0	0.00	0.0	0	0.00	0.00	Bottom
5074.00	162000	3.72	3.50	282892	6.49	27.22	Top of 10-Year Detention Zone
5075.50	240000	5.51	5.00	583869	13.40	168.33	Top of 100-Year Detention Zone

CONCEPTUAL POND 791 FOR GODDING HOLLOW SUBBASIN GH-91

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5101.10	0	0.00	0.0	0	0.00	0.00	Bottom
5104.60	32500	0.75	3.50	56103	1.29	4.33	Top of 10-Year Detention Zone
5106.10	44000	1.01	5.00	112958	2.59	28.76	Top of 100-Year Detention Zone

CONCEPTUAL POND 792 FOR GODDING HOLLOW SUBBASIN GH-92

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5105.50	0	0.00	0.0	0	0.00	0.00	Bottom
5109.00	18250	0.42	3.50	31630	0.73	5.39	Top of 10-Year Detention Zone
5110.50	34000	0.78	5.00	70823	1.63	36.89	Top of 100-Year Detention Zone

CONCEPTUAL POND 793 FOR GODDING HOLLOW SUBBASIN GH-93

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5014.60	0	0.00	0.0	0	0.00	0.00	Bottom
5018.10	26250	0.60	3.50	45655	1.05	12.01	Top of 10-Year Detention Zone
5019.60	35000	0.80	5.00	91684	2.10	51.33	Top of 100-Year Detention Zone

CONCEPTUAL POND 794 FOR GODDING HOLLOW SUBBASIN GH-94

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5036.40	0	0.00	0.0	0	0.00	0.00	Bottom
5040.15	39000	0.90	3.75	72108	1.66	6.79	Top of 10-Year Detention Zone
5041.40	55000	1.26	5.00	131652	3.02	40.53	Top of 100-Year Detention Zone

CONCEPTUAL POND 795 FOR GODDING HOLLOW SUBBASIN GH-95

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5060.90	0	0.00	0.0	0	0.00	0.00	Bottom
5064.65	65000	1.49	3.75	128198	2.94	6.42	Top of 10-Year Detention Zone
5065.90	120000	2.75	5.00	221639	5.09	46.21	Top of 100-Year Detention Zone

CONCEPTUAL POND 797 FOR GODDING HOLLOW SUBBASIN GH-97

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5018.70	0	0.00	0.0	0	0.00	0.00	Bottom
5022.45	78000	1.79	3.75	145911	3.35	9.21	Top of 10-Year Detention Zone
5023.70	105000	2.41	5.00	258878	5.94	81.69	Top of 100-Year Detention Zone

CONCEPTUAL POND 798 FOR GODDING HOLLOW SUBBASIN GH-98

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5040.00	0	0.00	0.0	0	0.00	0.00	Bottom
5043.75	211000	4.84	3.75	394522	9.06	19.39	Top of 10-Year Detention Zone
5045.00	240000	5.51	5.00	675898	15.52	163.42	Top of 100-Year Detention Zone

CONCEPTUAL POND 799 FOR GODDING HOLLOW SUBBASIN GH-99

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5093.70	0	0.00	0.0	0	0.00	0.00	Bottom
5097.20	62000	1.42	3.50	108280	2.49	9.81	Top of 10-Year Detention Zone
5098.70	85250	1.96	5.00	218867	5.02	61.12	Top of 100-Year Detention Zone

CONCEPTUAL POND 801 FOR GODDING HOLLOW SUBBASIN GH-101

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5015.20	0	0.00	0.0	0	0.00	0.00	Bottom
5018.95	19500	0.45	3.75	36134	0.83	2.55	Top of 10-Year Detention Zone
5020.20	25500	0.59	5.00	64583	1.48	15.76	Top of 100-Year Detention Zone

CONCEPTUAL POND 802 FOR GODDING HOLLOW SUBBASIN GH-102

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5040.70	0	0.00	0.0	0	0.00	0.00	Bottom
5044.45	6400	0.15	3.75	11146	0.26	8.02	Top of 10-Year Detention Zone
5045.70	11500	0.26	5.00	24588	0.56	23.46	Top of 100-Year Detention Zone

CONCEPTUAL POND 803 FOR GODDING HOLLOW SUBBASIN GH-103

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5051.46	0	0.00	0.0	0	0.00	0.00	Bottom
5055.21	80000	1.84	3.75	149820	3.44	17.11	Top of 10-Year Detention Zone
5056.46	120000	2.75	5.00	274609	6.30	89.43	Top of 100-Year Detention Zone

CONCEPTUAL POND 804 FOR GODDING HOLLOW SUBBASIN GH-104

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5057.00	0	0.00	0.0	0	0.00	0.00	Bottom
5060.50	134000	3.08	3.50	234345	5.38	24.30	Top of 10-Year Detention Zone
5062.00	200000	4.59	5.00	483787	11.11	154.41	Top of 100-Year Detention Zone

CONCEPTUAL POND 805 FOR GODDING HOLLOW SUBBASIN GH-105

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5067.80	0	0.00	0.0	0	0.00	0.00	Bottom
5071.30	129500	2.97	3.50	225975	5.19	39.12	Top of 10-Year Detention Zone
5072.80	245000	5.62	5.00	505901	11.61	211.48	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run

CONCEPTUAL POND 807 FOR GODDING HOLLOW SUBBASIN GH-107

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5075.80	0	0.00	0.0	0	0.00	0.00	Bottom
5079.30	9000	0.21	3.50	15628	0.36	4.52	Top of 10-Year Detention Zone
5080.80	12250	0.28	5.00	31612	0.73	16.87	Top of 100-Year Detention Zone

CONCEPTUAL POND 808 FOR GODDING HOLLOW SUBBASIN GH-108

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5094.00	0	0.00	0.0	0	0.00	0.00	Bottom
5097.50	126000	2.89	3.50	219675	5.04	38.75	Top of 10-Year Detention Zone
5099.00	150000	3.44	5.00	426507	9.79	178.37	Top of 100-Year Detention Zone

CONCEPTUAL POND 810 FOR GODDING HOLLOW SUBBASIN GH-110

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5109.90	0	0.00	0.0	0	0.00	0.00	Bottom
5113.40	2800	0.06	3.50	4714.00	0.11	0.66	Top of 10-Year Detention Zone
5114.90	4600	0.11	5.00	10428.00	0.24	4.55	Top of 100-Year Detention Zone

CONCEPTUAL POND 114 FOR GODDING HOLLOW SUBBASIN GH-114

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5013.00	0	0.00	0.0	0	0.00	0.00	Bottom
5016.75	162000	3.72	3.75	302039	6.93	18.93	Top of 10-Year Detention Zone
5018.00	235000	5.39	5.00	551037	12.65	125.99	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run

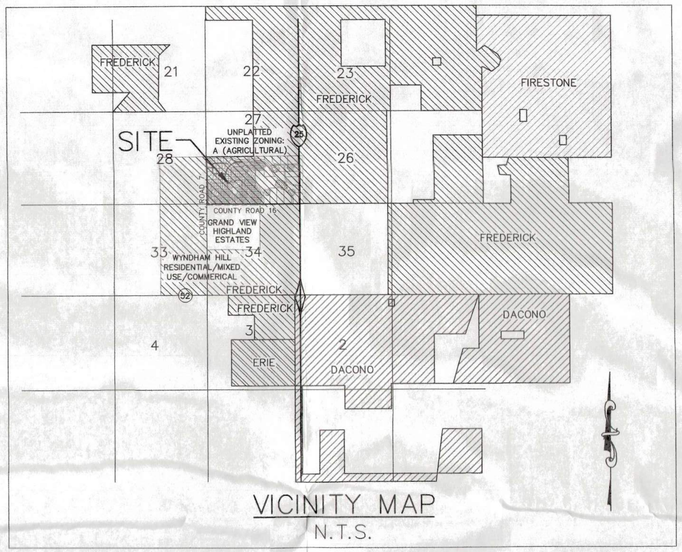
WILDFLOWER SUBDIVISION FILING NO. 1 AND A RE-PLAT OF TRACT OS6, COUNTRY MEADOWS FARM SUBDIVISION FILING NO. 1

A PART OF THE SOUTH 1/2 OF SECTION 27, TOWNSHIP 2 NORTH, RANGE 68 WEST OF THE 6TH PRINCIPAL MERIDIAN, TOWN OF FREDERICK, COUNTY OF WELD, STATE OF COLORADO

PRELIMINARY DRAINAGE PLAN

BASIN A RUNOFF SUMMARY TABLE

DESIGN POINT	BASIN	AREA	Q_2 (CFS)	Q_{100} (CFS)
1	A1	4.39	3.60	18.40
2	A2	3.48	3.10	15.70
3	A3	8.02	10.00	60.00
4	A4	3.73	3.30	50.40
5	A1–A4	19.62	12.80	74.50
6	A5	2.69	2.40	12.10
7	A6	2.88	4.30	46.30
8	A1–A6	25.19	16.00	90.90
9	A7	5.82	4.70	23.40
10	A8	5.41	4.40	32.90
11	A7–A8	11.23	9.00	45.20
12	A1–A8	36.42	23.10	144.80
13	A12	3.85	3.20	15.80
14	A13	4.57	7.8	31.50
15	A14	3.24	9.10	38.00
16	A10	5.80	4.30	21.70
17	A11	3.58	2.30	13.80
17	A9	7.10	2.20	29.20
17	A9–A14	28.14	14.40	80.40
18	A1–A14	41.75	34.20	184.80
19	A15	3.87	3.30	16.80
20	A1–A5	45.62	35.20	196.10
21	A16	6.21	5.20	25.00
22	A17	5.17	8.60	44.60
23	A18	4.08	10.80	55.20
24	A19	4.64	3.80	48.40
25	A1–A19	65.72	44.80	251.40
26	A20	3.08	2.50	35.10
27	A21	1.12	0.90	13.50
28	A20+A21	4.20	3.40	263.50
29	A1–A21	69.92	47.00	263.50
30	A22	3.22	1.10	14.00
31	A23	0.78	5.50	25.80
32	A1–A23	20.63	50.5	266.90
33	A24	55.27	1.10	4.90
34	A25	1.45	51.10	352.40
35	C1	56.72	1.70	7.50
36	C2	3.88	2.80	12.60
37	C3	4.67	5.30	23.90
38	C4	8.55	14.90	59.50
39	D1	195.44	1.30	5.70
40	D2	3.92	19.7	65.90
41	E1	0.49	0.69	2.44
42	E2	3.33	1.00	6.72
43	F1	1.91	1.07	5.32
44	F2	1.99	10.05	32.78
45	F3	4.55	12.56	35.34
46	F4	6.23	2.58	36.87
47	F5	13.55	4.57	26.30
47	F5	14.14	3.39	9.12
48	F6	2.87	0.69	19.40
49	G1	36.79	10.67	28.64
50	G2	1.11	25.85	19.59
51	H1	5.47	9.27	30.06
52	H2	0.59	1.40	7.00
52	H2	6.04	15.27	55.22
53	H3	0.59	0.50	2.50
53	H3	6.63	7.74	28.32
54	H4	10.73	16.13	49.65
55	H5	13.22	5.35	17.63
56	H6	4.78	32.86	28.71
57	H7	218.49	1.40	7.06
58	H8	5.75	0.71	2.50
59	H9	7.11	0.56	1.98
60	H10	14.11	0.49	1.73
61	H11	6.10	3.74	12.11
62	H12	4.07	40.37	73.90
63	H13	15.02	3.38	11.33
64	H14	3.24	3.43	11.39
65	H15	224.00	3.51	11.60
75	B1	1.45	4.80	24.50
76	B2	2.94	4.10	85.00
77	B3	2.33	13.30	133.80
78	B4	2.03	0.49	88.70
79	B1–B4	2.08	54.30	230.7
80	B5	237.17	3.30	16.60
81	B6	2.05	6.10	31.30
82	B7	2.03	0.80	31.30
82	B8	2.08	16.20	14.10
82	B1–B8	2.08	71.90	236.80



VICINITY MAP
N.T.S.

SHEET INDEX

1 COVER SHEET
2 PRELIMINARY DRAINAGE PLAN
3 PRELIMINARY DRAINAGE PLAN
4 PRELIMINARY DRAINAGE PLAN
5 PRELIMINARY DRAINAGE PLAN

LEGEND

- PROPERTY BOUNDARY
- PROPOSED RIGHT OF WAY
- PROPOSED LOT LINE
- PROPOSED CENTERLINE
- PROPOSED PEDESTRIAN RAMP
- PROPOSED TRAIL OR SIDEWALK
- A / 1.57 — BASIN DESIGNATION / AREA IN ACRES
- 5 — DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- EXISTING STORM SEWER
- PROPOSED STORM SEWER INLET
- PROPOSED STORM SEWER
- PROPOSED UTILITY EASEMENT
- 6500 — PROPOSED OVERLOT GRADE CONTOUR
- 6500 — EXISTING CONTOUR
- FLOW DIRECTION

ENGINEER'S STATEMENT

THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION

JEFFREY J. FRENCH
CO P.E. 32615

DATE

NO.	REVISION	DATE	BY
1	PER TOWN COMMENTS	03-29-04	BJ
2	UPDATE	06/03/05	RL

WILDFLOWER SUBDIVISION FILING NO. 1

COVER SHEET

DEVELOPER
R H FREDERICK, LLC
1805 SHEA CENTER DRIVE
SUITE 250
HIGHLANDS RANCH, CO 80129
(303) 798–7495
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CONTACT: MICK RICHARDSON

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2828 SPEER BLVD., SUITE 201
DENVER, COLORADO 80211
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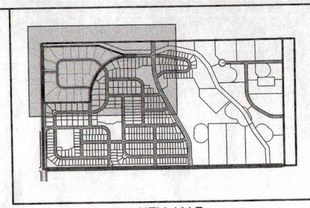
DATE: 08/14/03
JOB NO: 01.10
DRAWN BY: KJK
APPROVED:
CADD FILE: 01.10/PREDRN–0110



KEY MAP
NTS

NO.	REVISION	DATE	BY
1	PER TOWN COMMENTS	03-29-04	BJ
2	UPDATE	06/03/05	RL

WILDFLOWER SUBDIVISION FILING NO. 1

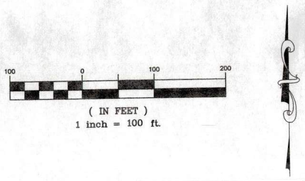
PRELIMINARY DRAINAGE PLAN

POND B
10 YR VOL=2.68 AC FT
10 YR WSEL=4979.7
10 YR RELEASE=40.00 CFS
100 YR VOL=3.28 AC FT.
100 WSEL=4980.1
100 YR RELEASE=140.00 CFS

EXISTING 42" CULVERT
INV IN=4676.98
INV OUT=4679.67

SEE SHEET 5

SEE SHEET 3



ENGINEER'S STATEMENT

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JOB NO: 01.10
DRAWN BY: KJK
APPROVED:
CADD FILE: 01.10/PREDRN-0110

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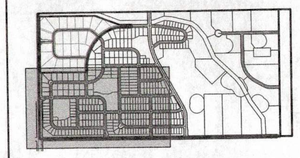

KEY MAP
NTS

NO.	REVISION	DATE	BY
1	PER TOWN COMMENTS	03-29-04	BJ
2	UPDATE	06/03/05	RL

WILDFLOWER SUBDIVISION FILING NO. 1

PRELIMINARY DRAINAGE PLAN

SEE SHEET 2

SEE SHEET 4

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100 0 100 200
(IN FEET)
1 inch = 100 ft.

ENGINEER'S STATEMENT

THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION

JEFFREY J. FRENCH
CO P.E. 32615

DATE

DATE: 08/14/03
JOB NO: 01.10
DRAWN BY: KJK
APPROVED:
CADD FILE: 01.10/PREDRN-0110

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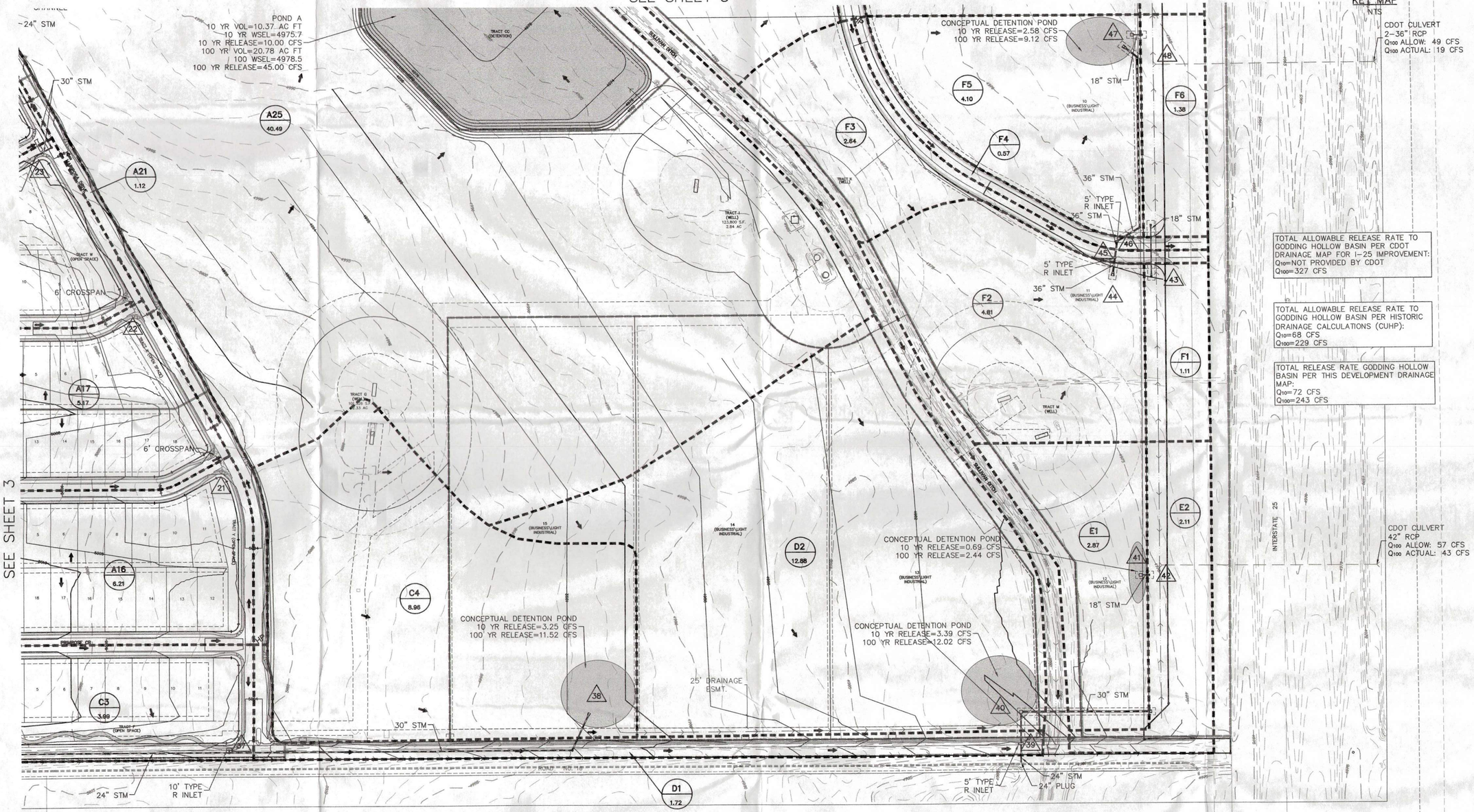

SEE SHEET 3

KEY MAP
NTS

NO.	REVISION	DATE	BY
1	PER TOWN COMMENTS	03-29-04	BJ
2	UPDATE	06/03/05	RL

WILDFLOWER SUBDIVISION FILING NO. 1

PRELIMINARY DRAINAGE PLAN

ENGINEER'S STATEMENT

THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION

JEFFREY J. FRENCH
CO P.E. 32615

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DATE: 08/14/03
JOB NO: 01.10
DRAWN BY: KJK
APPROVED:
CADD FILE: 01.10/PREDRN-0110

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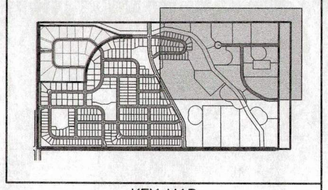

KEY MAP
NTS

NO.	REVISION	DATE	BY
1	PER TOWN COMMENTS	03-29-04	BJ
2	UPDATE	06/03/05	RL

WILDFLOWER SUBDIVISION FILING NO. 1

PRELIMINARY DRAINAGE PLAN

SEE SHEET 2

SEE SHEET 4

CONCEPTUAL DETENTION POND
10 YR RELEASE=0.71 CFS
100 YR RELEASE=2.50 CFS

CONCEPTUAL DETENTION POND
10 YR RELEASE=0.56 CFS
100 YR RELEASE=1.98 CFS

CONCEPTUAL DETENTION POND
10 YR RELEASE=0.49 CFS
100 YR RELEASE=1.73 CFS

POND A
10 YR VOL=10.37 AC FT
10 YR WSEL=4975.7
10 YR RELEASE=10.00 CFS
100 YR VOL=20.78 AC FT
100 WSEL=4978.5
100 YR RELEASE=45.00 CFS

CONCEPTUAL DETENTION POND
10 YR RELEASE=43.09 CFS
100 YR RELEASE=129.36 CFS

CONCEPTUAL DETENTION POND
10 YR RELEASE=2.58 CFS
100 YR RELEASE=9.12 CFS

CDOT CULVERT
2-60"X38" ELIPITICAL
Q_{100} ALLOW: 221 CFS
Q_{100} ACTUAL: 181 CFS

TOTAL ALLOWABLE RELEASE RATE TO GODDING HOLLOW BASIN PER CDOT DRAINAGE MAP FOR I-25 IMPROVEMENT:
Q_{10}=NOT PROVIDED BY CDOT
Q_{100}= 327 CFS

TOTAL ALLOWABLE RELEASE RATE TO GODDING HOLLOW BASIN PER HISTORIC DRAINAGE CALCULATIONS (CUHP):
Q_{10}=68 CFS
Q_{100}=229 CFS

TOTAL RELEASE RATE GODDING HOLLOW BASIN PER THIS DEVELOPMENT DRAINAGE MAP:
Q_{10}=72 CFS
Q_{100}=243 CFS

CDOT CULVERT
2-36" RCP
Q_{100} ALLOW: 49 CFS
Q_{100} ACTUAL: 19 CFS

(IN FEET)
1 inch = 100 ft.

ENGINEER'S STATEMENT

THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION

JEFFREY J. FRENCH
CO P.E. 32615

DATE

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DATE: 08/14/03
JOB NO: 01.10
DRAWN BY: K.K
APPROVED:
CADD FILE: 01.10/PREDRN-0110

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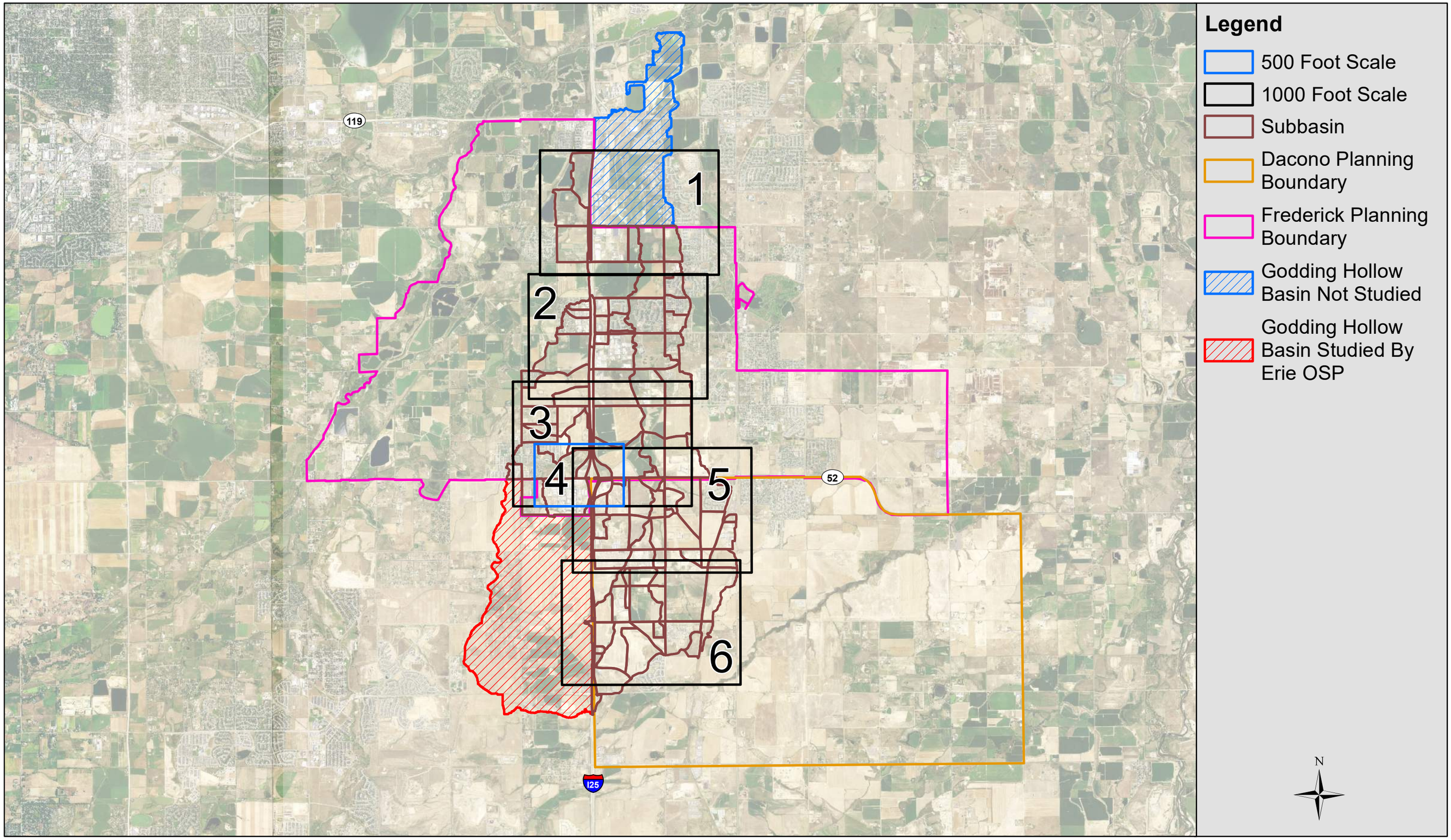
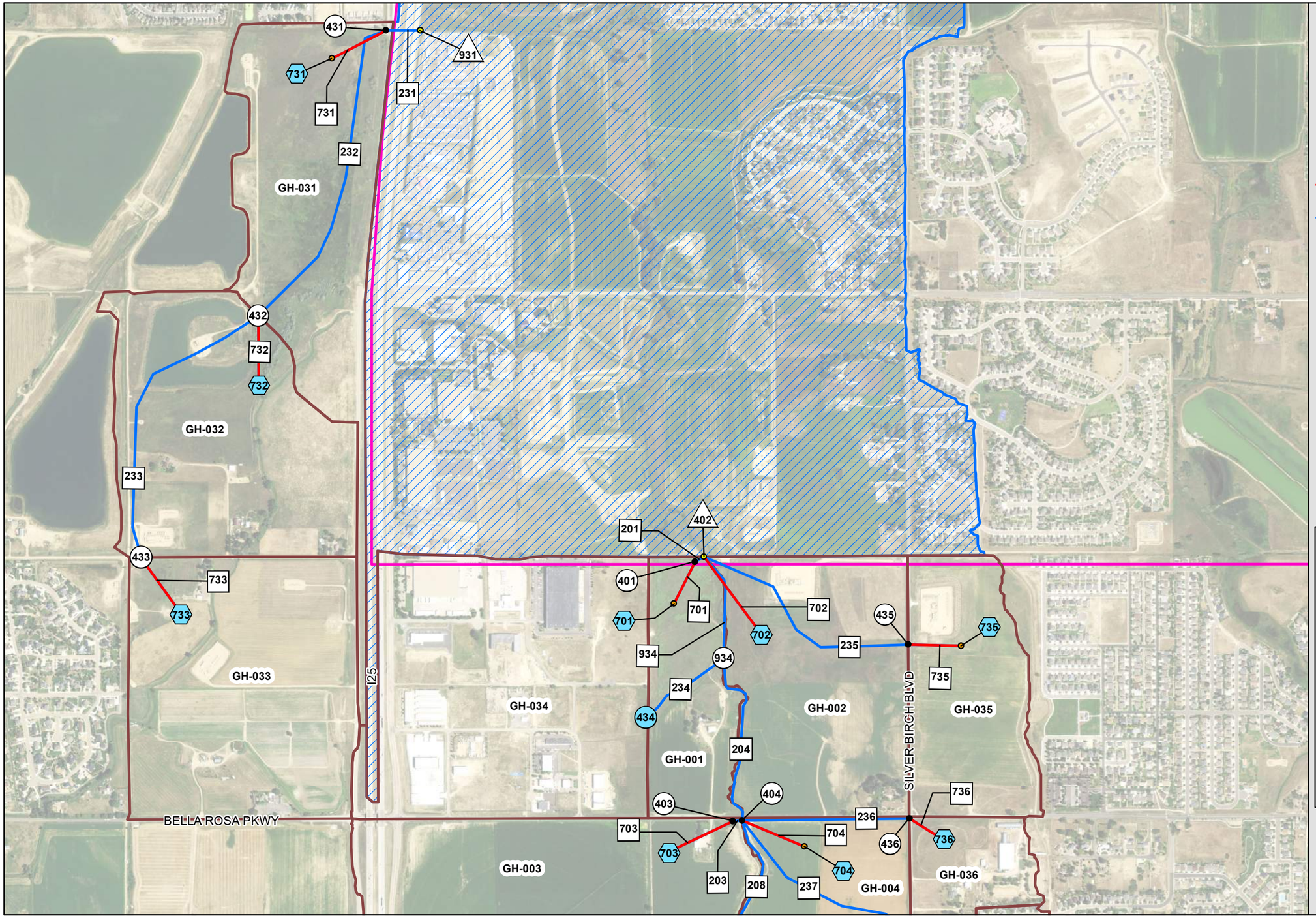


Anderson Consulting Engineers, Inc
Civil • Water Resources • Environmental
375 E. Horsetooth Road, Building #5, Fort Collins, CO 80525
Phone (970) 226-0120 / Fax (970) 226-0121
www.acewater.com

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: C-INDEX



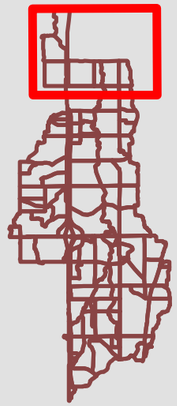
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



N

0 500 1,000 2,000
Feet

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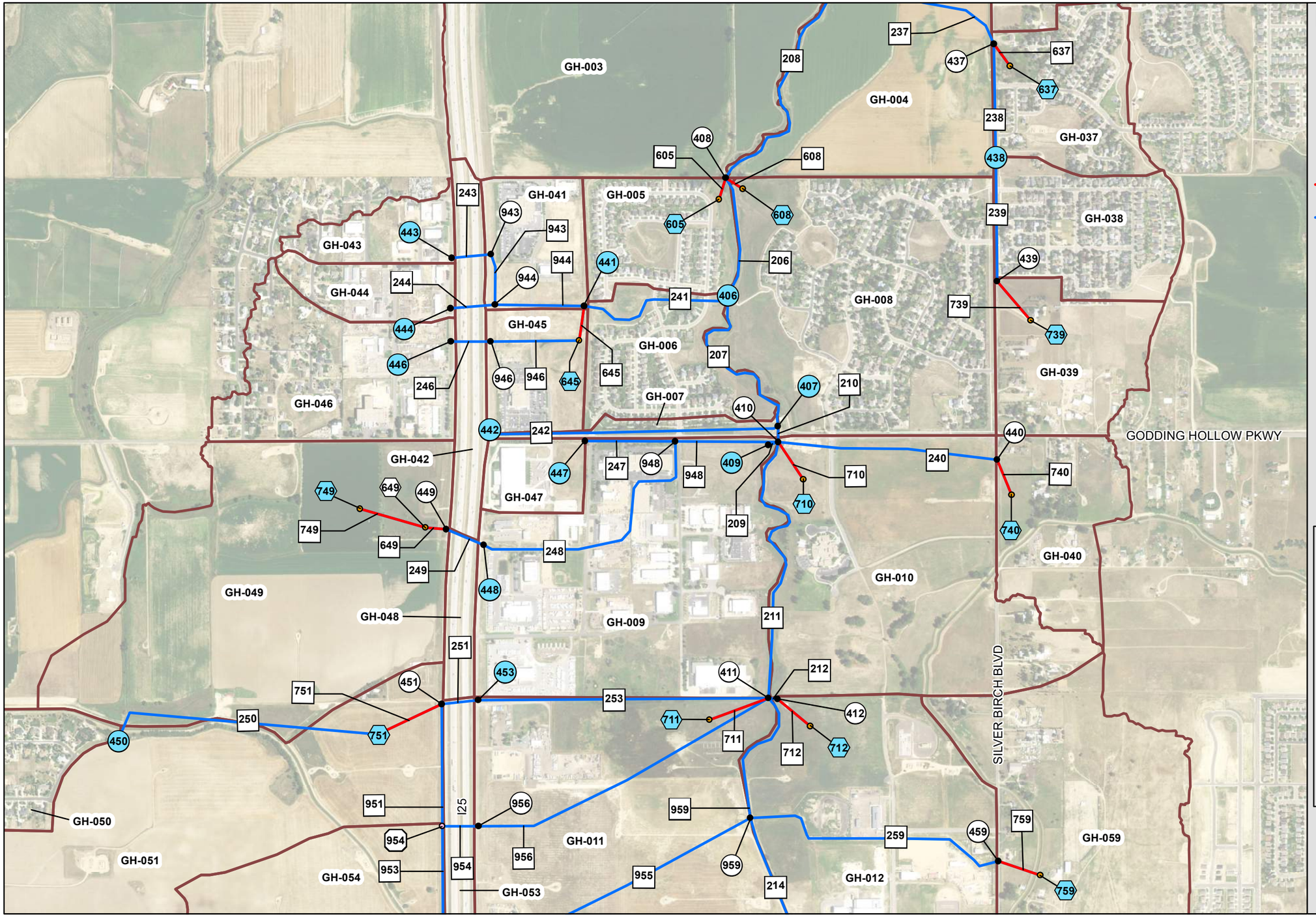
FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: FC-1



Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
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Key Map

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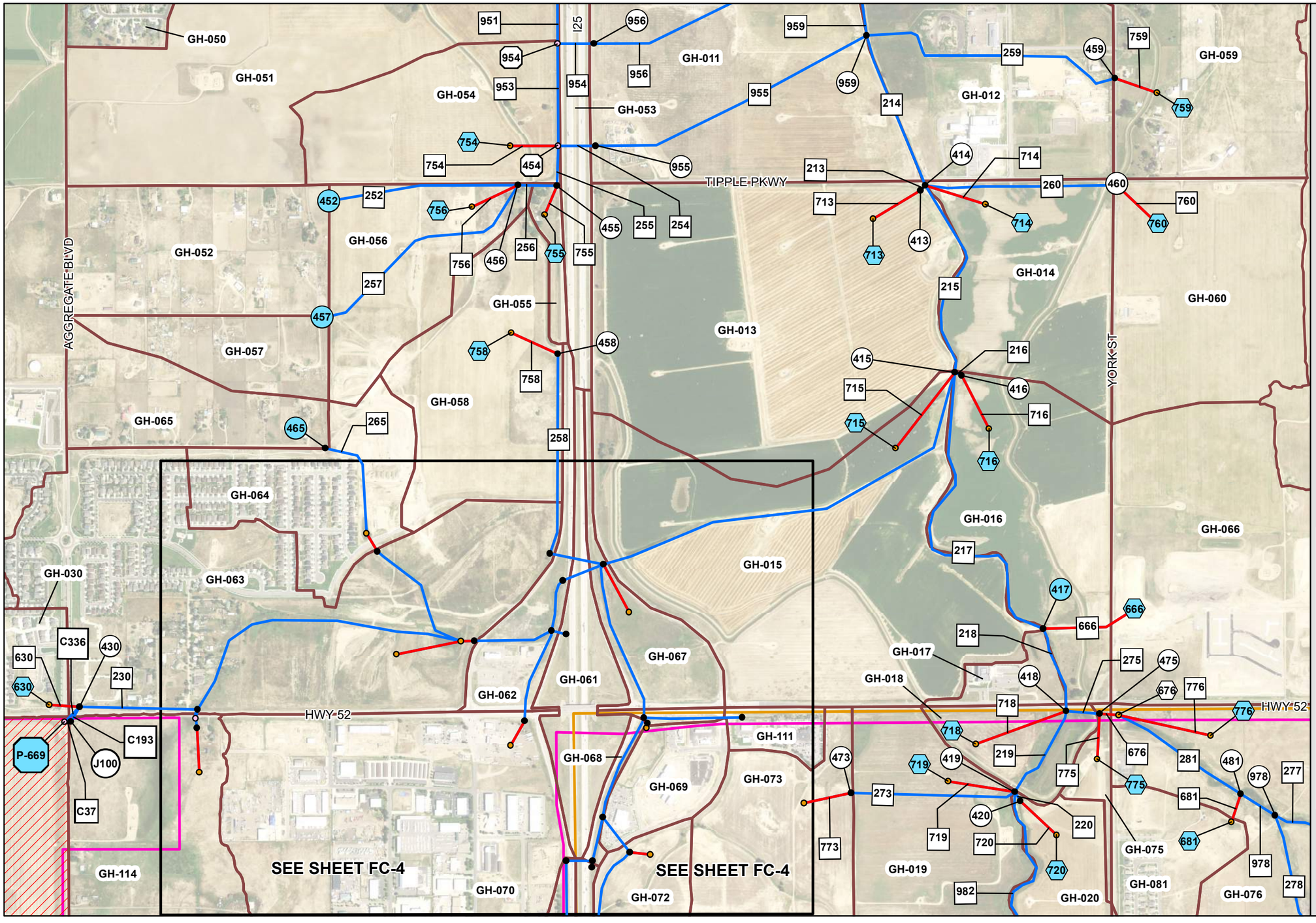
Civil • Water Resources • Environmental

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: FC-2



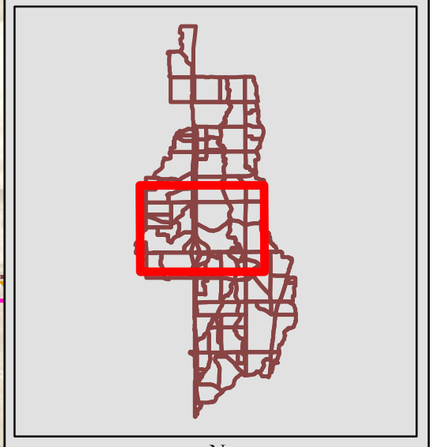
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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Feet

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GODDING HOLLOW
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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CHECKED BY:	BS
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DATE: 8/5/21	
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GH-064
GH-063
GH-062
GH-061
GH-015
GH-067
GH-068
GH-069
GH-070
GH-111
GH-073
GH-072
HWY 52
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664
664
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464
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270
268
914
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C335
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C195
P-675
814
814
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770
770
968
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272
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921
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772
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472
471
973
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773
773

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map

N

0 250 500 1,000
Feet

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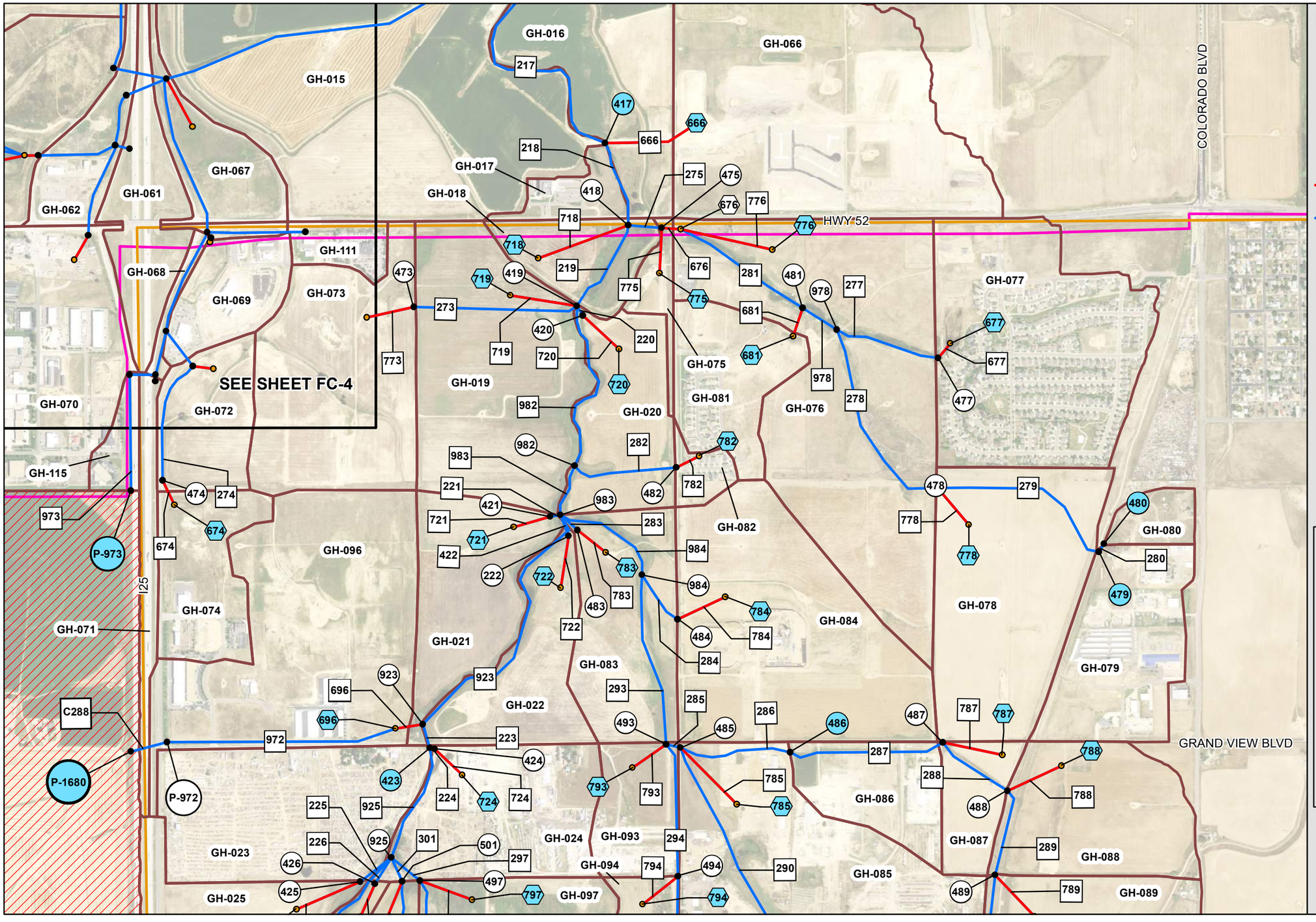


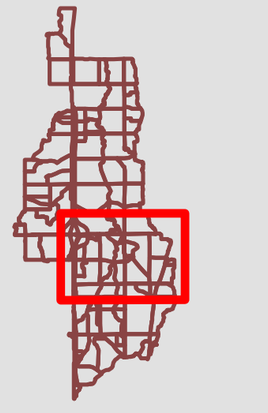
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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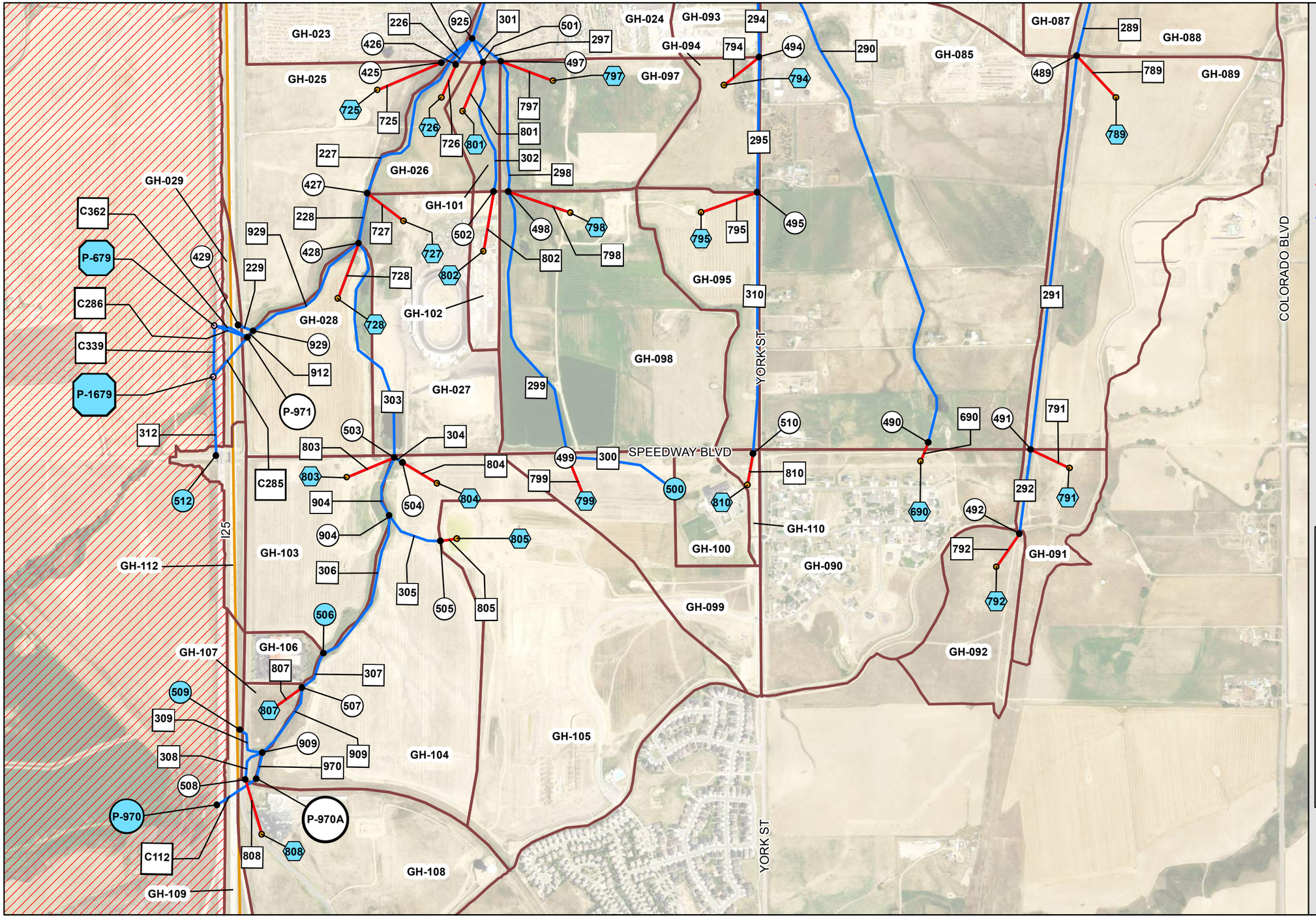

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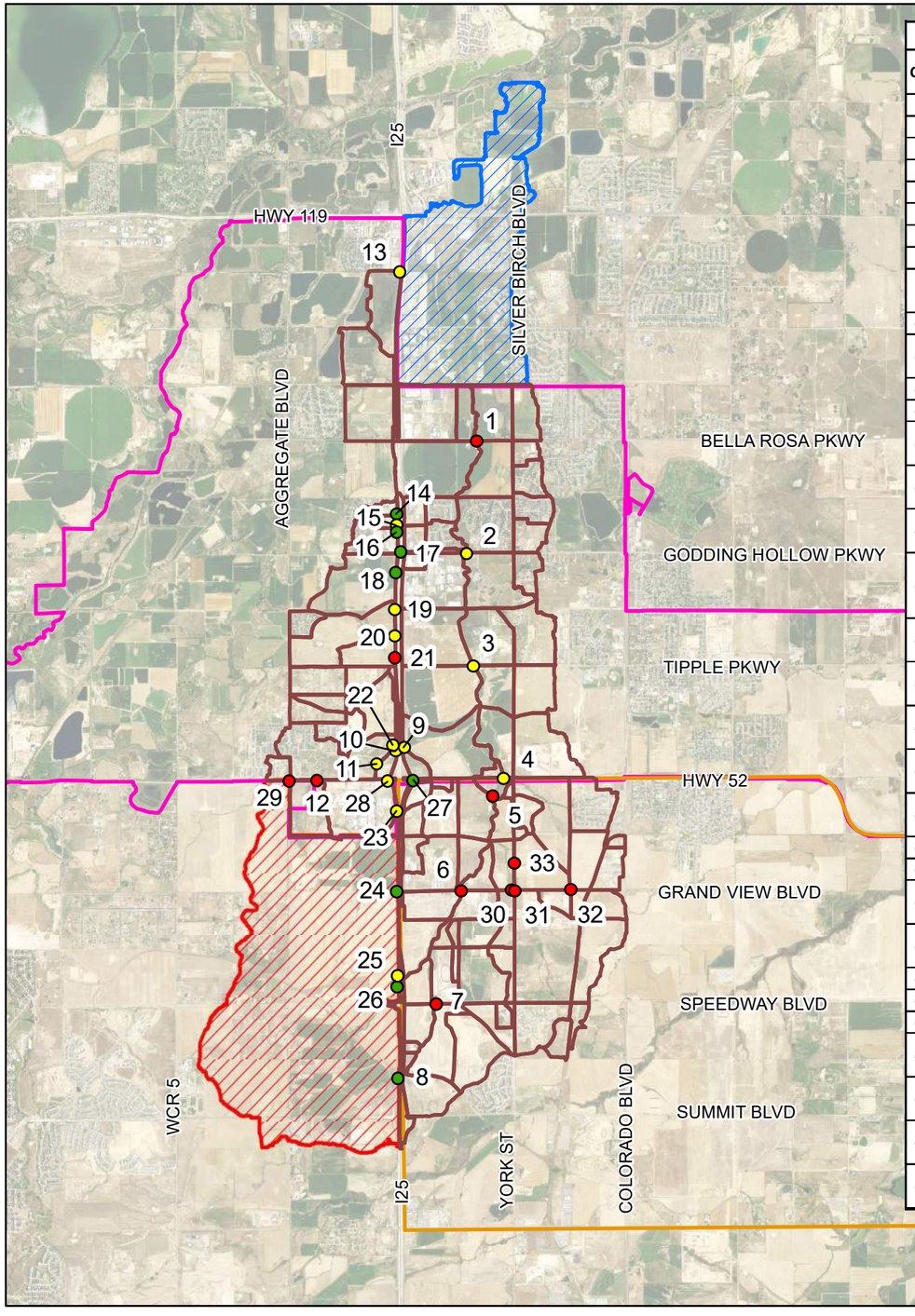

Godding Hollow Basin Crossings

Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
GH-C1	County Road 20/Bella Rosa Parkway	6' H x 8' W Arch CMP	< 2-Year	4890.4	404
GH-C2	County Road 18/Godding Hollow Parkway	(7) 6' H x 10' W RCBC	< 50-Year	4916.4	410
GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC	< 50-Year	4939.9	414
GH-C4	Highway 52	8' H x 8' W RCBC	< 50-Year	4964.0	418
GH-C5	Lower Boulder Ditch	7' H x 7' W RCBC	< 10-Year	4966.2	419
GH-C6	County Road 12/Grandview Blvd	36" CMP (24" ADS Inside)	< 2-Year	5000.4	423
GH-C7	County Road 10/Speedway Blvd	60" CMP	< 2-Year	5047.7	503
GH-C8	Interstate 25, North of County Road 8	(2) 6' H x 10' W RCBC	> 100-Year	5089.9	P-970
GH-C9	Eastern I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 50-Year	4972.9	467
GH-C10	Interstate 25, North of Highway 52	(3) 6' H x 8' W RCBC	< 100-Year	4975.5	462
GH-C11	Western I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 50-Year	4982.00	463
GH-C12	Highway 52	(2) 36" CMP	< 10-Year	5009.5	P-675
GH-C13	I-25, South of HWY 119	4' H x 12' W RCBC	< 50-Year	4855.1	431
GH-C14	I-25, North of Rowe Street (Indians Peaks Crossing #1)	42" RCP	> 100-Year	4953.1	443
GH-C15	I-25, South of Rowe Street (Indians Peaks Crossing #2)	24" RCP	< 50-Year	4949.1	444
GH-C16	I-25, North of Gage Street (Indian Peaks Crossing #3)	(2) 42" RCP	> 100-Year	4947.0	446
GH-C17	I-25, North of County Road 18/ Godding Hollow Parkway (Indian Peaks Crossing #4)	34" H x 52" W HERCP	> 100-Year	4944.8	N/A
GH-C18	I-25, South of County Road 18/ Godding Hollow Parkway	48" RCP	> 100-Year	4946.4	449
GH-C19	I-25, South of Access Road Between County Road 18 and 16 #1	(2) 38" H x 60" W HERCP	< 50-Year	4957.6	451
GH-C20	I-25, South of Access Road Between County Road 18 and 16 #2	(2) 36" RCP	< 50-Year	4962.9	954
GH-C21	I-25, South of Access Road Between County Road 18 and 16 #3	42" RCP	< 10-Year	4968.2	454
GH-C22	I-25 & Western Frontage Road, North of Highway 52	24" RCP	< 50-Year	4978.9	958
GH-C23	I-25, South of Highway 52	4' H x 6' W RCBC	< 100-Year	5002.7	515
GH-C24	I-25, North of County Road 12	4' H x 8' W RCBC	> 100-Year	5043.9	P-1680
GH-C25	I-25, North of County Road 10 (Crossing #1)	(2) 36" RCP	< 100-Year	5049.8	P-679
GH-C26	I-25, North of County Road 10 (Crossing #2)	(2) 6' H x 8' W RCBC	> 100-Year	5050.9	P-1679
GH-C27	Highway 52, East of I-25 Frontage Road	6' H x 8' W RCBC	> 100-Year	4988.0	468
GH-C28	Highway 52, West of I-25 Frontage Road	(2) 48" RCP	< 50-Year	4992.6	470
GH-C29	Highway 52, West of County Road 7	24" RCP	< 10-Year	5017.1	P-669
GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	Road Overtopping Location	< 2-Year	5013.6	493
GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	Road Overtopping Location	< 2-Year	5014.2	485
GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	Road Overtopping Location	< 2-Year	5048.4	487
CH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(2) 18" RCP	< 2-Year	5006	484

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

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GODDING HOLLOW
FUTURE CONDITION
CROSSING MAP

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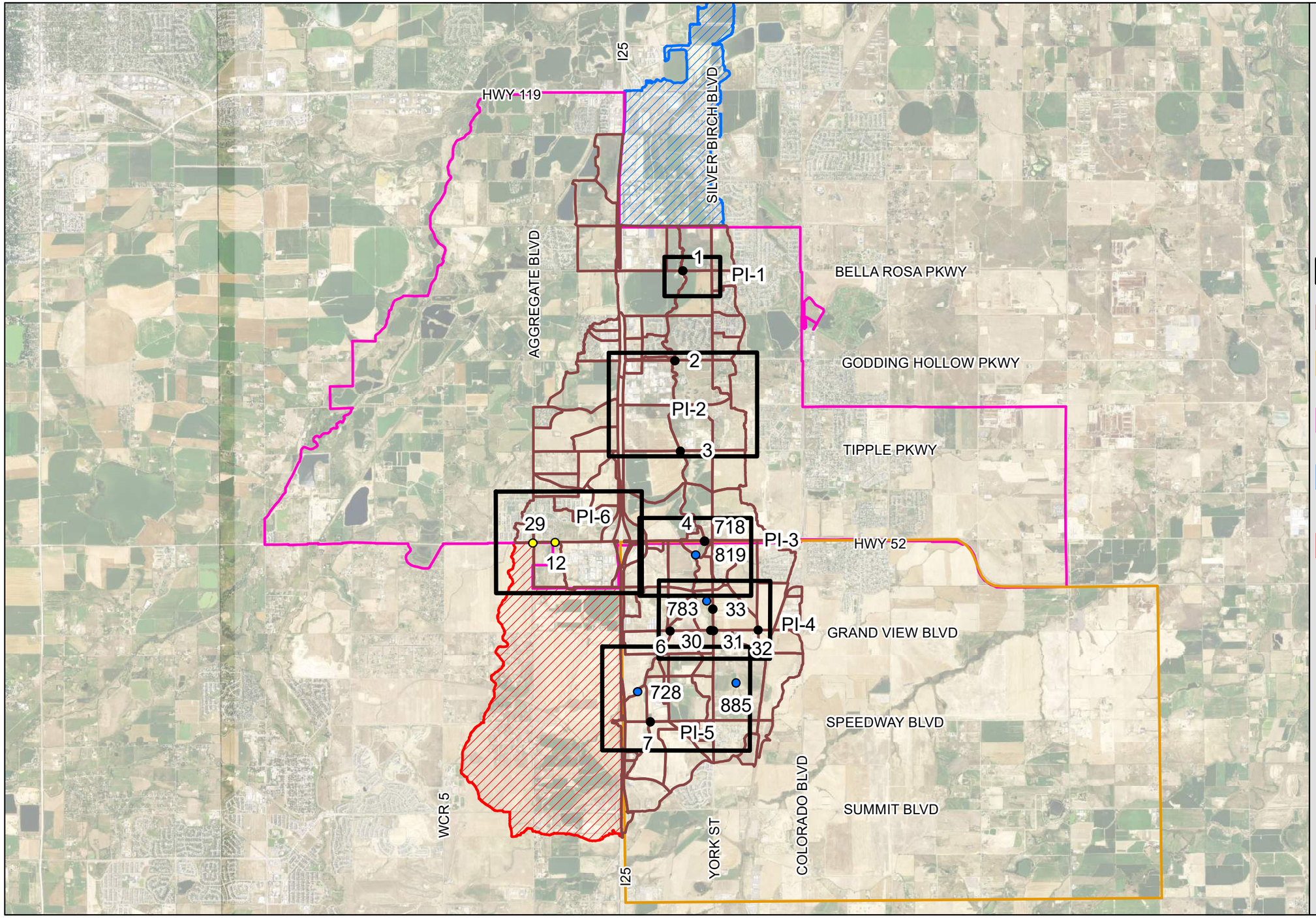
Table D.2.2: Godding Hollow Basin Peak Discharge Comparison: Existing Conditions 2022 OSP and Future Conditions 2022 OSP

Location	SWMM Node	Drainage Area (acres)	Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Difference (Future Condition - Existing Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	402	10511	292	493	1011	4342	6550	646	961	1428	5278	7590	354	467	417	936	1040	
County Road 20/Bella Rosa Parkway	404	10111	295	496	1014	4343	6529	643	955	1420	5274	7574	348	459	406	931	1045	
County Road 18/Godding Hollow Parkway	410	9140	289	484	963	4232	6400	641	924	1360	5168	7439	351	440	397	936	1038	New culvert crossing of Godding Hollow Parkway built in 2015 due to previous culvert failure during 2013 flood.
County Road 16/Tipple Parkway	414	7583	265	432	881	3900	5885	561	798	1220	4718	6771	296	366	339	818	886	New culvert crossing of Tipple Parkway built in 2018 due to previous culvert failure during 2013 flood.
Confluence with Erie Tributary	415	7181	266	432	872	3831	5753	545	773	1210	4582	6549	279	341	338	751	796	
State Highway 52 Frederick/Dacono Boundary	418	4226	194	316	662	2960	4450	430	612	915	3489	4960	237	296	253	528	510	1999 Study modeled significant inadvertent detention south of HWY 52. Existing Condition 2021 OSP model did not account for this inadvertent detention as this area has not officially been identified for detention purposes.
Lower Boulder Ditch	419	3732	151	249	564	2624	3904	372	528	785	3140	4444	221	279	220	516	539	1999 Study modeled significant inadvertent detention south of Lower Boulder Ditch. Existing Condition 2021 OSP model did not account for this inadvertent detention as this area has not officially been identified for detention purposes.
Confluence with York Tributary	983	3501	153	247	554	2517	3723	353	506	758	2979	4203	200	258	204	462	480	
County Road 12/Grandview Blvd	423	2107	110	153	395	1581	2293	205	312	508	1898	2667	95	159	113	317	374	
Confluence with Southeastern Tributary	925	1969	54	123	350	1479	2150	185	284	469	1810	2541	131	160	119	331	391	
Confluence with I-25 Tributary	428	1527	42	98	279	1159	1665	121	190	348	1390	1943	79	92	68	231	278	
I-25 Tributary, East of I-25/ Dacono Planning Boundary	929	558	9	27	102	451	644	9	27	102	451	644	0	0	0	0	0	1999 Study assumed flow on western side of I-25 would be conveyed through this crossing. 2021 OSP study incorporated an additional crossing of I-25 as constructed as part of I-25 widening project to reduce flows reaching this location. Existing condition flows are inflows from Erie OSP.
County Road 10/Speedway Blvd	503	919	36	75	181	696	988	106	157	247	927	1272	70	82	65	231	284	
Interstate 25, North of County Road 8/ Dacono Planning Boundary	P-970	466	20	45	109	419	585	20	45	109	419	585	0	0	0	0	0	Existing Condition inflows from Erie OSP.
Erie Tributary																		
Eastern I-25 Frontage Road, North of Highway 52	467	2475	154	224	329	1147	1715	202	279	357	1269	1878	48	54	28	121	162	
West Side of Interstate 25, North of Highway 52	462	2172	143	206	295	1005	1515	174	242	308	1095	1638	32	35	12	90	123	1999 Study modeled significant inadvertent detention west of I-25 due to a small crossing pipe of I-25. The I-25 widening project enlarged this crossing with three large box culverts that do not create inadvertent detention storage as part of the OSP study.
State Highway 52/ Frederick Planning Boundary	P-675	1270	19	55	167	765	1158	29	69	182	794	1192	10	14	15	29	33	Existing Condition inflows from Erie OSP.
Western Tributary																		
West Side of I-25, South of HWY 119/ Frederick Planning Boundary	431	388	2	5	14	164	279	11	15	19	201	323	9	10	5	37	44	

Appendix D.3. Godding Hollow Proposed Improvement Documentation



Legend

- Proposed Crossing Improvement
- Proposed Pond Improvement
- Proposed Crossing Improvement from Erie OSP
- Area with Proposed Improvement
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

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GODDING HOLLOW
PROPOSED
IMPROVEMENTS
INDEX

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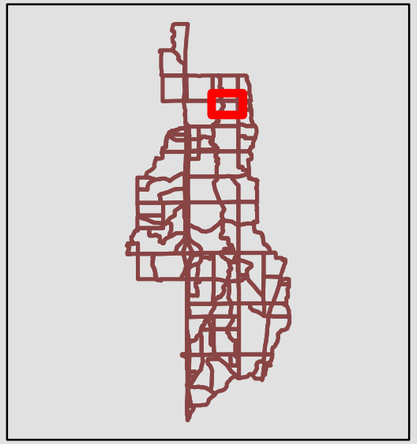
Legend

- Crossing Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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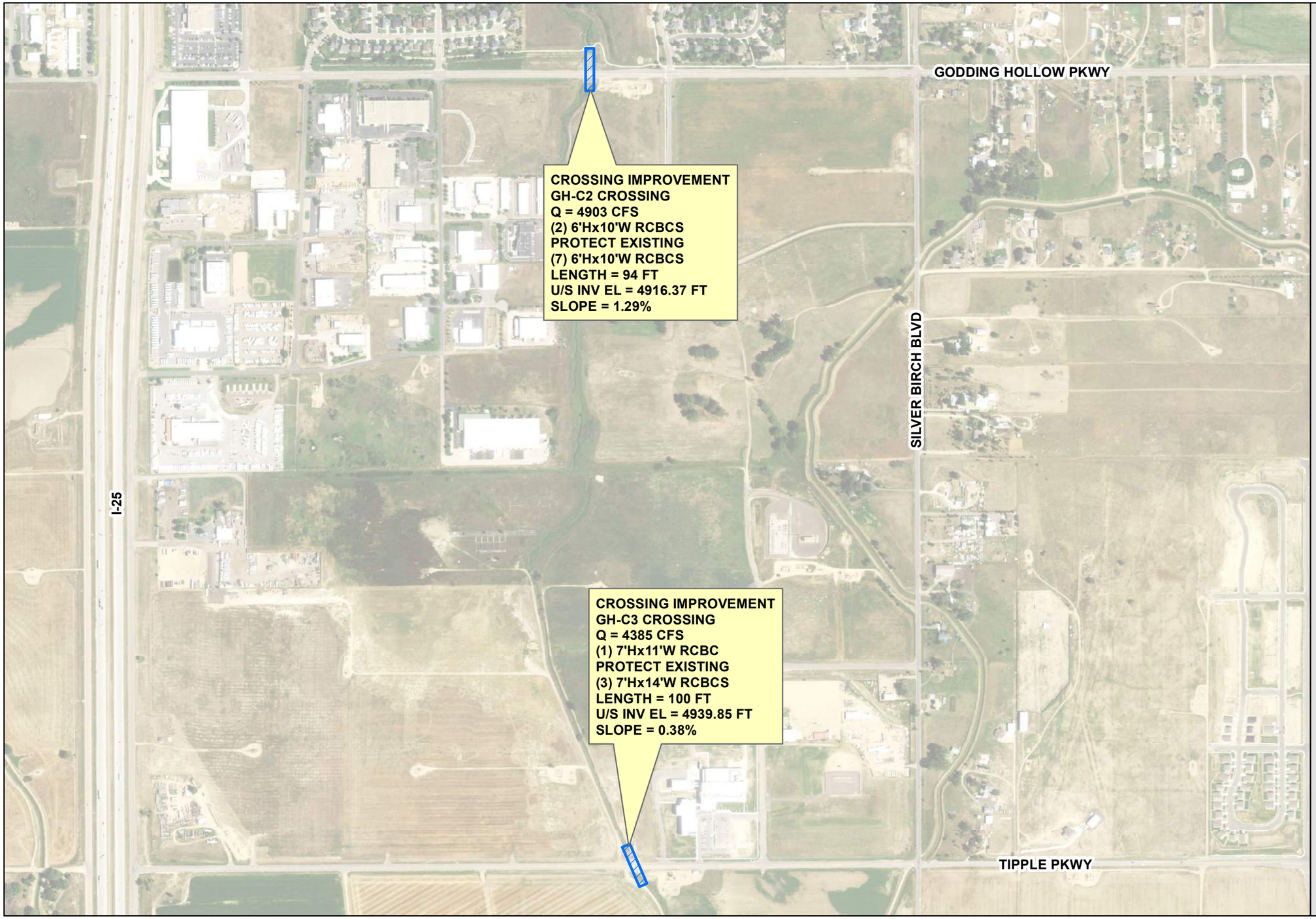
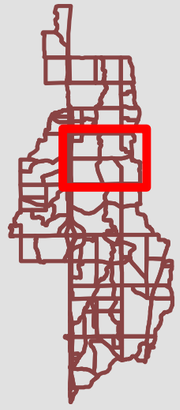


Legend

- Crossing Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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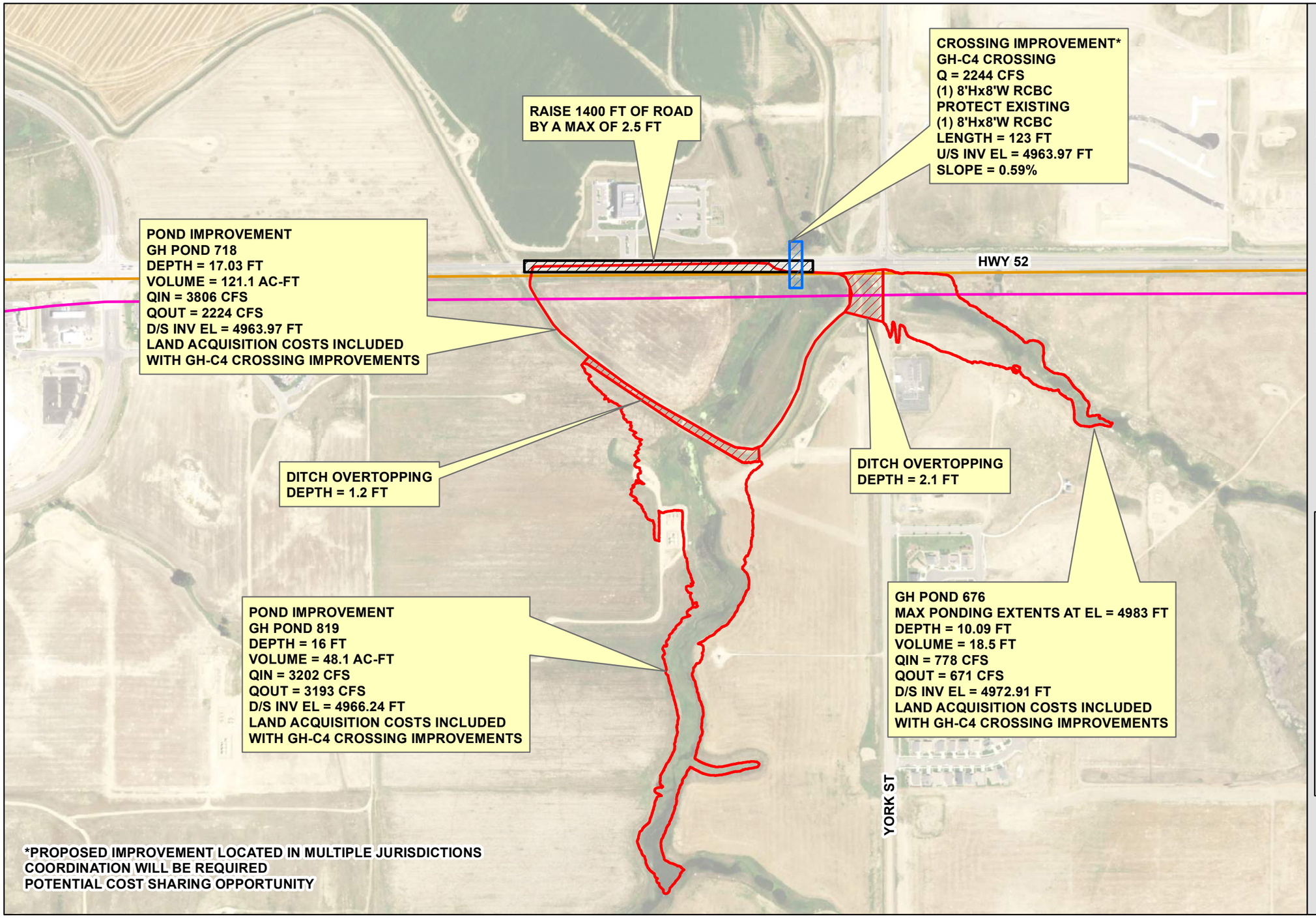
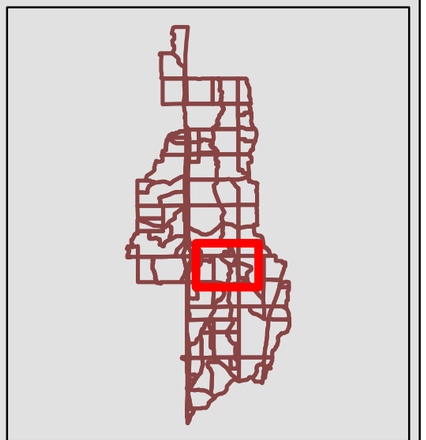


Legend

- Crossing Improvement
- Road Raise
- Lower Boulder Ditch Overtopping Area
- Pond Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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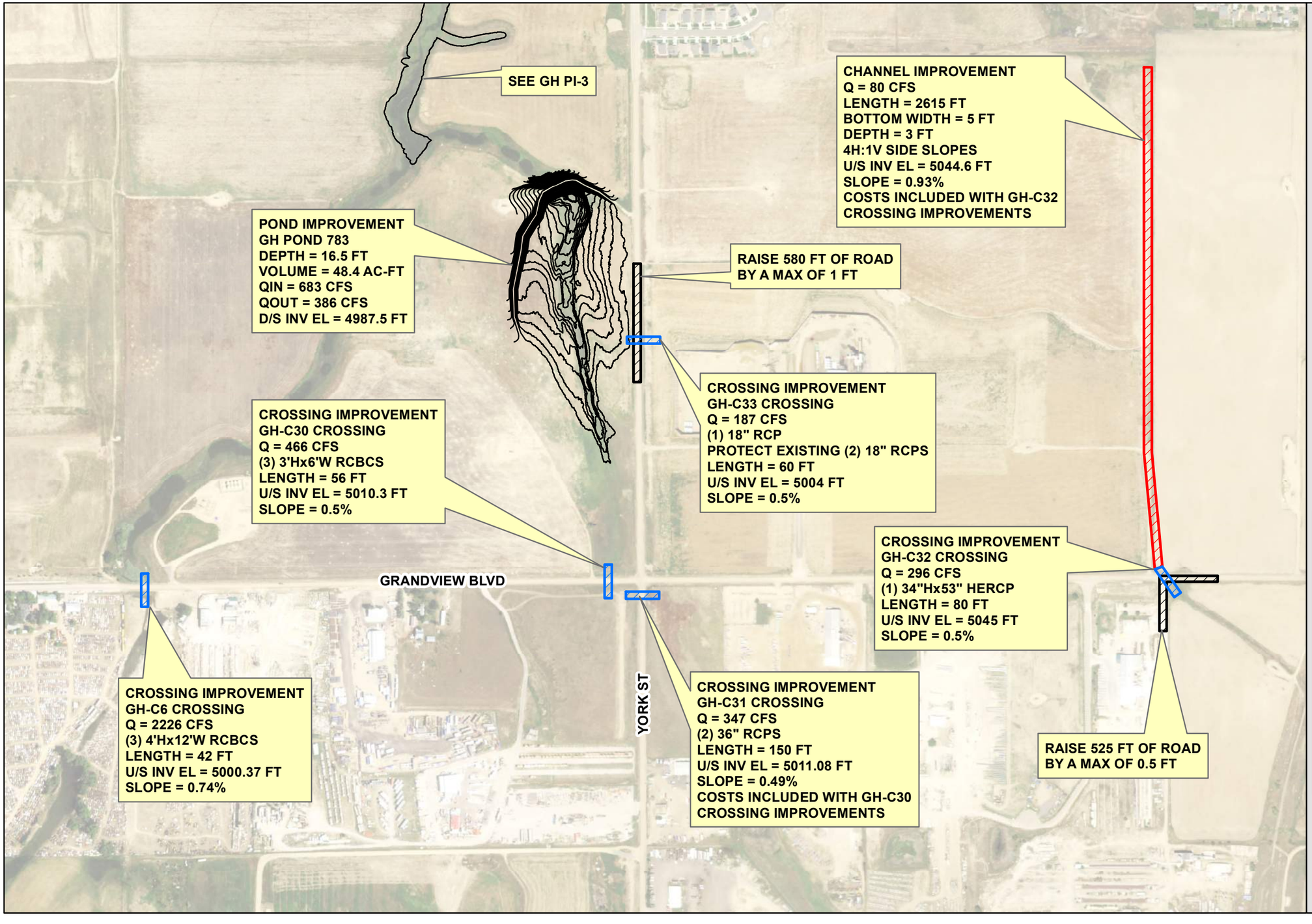

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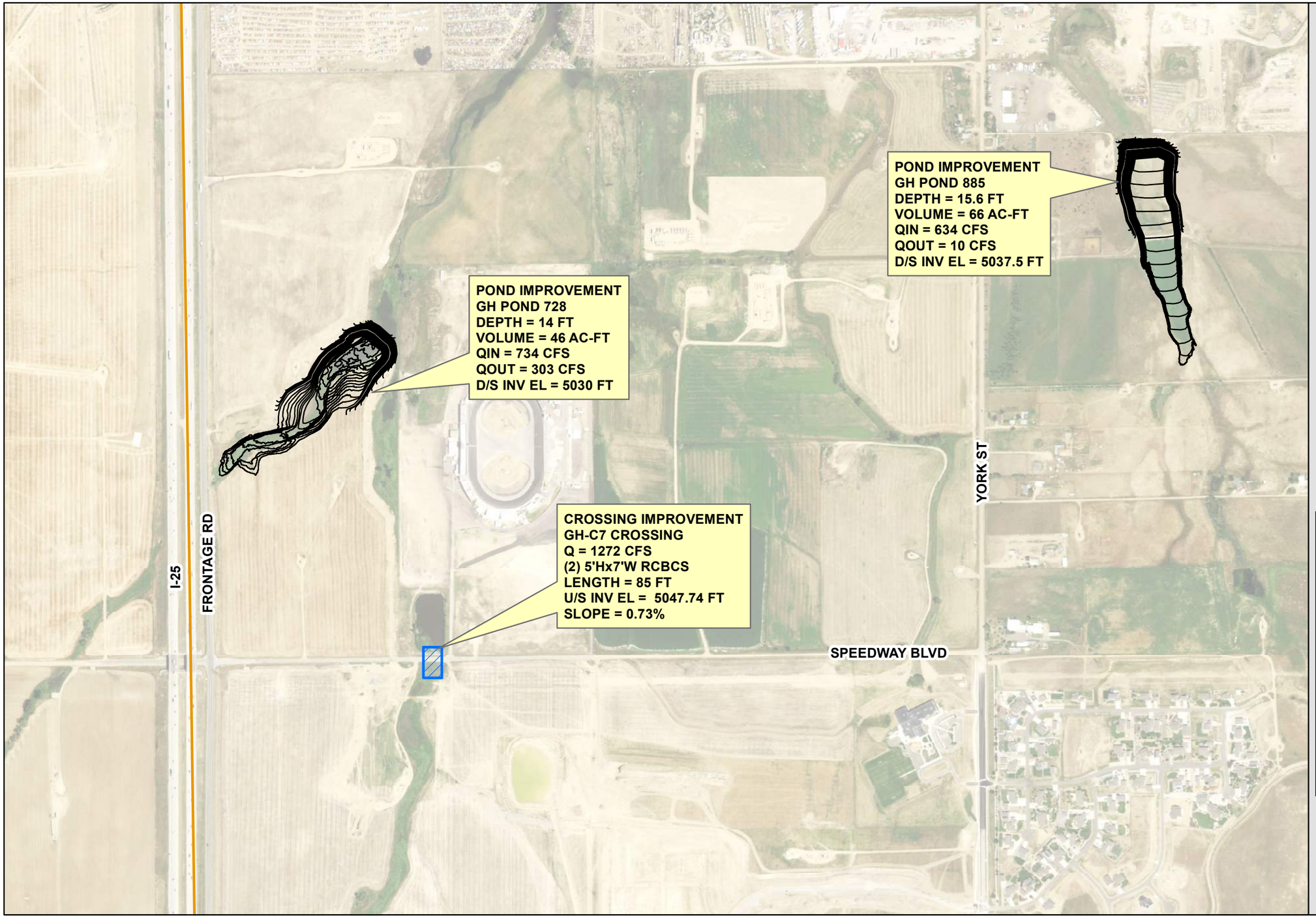
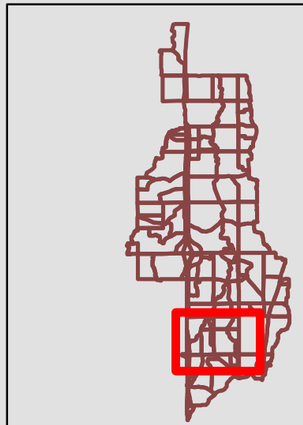


Legend

- Crossing Improvement
- Pond Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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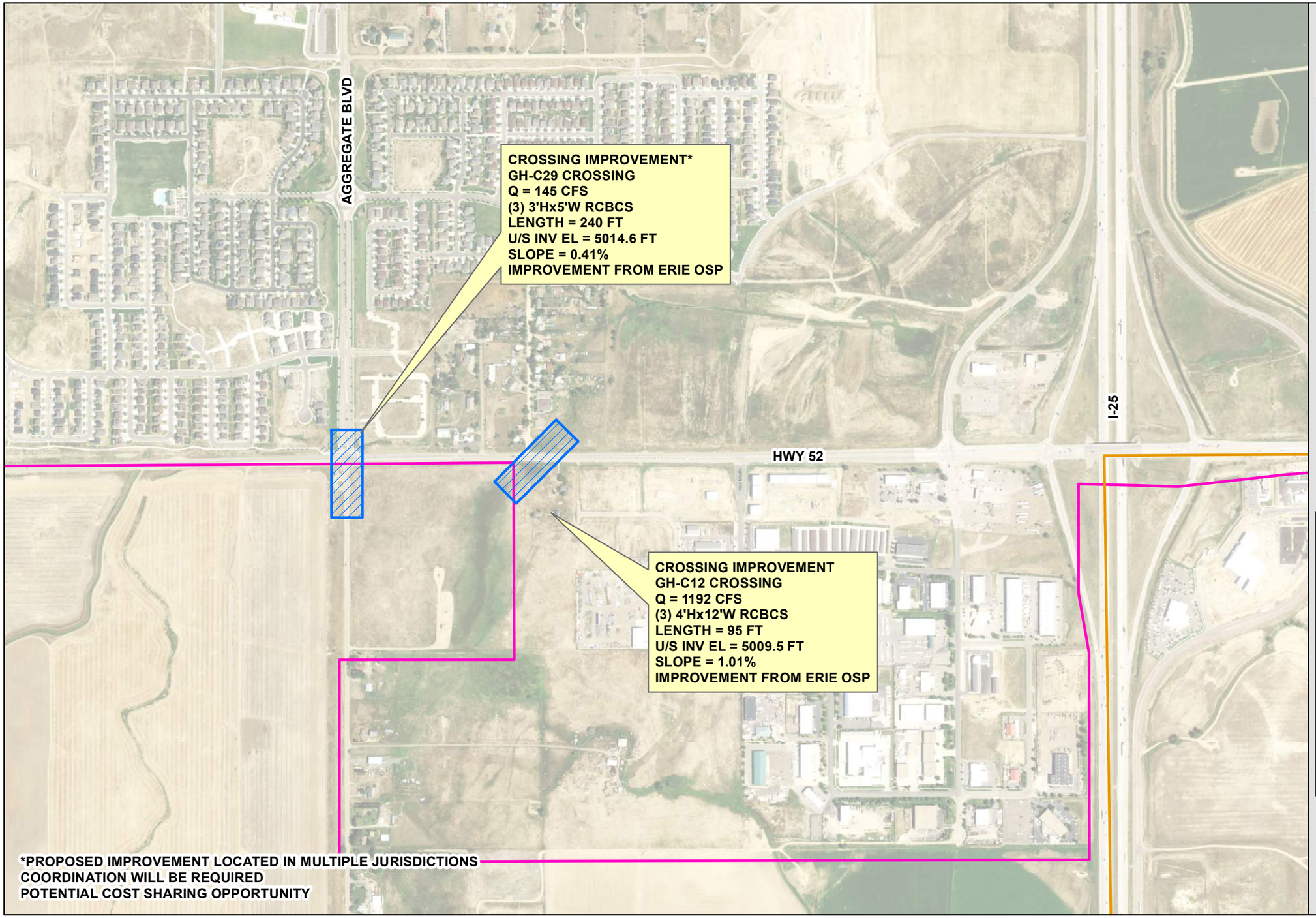
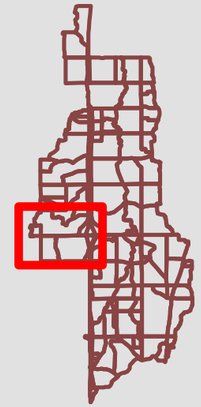


Legend

- Crossing Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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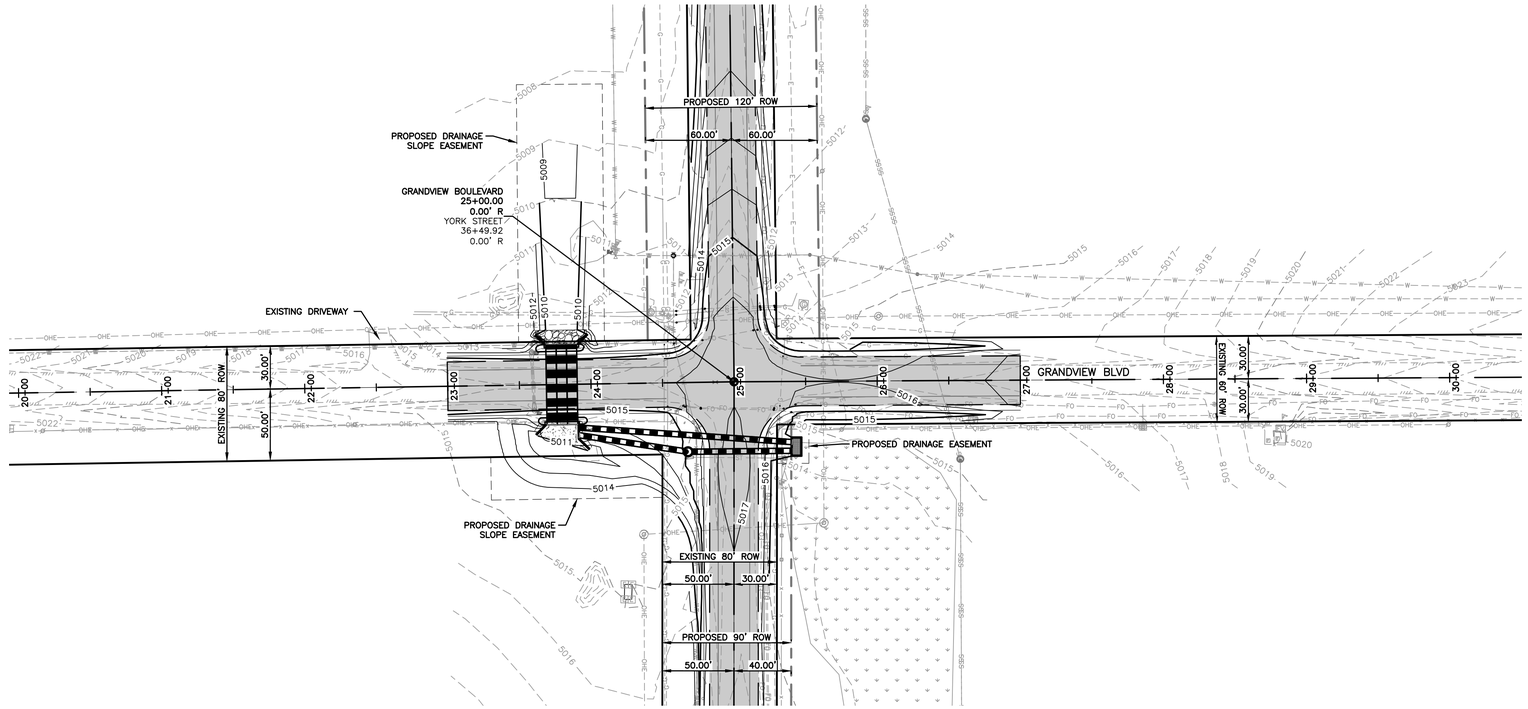
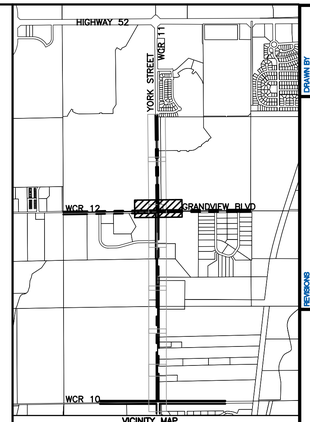
SHEET: GH	INDEX: PI-6





VICINITY MAP
NTS

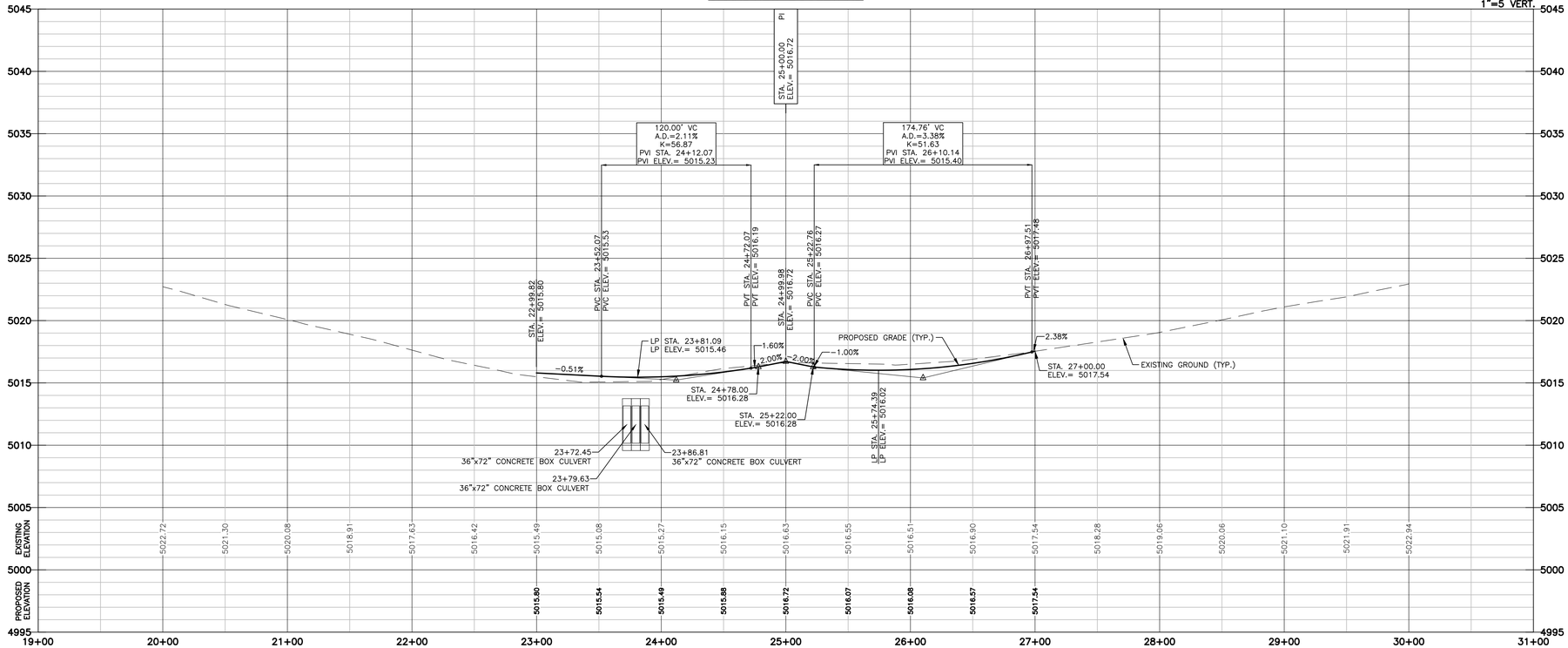
SCALE: 1" = 50'

NOTES:

1. PROFILES SHOWN REPRESENT EXISTING AND PROPOSED GRADE AT ROADWAY CENTERLINES.
2. PROPOSED GRADE SHOWN IN PROFILE IS FINISHED GRADE TO TOP OF PAVEMENT.
3. SEE COVER SHEET FOR TYPICAL ROAD SECTIONS.
   A. RURAL LOCAL: 4" HBP/8" ABC
   B. FUTURE MAJOR COLLECTOR: 4" HBP/6" ABC
   C. FUTURE ARTERIAL: 5" HBP/8" ABC
4. ALL CROSSPANS ARE 8' WIDE UNLESS OTHERWISE NOTED.

GRANDVIEW BOULEVARD

SCALES: 1"=50 HOR.
1"=5 VERT.



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DACONO, COLORADO

YORK STREET IMPROVEMENTS
PLAN AND PROFILE
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60.00' PROPOSED DRAINAGE/SLOPE EASEMENT

4.0:1

4.0:1

PROPOSED RIPRAP APRON

T.O.W.=5010.00
B.O.W.=5010.00

PROPOSED CONCRETE WINGWALL
SEE DETAIL, SHEET 21

T.O.W.=5013.60
B.O.W.=5010.02

T.O.W.=5013.60
B.O.W.=5010.02

T.O.W.=5010.00
B.O.W.=5010.00

PROPOSED CONCRETE WINGWALL
SEE DETAIL, SHEET 21

T.O.W.=5015.70

T.O.W.=5015.70

PROPOSED CONCRETE HEADWALL
SEE DETAIL, SHEET 21

(3) 36"x72" CONCRETE BOX CULVERTS
(SEE PLAN & PROFILE, SHEET 20)

PROPOSED CONCRETE HEADWALL
SEE DETAIL, SHEET 21

T.O.W.=5015.70

T.O.W.=5015.70

T.O.W.=5013.88
B.O.W.=5010.30

PROPOSED CONCRETE WINGWALL
SEE DETAIL, SHEET 21

T.O.W.=5013.88
B.O.W.=5010.30

T.O.W.=5011.38
B.O.W.=5011.38

T.O.W.=5013.88
B.O.W.=5010.53

PROPOSED CONCRETE APRON

PROPOSED CONCRETE WINGWALL
SEE DETAIL, SHEET 21

T.O.W.=5011.28
B.O.W.=5011.28

10.0:1

PROPOSED DRAINAGE/SLOPE EASEMENT

2.03%

1.97%

36+00

2.02%

1.98%

E.O.A.=5015.91

E.O.A.=5015.91

E.O.A.=5015.74

E.O.A.=5015.83

E.O.A.=5015.56

E.O.A.=5015.75

YORK STREET
36+49.92
0.00' R
GRANDVIEW BOULEVARD
25+00.00
0.00' R

G.B.=5016.72

24+00

25+00

26+00

2.00%

E.O.A.=5015.60

E.O.A.=5015.81

E.O.A.=5016.24

E.O.A.=5016.34

PROPOSED 36" RCP
(SEE PLAN & PROFILE, SHEET 20)

E.O.A.=5016.87

E.O.A.=5016.87

1.70%

1.90%

2.00%

37+00

2.00%

N 1269914.66
E 3150844.09
ELEV 5015.00

N 1269914.65
E 3150850.09
ELEV 5015.00

PROPOSED DRAINAGE EASEMENT

PROPOSED 6'x12' MODIFIED AREA INLET
INV. OUT=5011.08
(SEE DETAIL, SHEET 20)

N 1269902.66
E 3150844.09
ELEV 5015.00

N 1269902.65
E 3150850.09
ELEV 5015.00

EXISTING WETLAND

VICINITY MAP
NTS

10 0 10 20
SCALE: 1" = 10'

NOTES:

1. PROFILES SHOWN REPRESENT EXISTING AND PROPOSED GRADE AT ROADWAY CENTERLINES.
2. PROPOSED GRADE SHOWN IN PROFILE IS FINISHED GRADE TO TOP OF PAVEMENT.
3. SEE COVER SHEET FOR TYPICAL ROAD SECTIONS.
   A. RURAL LOCAL: 4" HBP/8" ABC
   B. FUTURE MAJOR COLLECTOR: 4" HBP/6" ABC
   C. FUTURE ARTERIAL: 5" HBP/8" ABC
4. ALL CROSSPANS ARE 8' WIDE UNLESS OTHERWISE NOTED.

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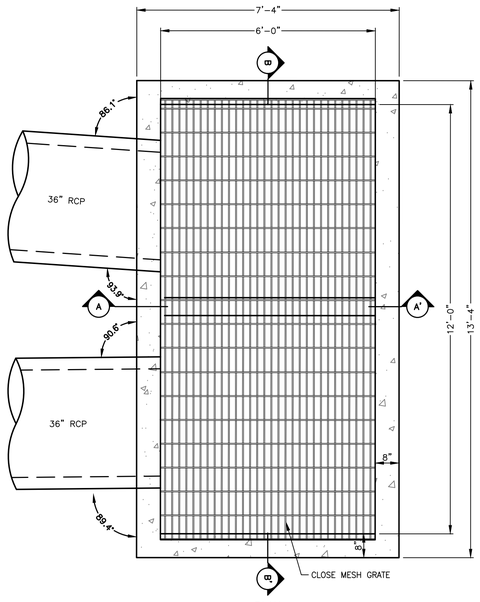
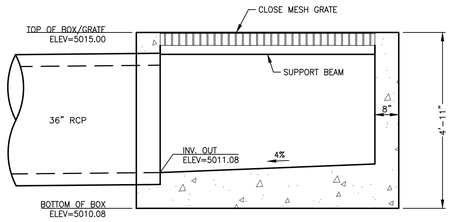
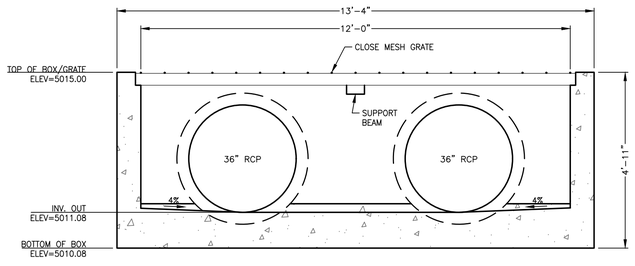


PLAN

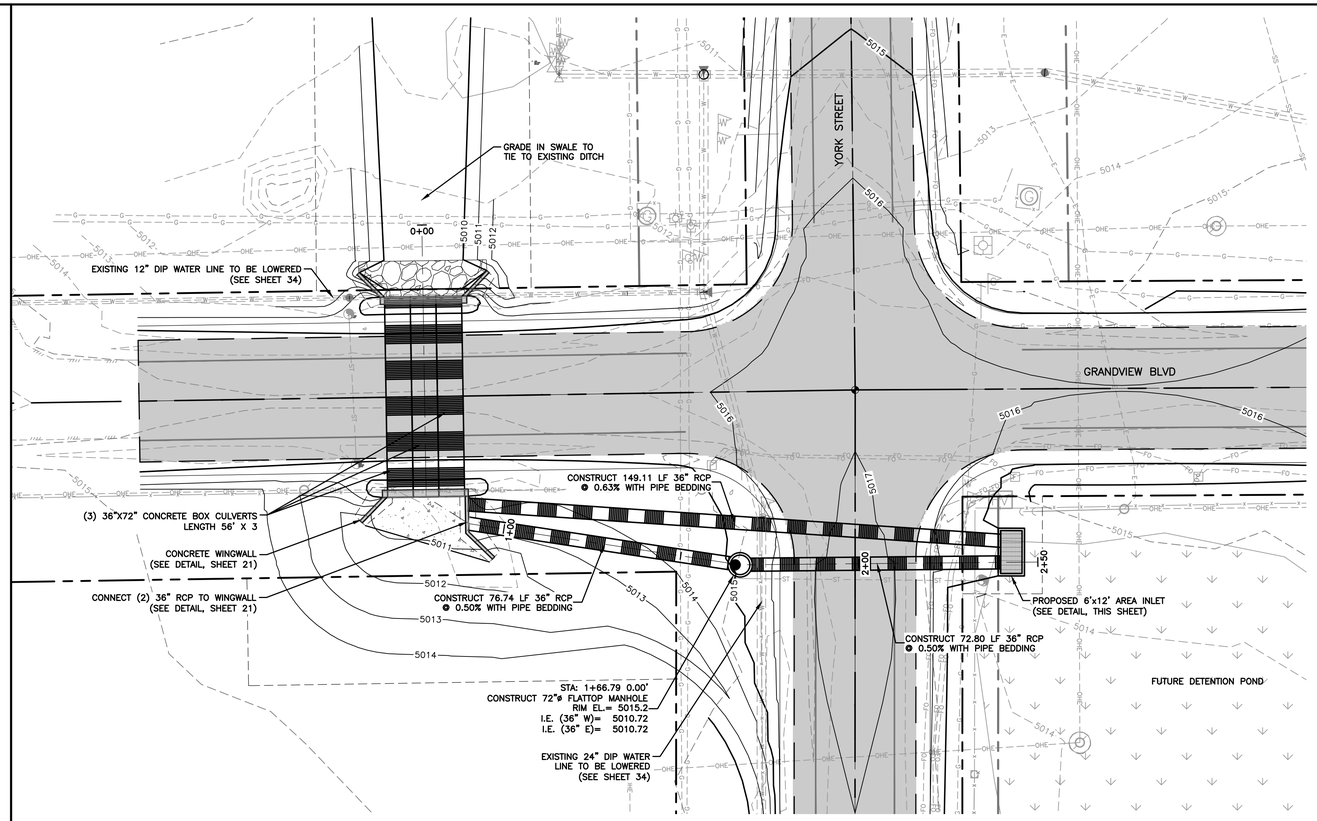


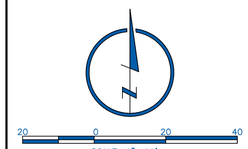
SECTION A–A'

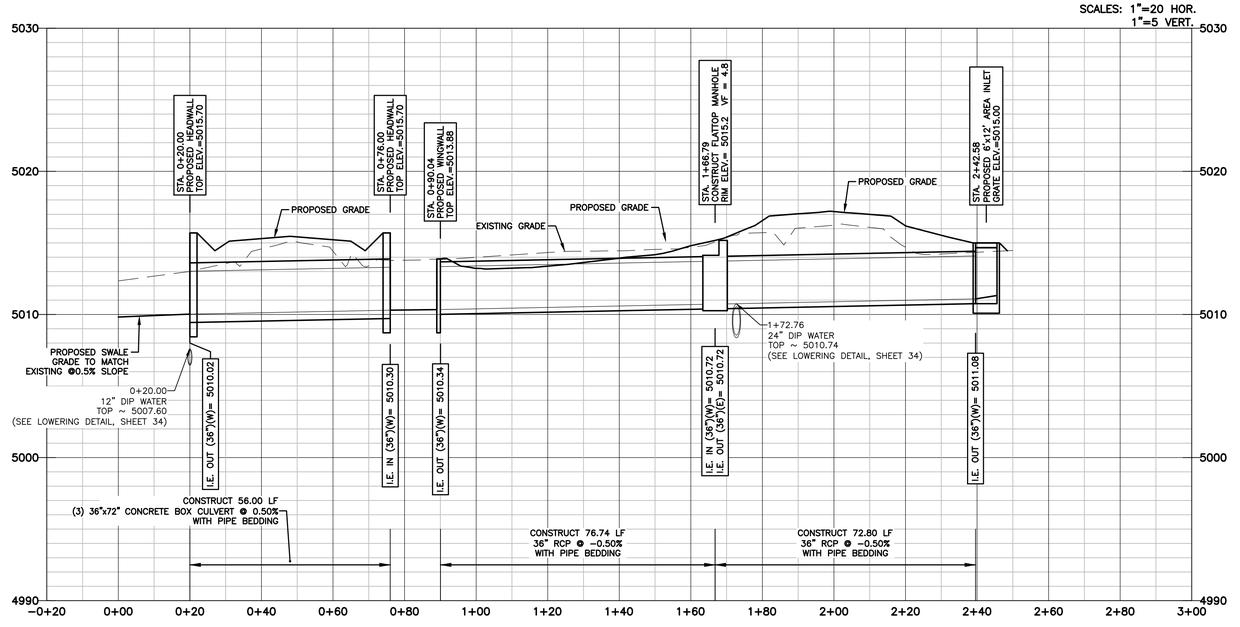


SECTION B–B'

6'x12' AREA INLET DETAIL
SCALE: 1"=2'







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GODDING HOLLOW PROPOSED REGIONAL POND 718

Proposed Regional Pond in Basin 18 (Upstream of Highway 52 with Additional 8' H X 8' W RCBC, Road Raised)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4963.97	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4964.00	39	0.00	0.03	0	0.00	1.07	0.00	1.07	
4965.0	1462	0.03	1.03	502	0.01	50.37	0.00	50.37	
4966.0	5652	0.13	2.03	3831	0.09	139.00	0.00	139.00	
4967.0	19503	0.45	3.03	15716	0.36	244.68	0.00	244.68	
4968.0	34829	0.80	4.03	42514	0.98	336.47	0.00	336.47	
4969.0	52493	1.21	5.03	85874	1.97	467.69	0.00	467.69	
4970.0	71202	1.63	6.03	147484	3.39	617.14	0.00	617.14	
4971.0	103402	2.37	7.03	234288	5.38	776.36	0.00	776.36	
4972.0	153883	3.53	8.03	362097	8.31	936.92	0.00	936.92	
4973.0	197246	4.53	9.03	537213	12.33	1205.32	0.00	1205.32	
4974.0	242297	5.56	10.03	756599	17.37	1304.44	0.00	1304.44	
4975.0	321287	7.38	11.03	1037463	23.82	1512.00	0.00	1512.00	
4976.0	434636	9.98	12.03	1414000	32.46	1684.00	0.00	1684.00	
4977.0	622602	14.29	13.03	1939812	44.53	1811.25	0.00	1811.25	
4978.0	775318	17.80	14.03	2637378	60.55	1930.00	0.00	1930.00	
4979.0	864869	19.85	15.03	3457063	79.36	2041.05	0.00	2041.05	
4980.0	903813	20.75	16.03	4341333	99.66	2145.00	0.00	2145.00	Raise Road
4981.0	968661	22.24	17.03	5277383	121.15	2244.43	0.00	2244.43	Raise Road/Emergency Spillway Elevation
4982.0	1002915	23.02	18.03	6263121	143.78	2338.72	3859.24	6197.96	

[1]Invert based on survey of existing culvert

[2]Based on 2013 LiDAR contours and conceptual design

[3]Based on HY-8 Analysis with existing 8' H x 8' W RCBC and a proposed additional 8' H x 8' W RCBC

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW PROPOSED REGIONAL POND 728

Proposed Regional Pond in Basin 28

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)	Total Discharge (cfs)	Notes:
5030.00	1515	0.03	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5031.0	17132	0.39	1.00	7914	0.18	8.55	0.00	8.55	
5032.0	37803	0.87	2.00	34709	0.80	28.00	0.00	28.00	
5033.0	52377	1.20	3.00	79602	1.83	56.36	0.00	56.36	
5034.0	66713	1.53	4.00	139002	3.19	89.64	0.00	89.64	
5035.0	87800	2.02	5.00	216018	4.96	126.43	0.00	126.43	
5036.0	112637	2.59	6.00	315979	7.25	160.00	0.00	160.00	
5037.0	129483	2.97	7.00	436941	10.03	188.65	0.00	188.65	
5038.0	148408	3.41	8.00	575779	13.22	213.49	0.00	213.49	
5039.0	174724	4.01	9.00	737167	16.92	235.42	0.00	235.42	
5040.0	197715	4.54	10.00	923268	21.20	255.09	0.00	255.09	
5041.0	231525	5.32	11.00	1137666	26.12	273.33	0.00	273.33	
5042.0	272023	6.24	12.00	1389168	31.89	291.03	0.00	291.03	
5043.0	307527	7.06	13.00	1678762	38.54	306.51	0.00	306.51	
5044.0	344733	7.91	14.00	2004715	46.02	321.79	0.00	321.79	Emergency Spillway Elevation

[1]Invert based on conceptual design

[2]Based on conceptual design

[3]Based on HY-8 Analysis with 60-inch Outlet Pipe

GODDING HOLLOW PROPOSED REGIONAL POND 783

Proposed Regional Pond in Basin 83

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)	Total Discharge (cfs)	Notes:
4987.50	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4988.0	1198	0.03	0.50	200	0.00	4.39	0.00	4.39	
4989.0	1978	0.05	1.50	1772	0.04	17.35	0.00	17.35	
4990.0	6823	0.16	2.50	5930	0.14	45.00	0.00	45.00	
4991.0	13066	0.30	3.50	15707	0.36	78.28	0.00	78.28	
4992.0	19617	0.45	4.50	31938	0.73	117.92	0.00	117.92	
4993.0	30815	0.71	5.50	56944	1.31	160.42	0.00	160.42	
4994.0	43670	1.00	6.50	94000	2.16	199.62	0.00	199.62	
4995.0	59410	1.36	7.50	145339	3.34	233.13	0.00	233.13	
4996.0	78398	1.80	8.50	214024	4.91	262.70	0.00	262.70	
4997.0	102745	2.36	9.50	304321	6.99	288.97	0.00	288.97	
4998.0	127584	2.93	10.50	419262	9.62	312.67	0.00	312.67	
4999.0	159207	3.65	11.50	562367	12.91	334.47	0.00	334.47	
5000.0	205862	4.73	12.50	744402	17.09	354.90	0.00	354.90	
5001.0	267552	6.14	13.50	980437	22.51	374.15	0.00	374.15	
5002.0	334991	7.69	14.50	1281077	29.41	392.50	0.00	392.50	
5003.0	412834	9.48	15.50	1654313	37.98	410.00	0.00	410.00	
5004.0	497805	11.43	16.50	2108970	48.42	426.89	0.00	426.89	Emergency Spillway Elevation

[1]Invert based on conceptual design

[2]Based on conceptual design

[3]Based on HY-8 Analysis with 66-inch Outlet Pipe

GODDING HOLLOW PROPOSED REGIONAL POND 819

Proposed Regional Pond in Basin 19 (Upstream of Lower Boulder Ditch)

Stage (NAVD 88)	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4966.24	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
4971.0	10115	0.23	4.76	16050	0.37	182.94	0.00	182.94	
4972.0	33061	0.76	5.76	36538	0.84	243.87	0.00	243.87	
4973.0	62804	1.44	6.76	83682	1.92	309.66	0.00	309.66	
4974.0	90580	2.08	7.76	159951	3.67	381.48	0.00	381.48	
4975.0	113452	2.60	8.76	261753	6.01	448.13	0.00	448.13	
4976.0	135193	3.10	9.76	385916	8.86	508.00	0.00	508.00	
4977.0	159106	3.65	10.76	532904	12.23	562.63	0.00	562.63	
4978.0	179999	4.13	11.76	702349	16.12	613.17	0.00	613.17	
4979.0	220327	5.06	12.76	902173	20.71	660.44	0.00	660.44	
4980.0	285046	6.54	13.76	1154166	26.50	703.91	0.00	703.91	
4980.2	303916	6.98	13.97	1215996	27.92	712.65	0.00	712.65	Ditch Overtopping Elevation
4981.0	374903	8.61	14.76	1483639	34.06	744.88	99.28	844.16	
4982.0	536301	12.31	15.76	1936840	44.46	474.36	1605.99	2080.35	
4983.0	786533	18.06	16.76	2594277	59.56	295.86	6748.78	7044.64	

[1]Invert based on survey of existing culvert

[2]Based on 2013 LiDAR contours

[3]Based on HY-8 Analysis with existing 7' H x 7' W RCBC

[4]Weir flow approximated as a broad crested weir

GODDING HOLLOW PROPOSED REGIONAL POND 885

Proposed Regional Pond in Basin 85

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)	Total Discharge (cfs)	Notes:
5037.50	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5038.0	18140	0.42	0.50	3023	0.07	0.77	0.00	0.77	
5039.0	39405	0.90	1.50	31117	0.71	2.67	0.00	2.67	
5040.0	61777	1.42	2.50	81290	1.87	3.64	0.00	3.64	
5041.0	86893	1.99	3.50	155269	3.56	4.41	0.00	4.41	
5042.0	111875	2.57	4.50	254391	5.84	5.09	0.00	5.09	
5043.0	135395	3.11	5.50	377839	8.67	5.67	0.00	5.67	
5044.0	158818	3.65	6.50	524790	12.05	6.21	0.00	6.21	
5045.0	182668	4.19	7.50	695394	15.96	6.70	0.00	6.70	
5046.0	205142	4.71	8.50	889190	20.41	7.17	0.00	7.17	
5047.0	226813	5.21	9.50	1105077	25.37	7.60	0.00	7.60	
5048.0	247105	5.67	10.50	1341963	30.81	8.02	0.00	8.02	
5049.0	269072	6.18	11.50	1599973	36.73	8.40	0.00	8.40	
5050.0	290257	6.66	12.50	1879571	43.15	8.78	0.00	8.78	
5051.0	312143	7.17	13.50	2180705	50.06	9.14	0.00	9.14	
5052.0	331498	7.61	14.50	2502477	57.45	9.49	0.00	9.49	
5053.0	348259	7.99	15.50	2842321	65.25	9.83	0.00	9.83	
5053.1	349666	8.03	15.60	2877217	66.05	9.86	0.00	9.86	Emergency Spillway Elevation

[1]Invert based on conceptual design

[2]Based on conceptual design

[3]Based on HY-8 Analysis with 12-inch Outlet Pipe

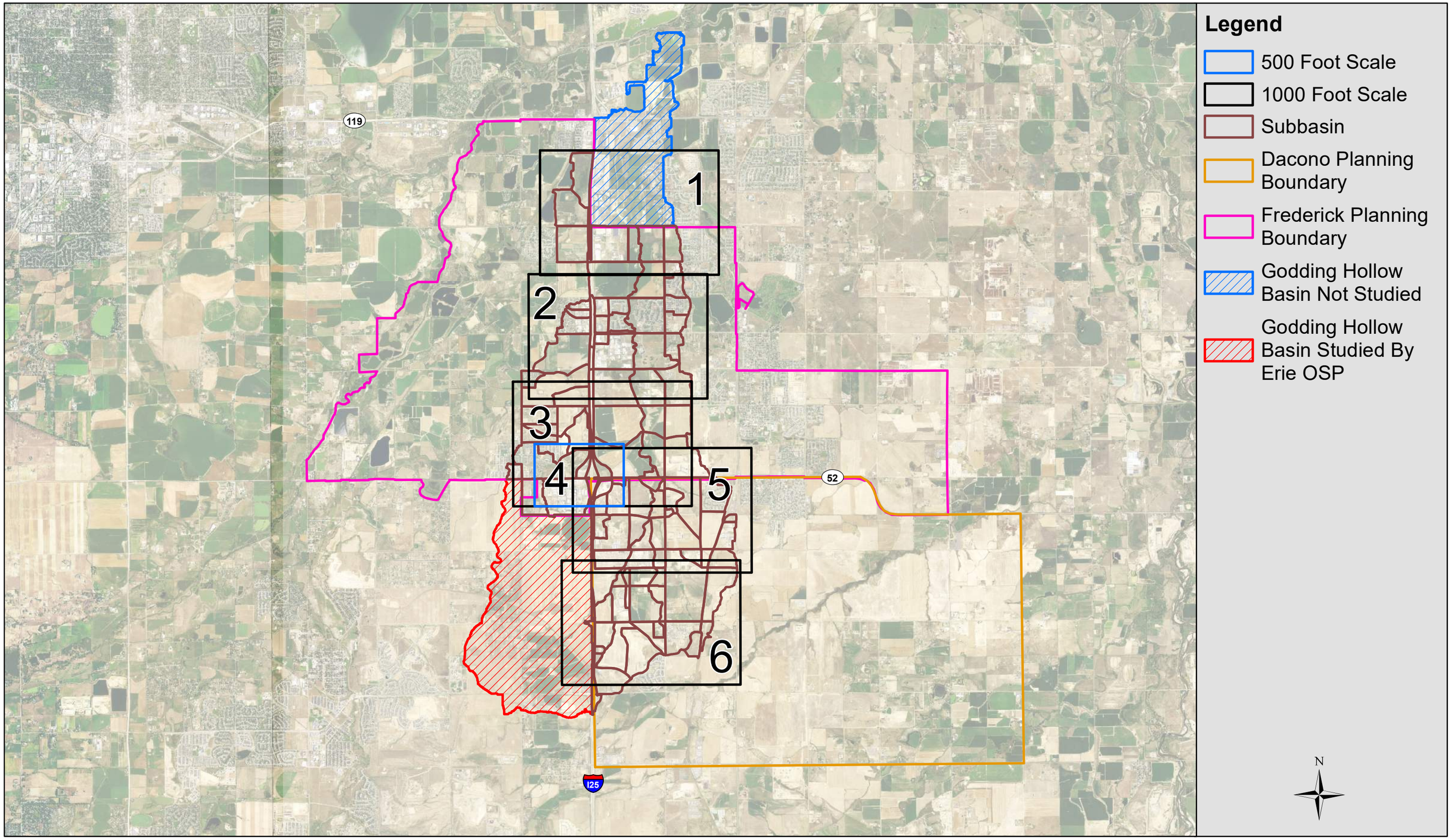
TABLE D.3.1: FUTURE CONDITION WITH PROPOSED IMPROVEMENTS CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
GODDING HOLLOW																				
GH-001	701	0.07869	50.4	0.28149	1486	0.50725	2678	0.0071	10	0.40	0.05	3.82	0.0014	0.67	46.72	0.93	31.82	4.58	2.22	0.99
GH-002	702	0.17091	109.4	0.39099	2064	0.58515	3090	0.0140	25	0.35	0.05	4.59	0.0015	0.72	151.02	1.38	108.88	29.13	18.53	11.35
GH-003	703	0.34210	218.9	0.52332	2763	0.79361	4190	0.0125	40	0.35	0.10	3.82	0.0018	0.55	443.24	2.02	338.70	132.29	84.38	53.08
GH-004	704	0.18744	120.0	0.30473	1609	0.50221	2652	0.0179	25	0.35	0.05	3.54	0.0018	0.54	225.57	1.88	169.38	59.01	33.82	18.76
GH-005	605	0.06291	40.3	0.21942	1159	0.26491	1399	0.0148	24	0.35	0.05	3.95	0.0018	0.56	69.16	1.72	51.95	17.30	9.50	5.44
GH-006	406	0.07109	45.5	0.20845	1101	0.31238	1649	0.0064	22	0.35	0.05	3.72	0.0018	0.55	67.19	1.48	49.83	16.21	8.83	4.86
GH-007	407	0.01550	9.9	0.22594	1193	0.45608	2408	0.0055	26	0.35	0.05	3.44	0.0018	0.53	7.61	0.77	5.48	1.84	1.09	0.60
GH-008	608	0.24347	155.8	0.37503	1980	0.59305	3131	0.0191	23	0.35	0.05	4.08	0.0017	0.59	262.72	1.69	194.91	61.26	31.69	19.37
GH-009	409	0.25288	161.8	0.35889	1895	0.64178	3389	0.0073	70	0.40	0.10	4.00	0.0018	0.58	488.27	3.02	386.72	188.19	141.32	99.58
GH-010	710	0.23840	152.6	0.47396	2503	0.75402	3981	0.0197	32	0.35	0.05	4.52	0.0012	0.79	236.42	1.55	169.59	47.94	34.64	21.87
GH-011	711	0.28844	184.6	0.44586	2354	0.67331	3555	0.0129	69	0.35	0.10	4.26	0.0013	0.76	550.78	2.98	431.67	205.35	158.27	110.48
GH-012	712	0.21051	134.7	0.40985	2164	0.56885	3004	0.0156	61	0.35	0.10	4.24	0.0016	0.64	391.99	2.91	306.81	141.44	103.30	70.88
GH-013	713	0.34368	220.0	0.41644	2199	0.69944	3693	0.0075	43	0.35	0.10	4.12	0.0015	0.67	462.53	2.10	349.13	132.33	89.09	58.41
GH-014	714	0.12545	80.3	0.31176	1646	0.49087	2592	0.0243	30	0.35	0.05	4.67	0.0012	0.81	132.42	1.65	95.04	26.03	18.58	11.44
GH-015	715	0.31768	203.3	0.55237	2916	0.76319	4030	0.0078	56	0.35	0.10	4.18	0.0013	0.75	446.99	2.20	341.21	142.41	107.33	72.40
GH-016	716	0.14518	92.9	0.35955	1898	0.47978	2533	0.0203	32	0.35	0.05	3.91	0.0014	0.69	172.63	1.86	128.51	41.56	26.65	16.65
GH-017	417	0.01902	12.2	0.14914	787	0.27867	1471	0.0103	50	0.40	0.10	4.77	0.0008	0.94	20.30	1.67	15.04	6.09	4.57	3.36
GH-018	718	0.04031	25.8	0.14305	755	0.20214	1067	0.0167	2	0.40	0.05	3.43	0.0016	0.61	38.69	1.50	27.03	3.85	0.44	0.20
GH-019	719	0.14993	96.0	0.36595	1932	0.45041	2378	0.0159	76	0.35	0.10	3.78	0.0014	0.69	337.18	3.51	269.70	139.07	106.96	75.18
GH-020	720	0.06764	43.3	0.26869	1419	0.33148	1750	0.0179	61	0.35	0.05	4.28	0.0011	0.82	121.58	2.81	94.05	43.48	33.76	24.03
GH-021	721	0.07901	50.6	0.22969	1213	0.29447	1555	0.0168	46	0.35	0.05	3.55	0.0015	0.64	139.05	2.75	107.15	45.23	30.65	20.45
GH-022	722	0.06494	41.6	0.34184	1805	0.50145	2648	0.0152	45	0.35	0.05	3.81	0.0016	0.63	77.37	1.86	58.99	23.86	16.12	10.84
GH-023	423	0.12069	77.2	0.34992	1848	0.56972	3008	0.0192	80	0.40	0.05	3.00	0.0018	0.50	259.95	3.37	210.97	114.71	88.85	63.86
GH-024	724	0.09371	60.0	0.29209	1542	0.40415	2134	0.0155	80	0.35	0.10	3.91	0.0013	0.73	208.03	3.47	166.51	87.77	68.55	48.60
GH-025	725	0.14093	90.2	0.36945	1951	0.47965	2533	0.0154	74	0.35	0.10	3.00	0.0018	0.50	304.04	3.37	245.31	128.45	96.56	66.26
GH-026	726	0.02763	17.7	0.17058	901	0.25456	1344	0.0187	80	0.35	0.10	3.00	0.0018	0.50	60.88	3.44	48.88	26.54	20.45	14.34
GH-027	727	0.10760	68.9	0.32445	1713	0.57466	3034	0.0184	80	0.35	0.10	3.00	0.0018	0.50	225.93	3.28	183.30	98.57	75.50	52.62
GH-028	728	0.07907	50.6	0.27374	1445	0.44067	2327	0.0153	77	0.40	0.05	3.00	0.0018	0.50	165.95	3.28	133.89	71.77	55.08	39.44
GH-029	429	0.01316	8.4	0.05480	289	0.21101	1114	0.0148	50	0.40	0.10	3.00	0.0018	0.50	24.66	2.93	19.12	8.55	5.64	3.76
GH-030	630	0.04082	26.1	0.13347	705	0.21656	1143	0.0091	32	0.35	0.05	3.96	0.0018	0.56	54.66	2.09	41.75	15.20	9.13	5.50
GH-031	731	0.18591	119.0	0.40109	2118	0.59196	3126	0.0021	60	0.35	0.10	3.42	0.0016	0.59	252.89	2.13	198.17	89.85	64.18	44.19
GH-032	732	0.20103	128.7	0.31863	1682	0.61598	3252	0.0101	25	0.35	0.05	4.17	0.0013	0.76	178.19	1.38	127.02	31.66	21.77	13.13
GH-033	733	0.21882	140.0	0.35645	1882	0.52453	2770	0.0301	35	0.35	0.05	4.56	0.0014	0.72	320.32	2.29	237.72	77.49	52.90	34.21
GH-034	434	0.26541	169.9	0.27234	1438	0.52254	2759	0.0101	65	0.40	0.10	4.59	0.0014	0.75	577.86	3.40	450.88	210.55	162.18	113.24
GH-035	735	0.11085	70.9	0.18342	968	0.37938	2003	0.0183	31	0.35	0.05	4.52	0.0017	0.64	160.11	2.26	120.27	40.63	24.07	15.19
GH-036	736	0.04720	30.2	0.17756	938	0.25563	1350	0.0183	30	0.35	0.05	4.20	0.0012	0.79	53.04	1.76	38.27	10.35	7.41	4.57
GH-037	637	0.07837	50.2	0.17220	909	0.29108	1537	0.0178	24	0.35	0.05	4.58	0.0014	0.75	90.20	1.80	65.12	15.97	10.79	6.49
GH-038	438	0.08298	53.1	0.20737	1095	0.37640	1987	0.0103	27	0.35	0.05	4.50	0.0018	0.60	87.91	1.66	64.88	21.36	11.74	7.39
GH-039	739	0.07759	49.7	0.21686	1145	0.32389	1710	0.0147	30	0.35	0.05	4.11	0.0018	0.57	97.32	1.96	73.94	25.96	15.04	9.05
GH-040	740	0.07735	49.5	0.15809	835	0.31450	1661	0.0164	30	0.35	0.05	4.61	0.0014	0.75	100.43	2.03	73.40	20.98	14.19	8.86
GH-041	441	0.04896	31.3	0.15926	841	0.28782	1520	0.0268	71	0.40	0.10	4.05	0.0018	0.57	116.37	3.71	91.30	46.66	35.06	24.68
GH-042	442	0.04128	26.4	0.17809	940	0.53694	2835	0.0044	56	0.40	0.10	4.17	0.0018	0.58	49.45	1.87	38.16	16.41	11.68	7.98
GH-043	443	0.03208	20.5	0.14955	790	0.24355	1286	0.0193	55	0.35	0.10	3.62	0.0018	0.54	62.01	3.02	48.45	22.55	15.78	10.41
GH-044	444	0.03379	21.6	0.17256	911	0.34362	1814	0.0186	53	0.35	0.10	4.03	0.0016	0.63	52.97	2.45	41.24	18.02	12.52	8.39
GH-045	645	0.04482	28.7	0.14971	790	0.24143	1275	0.0132	64	0.40	0.10	4.50	0.0018	0.60	96.66	3.37	75.42	36.07	26.74	18.43
GH-046	446	0.10733	68.7	0.25647	1354	0.42324	2235	0.0134	51	0.35	0.10	4.64	0.0015	0.72	176.44	2.57	134.98	55.43	40.41	26.73
GH-047	447	0.02730	17.5	0.13244	699	0.17977	949	0.0171	75	0.35	0.10	4.50	0.0018	0.60	64.20	3.67	50.74	26.76	20.20	14.42
GH-048	448	0.01817	11.6	0.14380	759	0.28044	1481	0.0039	50	0.40	0.10	3.30	0.0018	0.53	20.47	1.76	15.68	6.58	4.42	2.99
GH-049	749	0.32146	205.7	0.37885	2000	0.75233	3972	0.0093	38	0.35	0.10	3.90	0.0015	0.66	405.77	1.97	303.88	107.63	69.16	44.94
GH-050	450	0.05542	35.5	0.11462	605	0.24685	1303	0.0161	28	0.35	0.05	3.71	0.0018	0.55	80.99	2.28	61.42	22.00	12.75	7.37
GH-051	751	0.29285	187.4	0.77062	4069	0.93669	4946	0.0102	34	0.35	0.05	3.82	0.0014	0.68	241.63	1.29	177.11	57.98	37.70	23.98
GH-052	452	0.12508	80.0	0.29200	1542	0.38770	2047	0.0144	20	0.40	0.05	3.48	0.0018	0.53	131.56	1.64	96.40	29.01	13.70	8.52
GH-053	453	0.04919	31.5	0.41530	2193	0.70107	3702	0.0057	50	0.40	0.10	3.00	0.0018	0.50	42.14	1.34	32.28	13.54	9.14	6.02
GH-054	754	0.11598	74.2	0.23409	1236	0.44554	2352	0.0158	45	0.35	0.10	3.40	0.0016	0.60	193.79	2.61	149.47	61.70	40.09	26.48
GH-055	755	0.01215	7.8	0.13797	728	0.21856	1154	0.0082	75	0.35	0.10	3.00	0.0018	0.50	19.79	2.55	15.92	8.23	6.23	4.28
GH-056	756	0.09730	62.3	0.27228	1438	0.54075	2855	0.0106	37	0.35	0.05	3.15	0.0018	0.51	118.78	1.91	90.47	36.52	23.61	14.01
GH-057	457	0.05232	33.5	0.18466	975	0.23555	1244	0.0258	20	0.40	0.05	4.00	0.0018	0.57	61.34	1.83	45.52	13.01	6.51	3.92
GH-058	758	0.13531	86.6	0.24525	1295	0.36945	1951	0.0164	51	0.35	0.05	4.06	0.0018	0.57	281.35	3.25	220.01	99.34	68.49	45.94
GH-059	759	0.19875	127.2	0.24918	1316	0.44798	2365	0.0158	35	0.35	0.05	4.41	0.0016	0.65	311.69	2.45	235.34	84.55	52.52	34.06
GH-060	760	0.15829	101.3	0.24130	1274	0.43301	2286	0.0203	30	0.35	0.05	4.16	0.0018	0.58	231.14	2.28	175.47	62.08	35.69	21.63
GH-061	461	0.06125	39.2	0.27221	1437	0.60092	3173	0.0075	10	0.40	0.10	3.24	0.0018	0.52	36.17	0.92	25.54	6.27	2.04	0.93
GH-062	462	0.04350	27.8	0.11048	583	0.22272	1176	0.0119	71	0.40	0.10	3.79	0.0018	0.55	106.09	3.81	83.15	42.83	32.05	22.63
GH-063	763	0.35345	226.2	0.41123	2171	0.88581	4677	0.0117	51	0.40	0.10	3.48	0.0018	0.53	562.46	2.49	437.87	186.91	126.81	84.88
GH-064	664	0.09778	62.6	0.15687	828	0.41229	2177	0.0067	25	0.35	0.05	4.15	0.0018	0.58	105.63	1.69	78.45	26.03	14.21	8.49
GH-065	465	0.07473	47.8	0.31026	1638	0.37547	1982	0.0056	20	0.40	0.05	4.21	0.0018	0.58	53.38	1.12	38.61	10.32	5.37	3.21
GH-066	666	0.26795	171.5	0.30149	1592	0.51975	2744	0.0151	36	0.40	0.05	3.12	0.0018	0.52	430.42	2.51	328.49	126.04	75.80	49.31
GH-067	767	0.04586	29.4	0.20906	1104	0.26352	1391	0.0073	63	0.35	0.10	3.61	0.0016	0.62	78.86	2.69	62.34	29.75	21.51	14.75
GH-068	468	0.00661	4.2	0.11261	595	0.24376	1287	0.0095	31	0.40	0.10	3.00	0.0018	0.50	4.95	1.17	3.70	1.29	0.73	0.43
GH-069	669	0.03997	25.6	0.12053	636	0.20037	1058	0.0267	75	0.40	0.10	3.00	0.0018	0.50	107.53	4.20	89.13	45.41	34.17	24.55
GH-070	770	0.30703	196.5	0.35435	1871	0.62988	3326	0.0170	75	0.35	0.10	3.40	0.0017	0.55	749.26	3.81	604.72	316.08	238.64	166.06
GH-071	471	0.02512	16.1	0.37731	1992	0.68139	3598	0.0140	50	0.40	0.10	3.00	0.0018	0.50	20.89	1.30	16.06	6.72	4.53	2.98
GH-072	772	0.04841	31.0	0.12941	683	0.26752	1412	0.0136	79	0.35	0.10	3.00	0.0018	0.50	121.46	3.92	96.60	53.05	40.92	28.75
GH-073	773	0.13214	84.6	0.21789	1150	0.41558	2194	0.0132	75	0.35	0.10	3.12	0.0018	0.52	328.61	3.89	263.82	140.80	106.74	74.30
GH-074	674	0.05656	36.2	0.17508	924	0.31685	1673	0.0175	80	0.40	0.10	3.25	0.0017	0.56	136.10	3.76	108.27	58.35	45.03	32.20
GH-075	775	0.01305	8.3	0.15525	820	0.21503	1135	0.0274	45	0.35	0.05	3.00	0.0018	0.50	18.46	2.21	14.44	6.26	4.29	2.67
GH-076	776	0.24903	159.4	0.48638	2568	0.95581	5047	0.0129	77	0.35	0.05	3.00	0.0018	0.50	466.16	2.92	376.57	199.64	154.56	109.66
GH-077	677	0.16887	108.1	0.19105	1009	0.41268	2179	0.0090	52	0.35	0.05	3.00	0.0018	0.50	370.68	3.43	291.66	138.11	96.48	62.26
GH-078	778	0.14249	91.2	0.29000	1531	0.44274	2338	0.0128	74	0.35	0.10	3.00	0.0018	0.50	333.64	3.66	268.16	141.41	106.48	73.23
GH-079	479	0.08475	54.2	0.20686	1092	0.34733	1834	0.0228	80	0.40	0.10	3.00	0.0018	0.50	217.44	4.01	172.90	94.48	72.34	51.81
GH-080	480	0.01552	9.9	0.10879	574	0.14676	775	0.0072	79	0.40	0.05	3.00	0.0018	0.50	33.36	3.36	26.75	14.60	11.28	8.16
GH-081	681	0.05869	37.6	0.16097	850	0.33016	1743	0.0101	79	0.40	0.05	3.00	0.0018	0.50	137.51	3.66	110.28	60.34	46.61	33.69
GH-082	782	0.01152	7.4	0.05148	272	0.10932	577	0.0204	75	0.35	0.05	3.00	0.0018	0.50	31.50	4.27	26.36	14.00	10.51	7.33
GH-083	783	0.08579	54.9	0.32887	1736	0.52937	2795	0.0146	46	0.35	0.05	3.77	0.0014	0.69	109.71	2.00	84.24	33.37	23.48	15.82
GH-084	784	0.18087	115.8	0.24786	1309	0.50344	2658	0.0139	70	0.35	0.10	3.28	0.0018	0.52	443.29	3.83	353.59	182.70	135.94	93.06
GH-085	785	0.49645	317.7	0.56447	2980	1.00455	5304	0.0136	63	0.35	0.10	3.47	0.0016	0.61	870.15	2.74	690.45	324.29	233.90	161.28
GH-086	486	0.04885	31.3	0.18602	982	0.31416	1659	0.0148	80	0.40	0.05	3.43	0.0018	0.53	112.25	3.59	89.97	49.21	38.30	27.72
GH-087	787	0.03095	19.8	0.15304	808	0.25410	1342	0.0128	79	0.35	0.10	3.00	0.0018	0.50	68.47	3.46	54.92	29.70	22.82	15.96
GH-088	788	0.08851	56.6	0.22566	1191	0.38114	2012	0.0243	77	0.35	0.10	3.00	0.0018	0.50	219.70	3.88	175.18	95.01	72.69	50.72
GH-089	789	0.20838	133.4	0.36710	1938	0.65032	3434	0.0110	57	0.35	0.10	3.13	0.0018	0.51	372.30	2.79	293.55	137.02	97.57	63.65
GH-090	690	0.17156	109.8	0.40687	2148	0.63849	3371	0.0122	20	0.40	0.05	3.00	0.0018	0.50	149.80	1.36	110.59	34.80	17.15	9.67
GH-091	791	0.03864	24.7	0.15263	806	0.37474	1979	0.0102	58	0.35	0.10	3.15	0.0018	0.51	64.11	2.59	50.62	23.93	16.99	11.09
GH-092	792	0.05456	34.9	0.22714	1199	0.47316	2498	0.0110	28	0.35	0.05	3.29	0.0018	0.52	49.23	1.41	36.75	13.06	7.77	4.33
GH-093	793	0.04062	26.0	0.17182	907	0.25774	1361	0.0209	80	0.35	0.10	4.14	0.0012	0.78	94.16	3.62	74.33	39.24	31.22	22.21
GH-094	794	0.04117	26.3	0.16031	846	0.24218	1279	0.0186	79	0.35	0.05	3.07	0.0018	0.52	100.57	3.82	80.18	44.50	34.71	24.88
GH-095	795	0.06053	38.7	0.22534	1190	0.48235	2547	0.0192	79	0.35	0.05	3.16	0.0017	0.54	127.84	3.30	103.25	56.29	43.69	31.19
GH-096	696	0.19138	122.5	0.35590	1879	0.44035	2325	0.0171	80	0.40	0.10	3.14	0.0017	0.54	486.79	3.97	390.73	210.28	161.44	114.67
GH-097	797	0.08441	54.0	0.22095	1167	0.34004	1795	0.0257	71	0.35	0.05	3.70	0.0014	0.68	201.25	3.73	158.21	82.12	62.85	45.03
GH-098	798	0.18818	120.4	0.37286	1969	0.58656	3097	0.0217	78	0.35	0.05	3.34	0.0016	0.58	447.94	3.72	361.83	195.69	151.09	108.10
GH-099	799	0.07760	49.7	0.24779	1308	0.54786	2893	0.0191	56	0.35	0.05	3.02	0.0018	0.51	132.82	2.67	104.83	49.34	35.56	23.50
GH-100	500	0.02873	18.4	0.10767	568	0.20721	1094	0.0091	23	0.40	0.10	3.37	0.0016	0.59	29.65	1.61	21.90	6.30	3.37	2.03
GH-101	801	0.01868	12.0	0.12278	648	0.23959	1265	0.0216	80	0.40	0.05	3.00	0.0018	0.50	41.65	3.48	33.38	18.35	14.23	10.32
GH-102	802	0.01730	11.1	0.15009	792	0.29328	1549	0.0144	80	0.35	0.10	3.00	0.0018	0.50	31.58	2.85	25.47	13.69	10.52	7.33
GH-103	803	0.08667	55.5	0.22082	1166	0.34759	1835	0.0194	85	0.35	0.10	3.00	0.0018	0.50	222.24	4.01	178.05	100.08	78.45	55.97
GH-104	804	0.17784	113.8	0.36992	1953	0.64333	3397	0.0203	56	0.35	0.10	3.07	0.0018	0.50	328.99	2.89	258.70	120.46	85.73	55.66
GH-105	805	0.22233	142.3	0.45500	2402	0.58955	3113	0.0278	48	0.35	0.05	3.17	0.0018	0.51	397.00	2.79	310.02	138.79	96.11	61.19
GH-106	506	0.01327	8.5	0.08718	460	0.14767	780	0.0294	85	0.40	0.10	3.00	0.0018	0.50	34.36	4.05	28.21	15.35	11.98	8.70
GH-107	807	0.01311	8.4	0.11305	597	0.13626	719	0.0315	84	0.35	0.10	3.00	0.0018	0.50	32.86	3.91	26.52	14.71	11.53	8.23
GH-108	808	0.14785	94.6	0.28388	1499	0.42732	2256	0.0293	85	0.35	0.10	3.82	0.0018	0.55	402.80	4.26	321.81	180.58	141.34	102.10
GH-109	509	0.04724	30.2	0.41357	2184	0.78090	4123	0.0235	50	0.40	0.10	3.36	0.0018	0.52	48.68	1.61	37.40	15.61	10.50	7.09
GH-110	810	0.00734	4.7	0.08836	467	0.20125	1063	0.0091	29	0.35	0.05	3.07	0.0018	0.52	6.31	1.34	4.73	1.71	1.03	0.57
GH-111	511	0.01710	10.9	0.07871	416	0.16611	877	0.0141	75	0.35	0.10	3.72	0.0015	0.66	40.17	3.67	31.62	16.62	12.66	9.02
GH-112	512	0.01918	12.3	0.14630	772	0.27692	1462	0.0239	50	0.40	0.10	3.00	0.0018	0.50	29.41	2.40	22.98	9.99	6.63	4.39
GH-113	513	0.00524	3.4	0.05468	289	0.14352	758	0.0112	50	0.40	0.10	3.00	0.0018	0.50	7.95	2.37	6.21	2.73	1.81	1.19
GH-114	814	0.16069	102.8	0.33470	1767	0.53461	2823	0.0083	75	0.35	0.10	3.06	0.0018	0.51	323.73	3.15	262.32	136.89	103.07	70.84
GH-115	515	0.01431	9.2	0.15502	819	0.21665	1144	0.0142	75	0.35	0.10	3.00	0.0018	0.50	25.80	2.82	20.71	10.89	8.25	5.67
Totals/Averages			**8218.7**						**53**						**185.86**	**2.60**	**144.85**	**65.66**	**47.34**	**32.27**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Basin 18 parameters changed to match existing conditions due to proposed detention pond covering the entire basin.



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OUTFALL SYSTEM PLAN

GODDING HOLLOW
SWMM CONVEYANCE
ELEMENT MAPS

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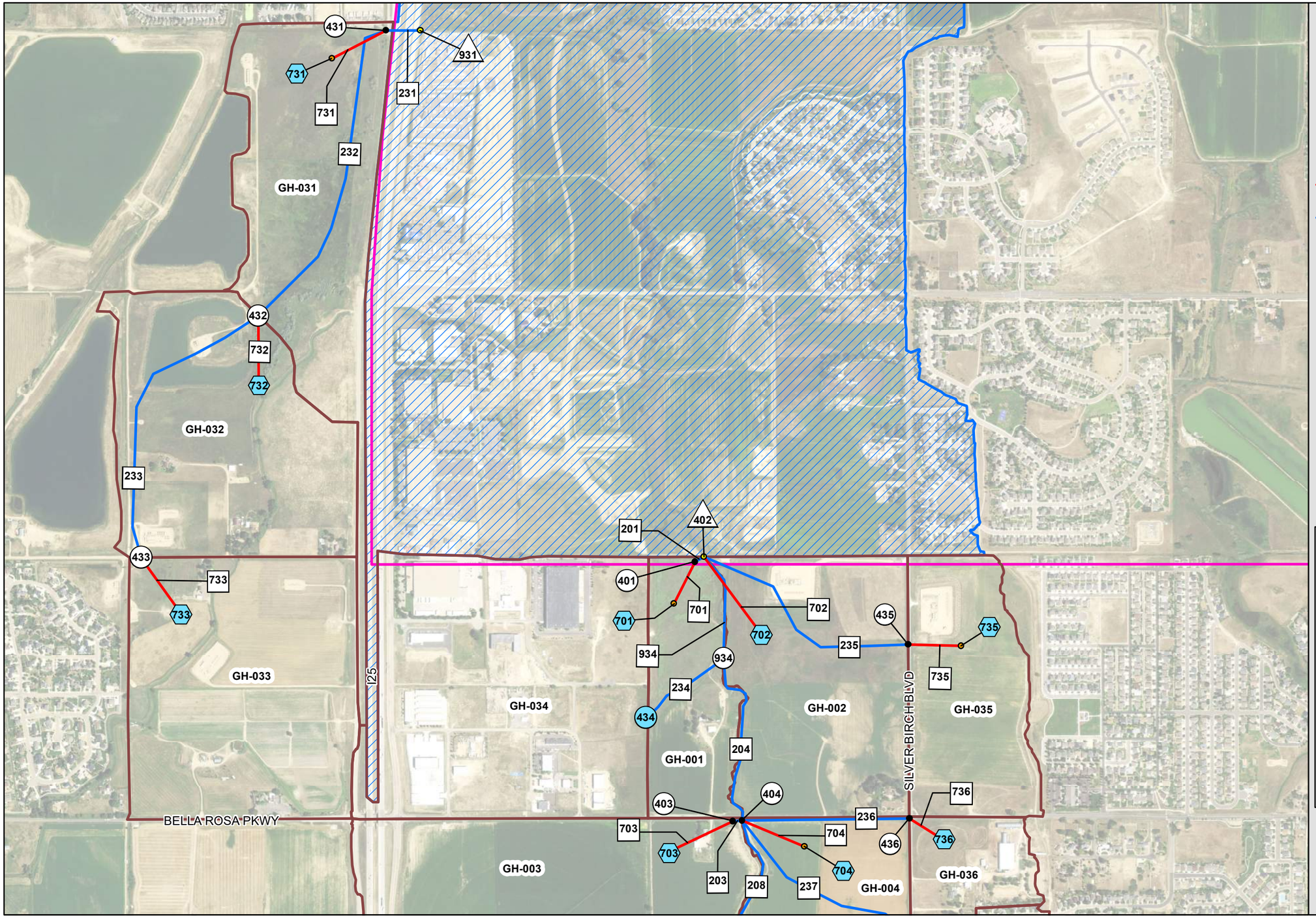
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 8/5/21	
SHEET: GH	INDEX: C-INDEX



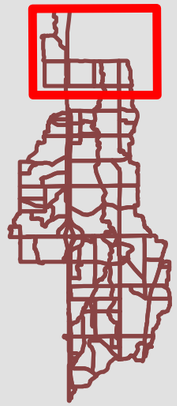
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement Subbasin
- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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GODDING HOLLOW
PROPOSED IMPROVEMENT
SWMM CONVEYANCE
ELEMENT MAPS

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Legend

- Junction
- Flow Diversion Node
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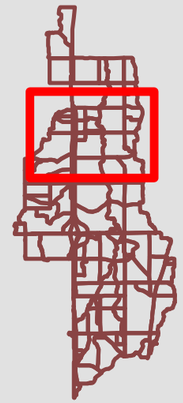
Key Map



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GODDING HOLLOW PKWY

SILVER BIRCH BLVD

I25

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GODDING HOLLOW PROPOSED IMPROVEMENT SWMM CONVEYANCE ELEMENT MAPS

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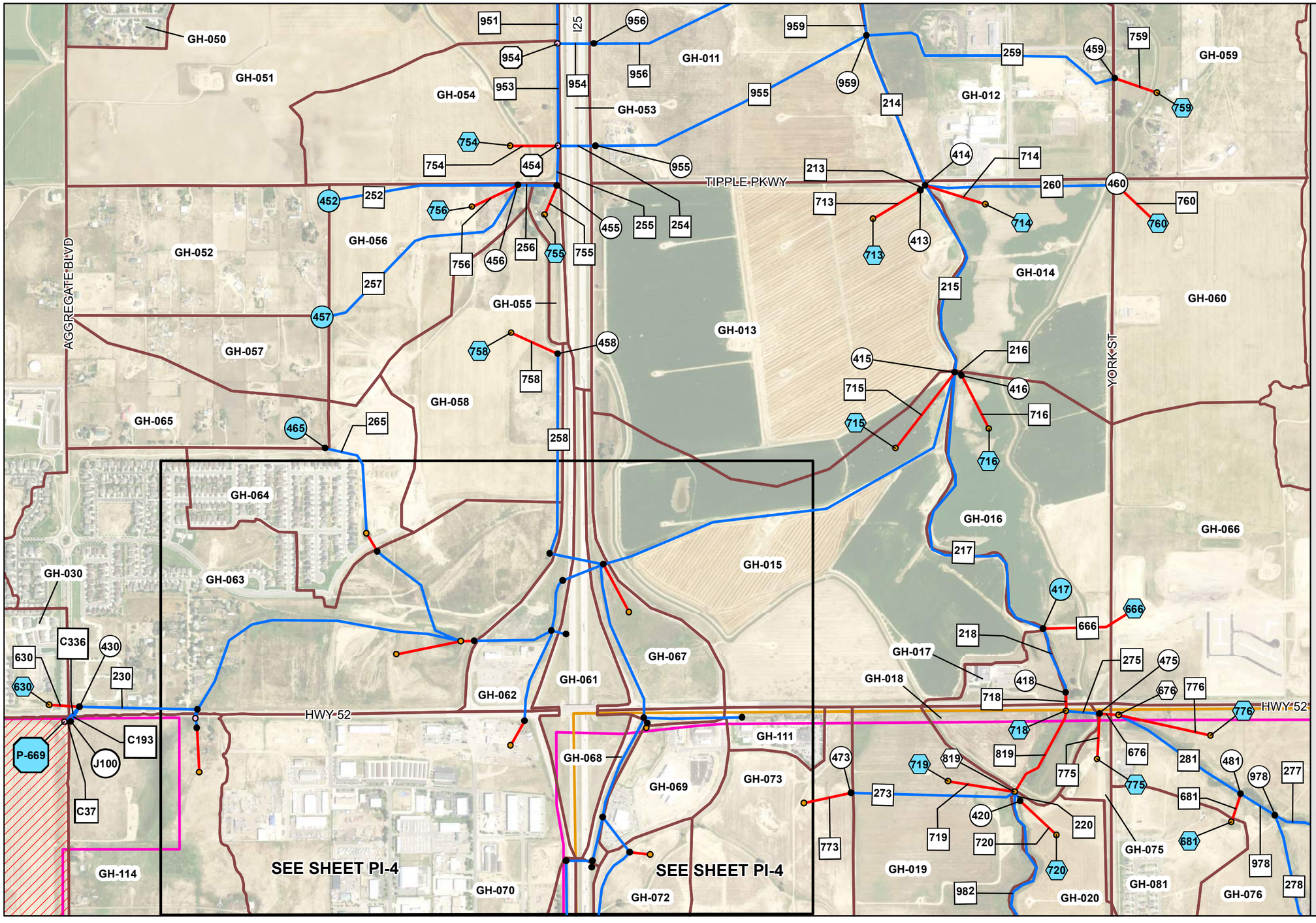
SHEET: GH	INDEX: PI-2



Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

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- Dacono Planning Boundary
- Frederick Planning Boundary
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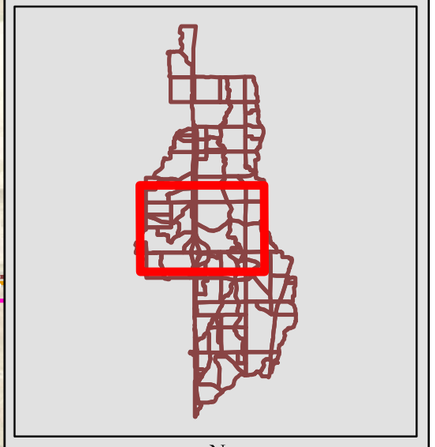
Key Map



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GODDING HOLLOW
PROPOSED IMPROVEMENT
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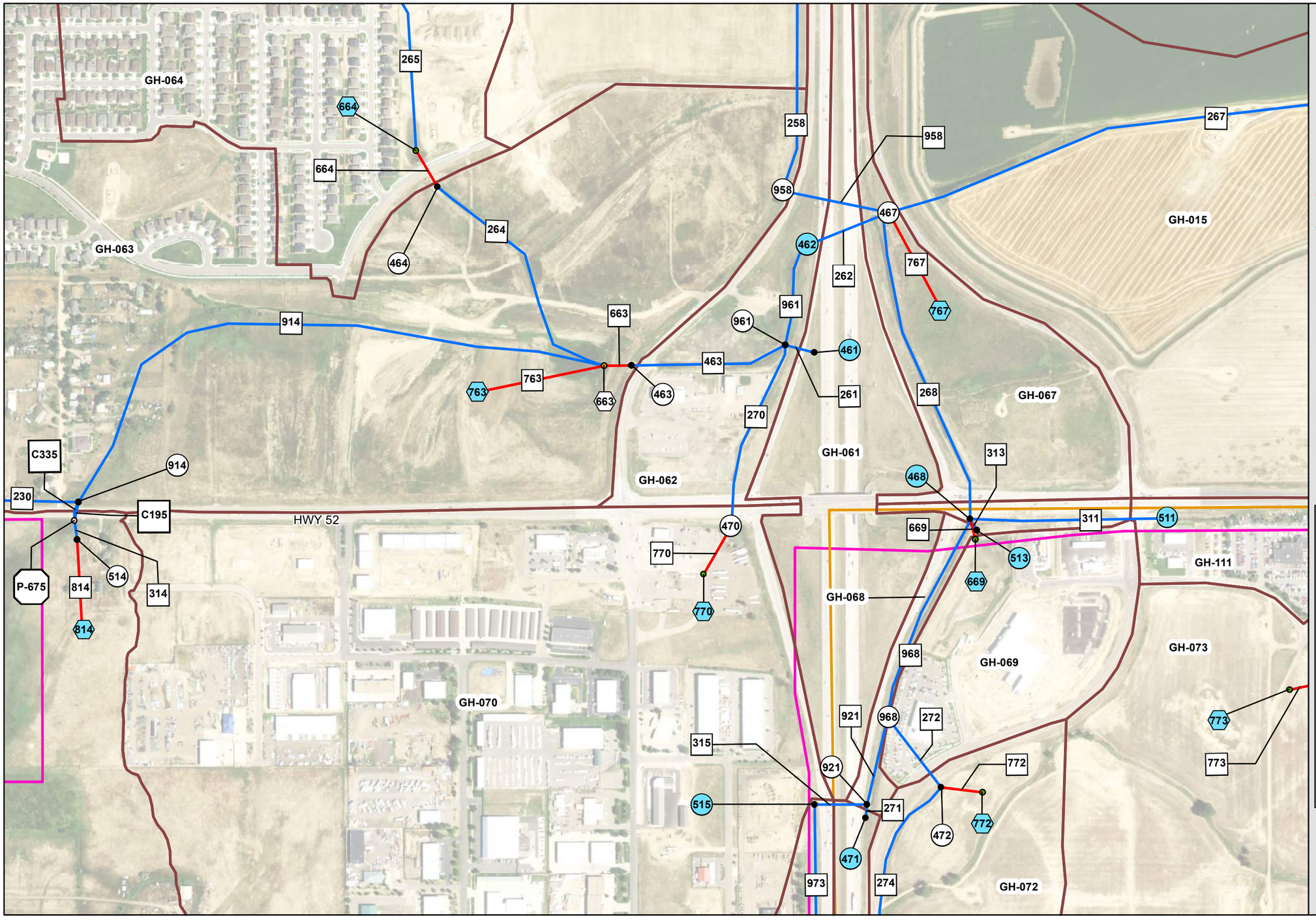


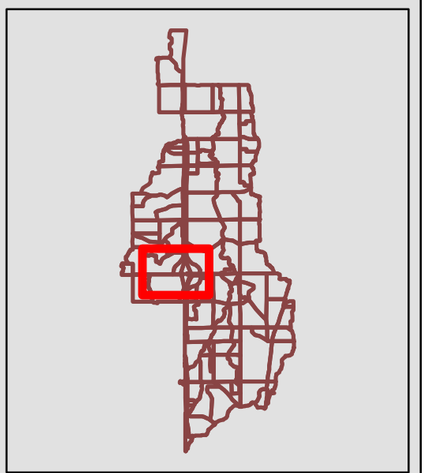
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Godding Hollow Basin Studied By Erie OSP
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied

Key Map



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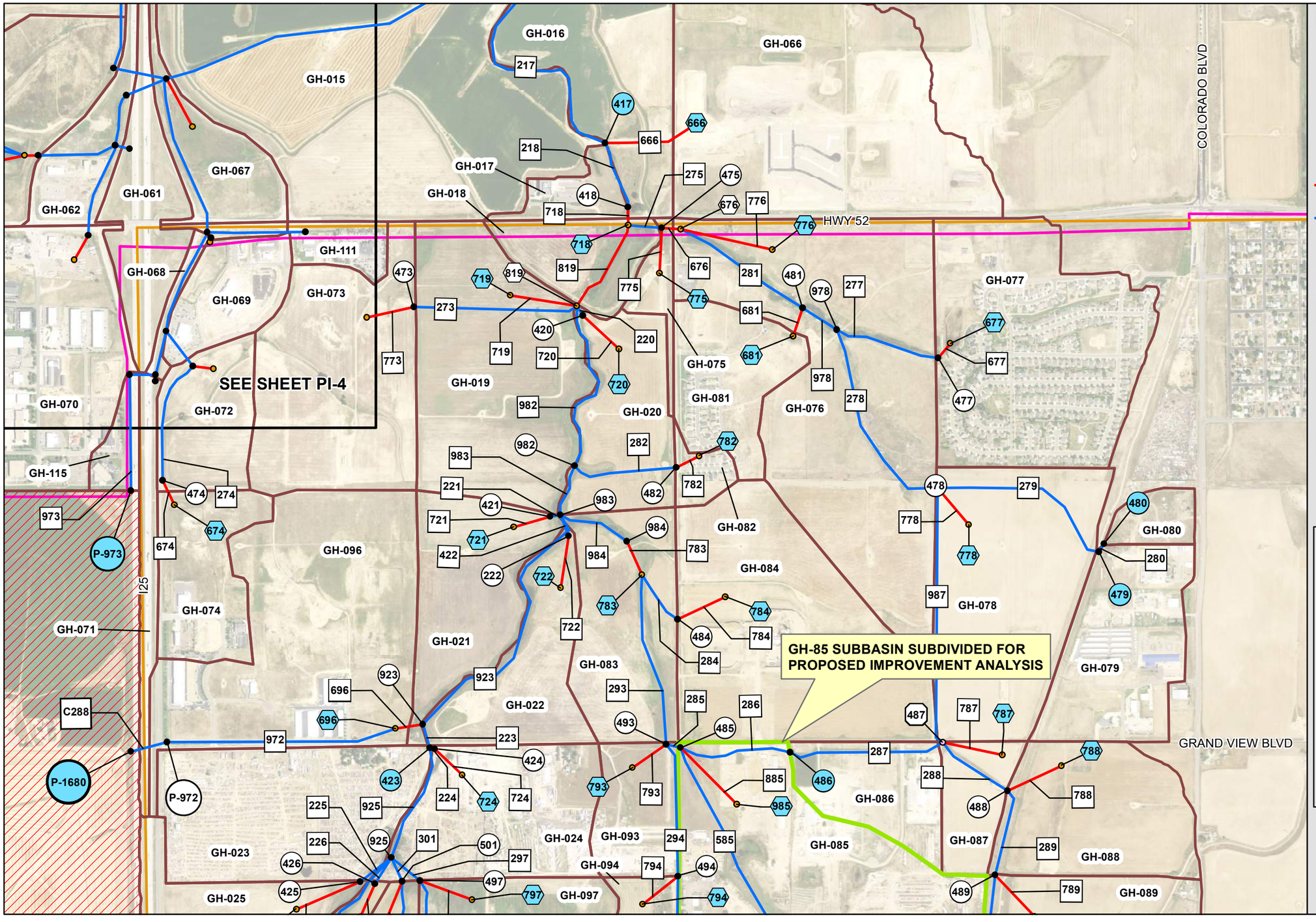

Legend

- Junction
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- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

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- Frederick Planning Boundary
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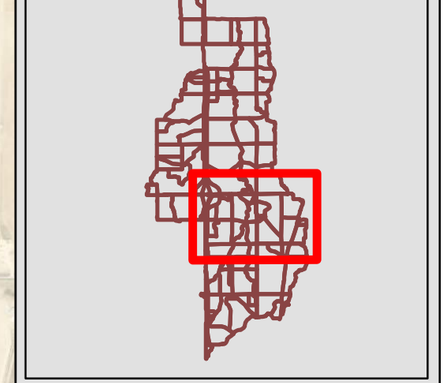
Key Map



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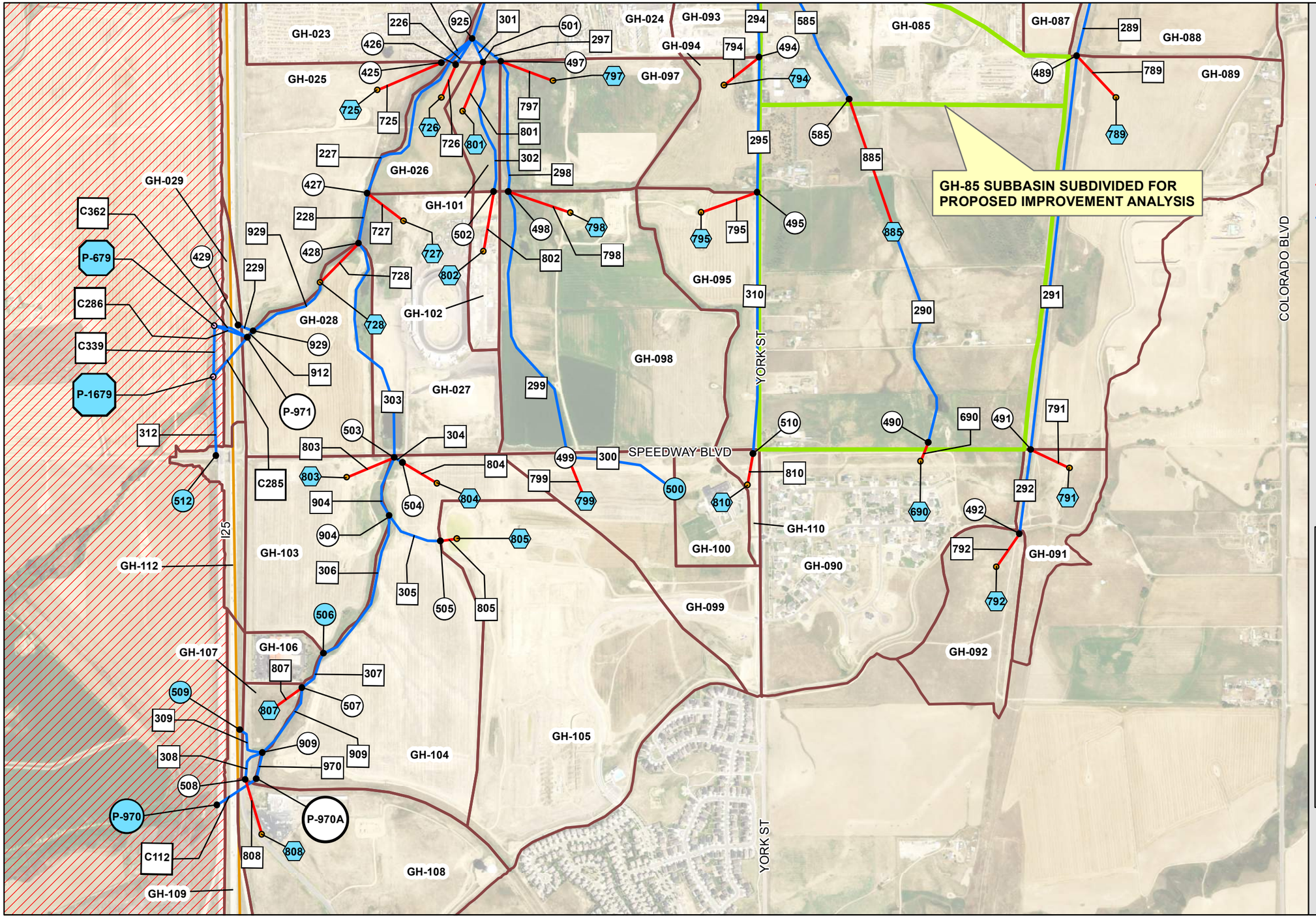

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement Subbasin
- Sheet Callout
- Subbasin
- Godding Hollow Basin Studied By Erie OSP
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Key Map

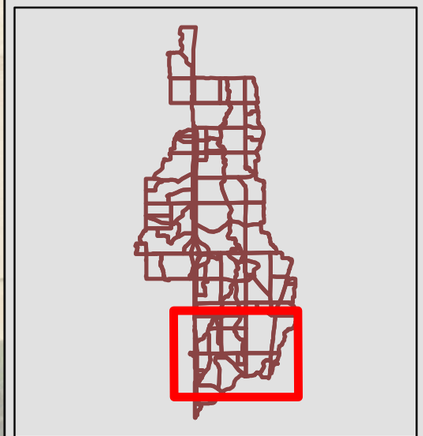

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Table D.3.2: Godding Hollow Basin Peak Discharge Comparison: Future Conditions 2022 OSP and Proposed Improvements 2022 OSP

Location	SWMM Node	Drainage Area (acres)	Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Difference (Proposed Improvements - Future Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Frederick Planning Boundary	402	10511	646	961	1428	5278	7590	595	845	1221	3801	5073	-51	-116	-208	-1477	-2517	
County Road 20/Bella Rosa Parkway	404	10111	643	955	1420	5274	7574	591	838	1210	3796	5059	-53	-117	-210	-1478	-2515	Proposed crossing improvement to eliminate overtopping of Bella Rosa Parkway.
County Road 18/Godding Hollow Parkway	410	9140	641	924	1360	5168	7439	581	803	1161	3684	4903	-60	-121	-199	-1484	-2535	New culvert crossing of Godding Hollow Parkway built in 2015 due to previous culvert failure during 2013 flood. Proposed crossing improvement to eliminate overtopping of Godding Hollow Parkway.
County Road 16/Tipple Parkway	414	7583	561	798	1220	4718	6771	518	704	1065	3345	4385	-43	-94	-154	-1373	-2386	New culvert crossing of Tipple Parkway built in 2018 due to previous culvert failure during 2013 flood. Proposed crossing improvement to eliminate overtopping of Tipple Parkway.
Confluence with Erie Tributary	415	7181	545	773	1210	4582	6549	502	679	1036	3275	4267	-43	-94	-174	-1307	-2282	
State Highway 52 Frederick/Dacono Boundary	418	4226	430	612	915	3489	4960	396	536	713	1951	2244	-34	-75	-202	-1538	-2716	Regional detention pond proposed at HWY 52/Lower Boulder Ditch to reduce flows. Proposed crossing improvement to eliminate overtopping of HWY 52.
Lower Boulder Ditch	419/819	3732	372	528	785	3140	4444	319	461	692	2383	3202	-53	-67	-93	-757	-1242	
Confluence with York Tributary	983	3501	353	506	758	2979	4203	301	439	665	2226	2966	-53	-67	-93	-753	-1237	Upstream regional detention pond proposed to reduce flows.
County Road 12/Grandview Blvd	423	2107	205	312	508	1898	2667	212	321	505	1642	2226	7	8	-4	-256	-441	Proposed crossing improvement to reduce overtopping of Grandview Blvd per City of Dacono criteria.
Confluence with Southeastern Tributary	925	1969	185	284	469	1810	2541	192	291	468	1563	2118	7	7	-1	-247	-423	
Confluence with I-25 Tributary	428	1527	121	190	348	1390	1943	126	197	348	1157	1539	5	7	0	-233	-404	Upstream regional detention pond proposed to reduce flows.
I-25 Tributary, East of I-25/ Dacono Planning Boundary	929	558	9	27	102	451	644	9	27	102	451	644	0	0	0	0	0	Existing condition flows are inflows from Erie OSP.
County Road 10/Speedway Blvd	503	919	106	157	247	927	1272	106	157	247	927	1272	0	0	0	0	0	Proposed crossing improvement to reduce overtopping of Speedway Blvd per City of Dacono criteria.
Interstate 25, North of County Road 8/ Dacono Planning Boundary	P-970	466	20	45	109	419	585	20	45	109	419	585	0	0	0	0	0	Existing Condition inflows from Erie OSP.
Erie Tributary																		
Eastern I-25 Frontage Road, North of Highway 52	467	2475	202	279	357	1269	1878	202	279	357	1271	1880	0	0	0	2	2	
West Side of Interstate 25, North of Highway 52	462	2172	174	242	308	1095	1638	174	242	308	1097	1639	0	0	0	2	1	
State Highway 52/ Frederick Planning Boundary	P-675	1270	29	69	182	794	1192	29	69	182	794	1192	0	0	0	0	0	Existing Condition inflows from Erie OSP. Proposed crossing improvement to eliminate overtopping of Hwy 52 per Erie OSP.
Western Tributary																		
West Side of I-25, South of HWY 119/ Frederick Planning Boundary	431	388	11	15	19	201	323	11	15	19	201	323	0	0	0	0	0	

Table D.3.3: Godding Hollow Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
GH-C1	County Road 20/Bella Rosa Parkway	404	(10) 5' H x 12' W RCBC	4890.4	5170	< 2-Year	> 100-Year	643	955	1420	5274	7574	591	838	1210	3796	5059	Proposed crossing improvements to eliminate overtopping of Bella Rosa Parkway.
GH-C2	County Road 18/Godding Hollow Parkway	410	(9) 6' H x 10' W RCBC	4916.4	4990	< 50-Year	> 100-Year	641	924	1360	5168	7439	581	803	1161	3684	4903	Existing seven 6' H x 10' W RCBCs to remain and two additional proposed 6' H x 10' W RCBCs to be added as a side overflow culvert to eliminate overtopping of Godding Hollow Parkway.
GH-C3	County Road 16/Tipple Parkway	414	(3) 7' H x 14' W RCBC 7' H X 11 W RCBC	4939.9	4400	< 50-Year	> 100-Year	561	798	1220	4718	6771	518	704	1065	3345	4385	Existing three 7' H x 14' W RCBCs to remain and an additional proposed 7' H x 11' W RCBC to be added as a side overflow culvert to eliminate overtopping of Tipple Parkway.
GH-C4	Highway 52	418	(2) 8' H x 8' W RCBC	4964.0	2245	< 50-Year	> 100-Year	430	612	915	3489	4960	396	536	713	1951	2244	Existing 8' H x 8' W RCBCs to remain, an additional proposed 8' H x 8' W RCBC to be added, and proposed road raising to eliminate overtopping of HWY 52.
GH-C5	Lower Boulder Ditch	419/819	7' H x 7' W RCBC	4966.2	720	< 10-Year	< 10-Year	372	528	785	3140	4444	319	461	692	2383	3202	Existing crossing of Lower Boulder Ditch will be inundated by downstream pond during larger flow events. Overtopping of ditch not anticipated to be severely erosive due to downstream ponding. No proposed improvements for this crossing.
GH-C6	County Road 12/Grandview Blvd	423	(3) 4' H x 12' W RCBC	5000.4	1250	< 2-Year	< 50-Year	205	312	508	1898	2667	212	321	505	1642	2226	Proposed crossing and road raising improvements to eliminate overtopping of Grandview Blvd up to the 10-year event, and have less than 1.0-feet of overtopping during 100-year event per City of Dacono criteria.
GH-C7	County Road 10/Speedway Blvd	503	(2) 5' H x 7' W RCBC	5047.7	720	< 2-Year	< 50-Year	106	157	247	927	1272	106	157	247	927	1272	Proposed crossing and road raising improvements to eliminate overtopping of Speedway Blvd up to the 10-year event, and have less than 1.0-feet of overtopping during 100-year event per City of Dacono criteria.
GH-C8	Interstate 25, North of County Road 8	P-970	(2) 6' H x 10' W RCBC	5089.9	1030	> 100-Year	> 100-Year	20	45	109	419	585	20	45	109	419	585	
Erie Tributary																		
GH-C9	Eastern I-25 Frontage Road, North of Highway 52	467	(3) 4' H x 8' W RCBC	4972.9	840	< 50-Year	< 50-Year	202	279	357	1269	1878	202	279	357	1271	1880	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C10	Interstate 25, North of Highway 52	462	(3) 6' H x 8' W RCBC	4975.5	1540	< 100-Year	< 100-Year	174	242	308	1095	1638	174	242	308	1097	1639	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C11	Western I-25 Frontage Road, North of Highway 52	463	(3) 4' H x 8' W RCBC	4982.0	1030	< 50-Year	< 50-Year	41	94	249	1041	1562	41	94	249	1042	1563	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C12	Highway 52	P-675	(3) 4' H x 12' W RCBC**	5009.5	1230	< 10-Year	> 100-Year	29	69	182	794	1192	29	69	182	794	1192	Proposed culvert crossing of HWY 52 per Erie OSP.
Other I-25 Crossings																		
GH-C13	I-25, South of HWY 119	431	4' H x 12' W RCBC	4855.1	80	< 50-Year	< 50-Year	11	15	19	201	323	11	15	19	201	323	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C14	I-25, North of Rowe Street (Indians Peaks Crossing #1)	443	42" RCP	4953.1	80	> 100-Year	> 100-Year	10	16	23	48	62	10	16	23	48	62	
GH-C15	I-25, South of Rowe Street (Indians Peaks Crossing #2)	444	24" RCP	4949.1	25	< 50-Year	< 50-Year	8	13	18	41	53	8	13	18	41	53	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.

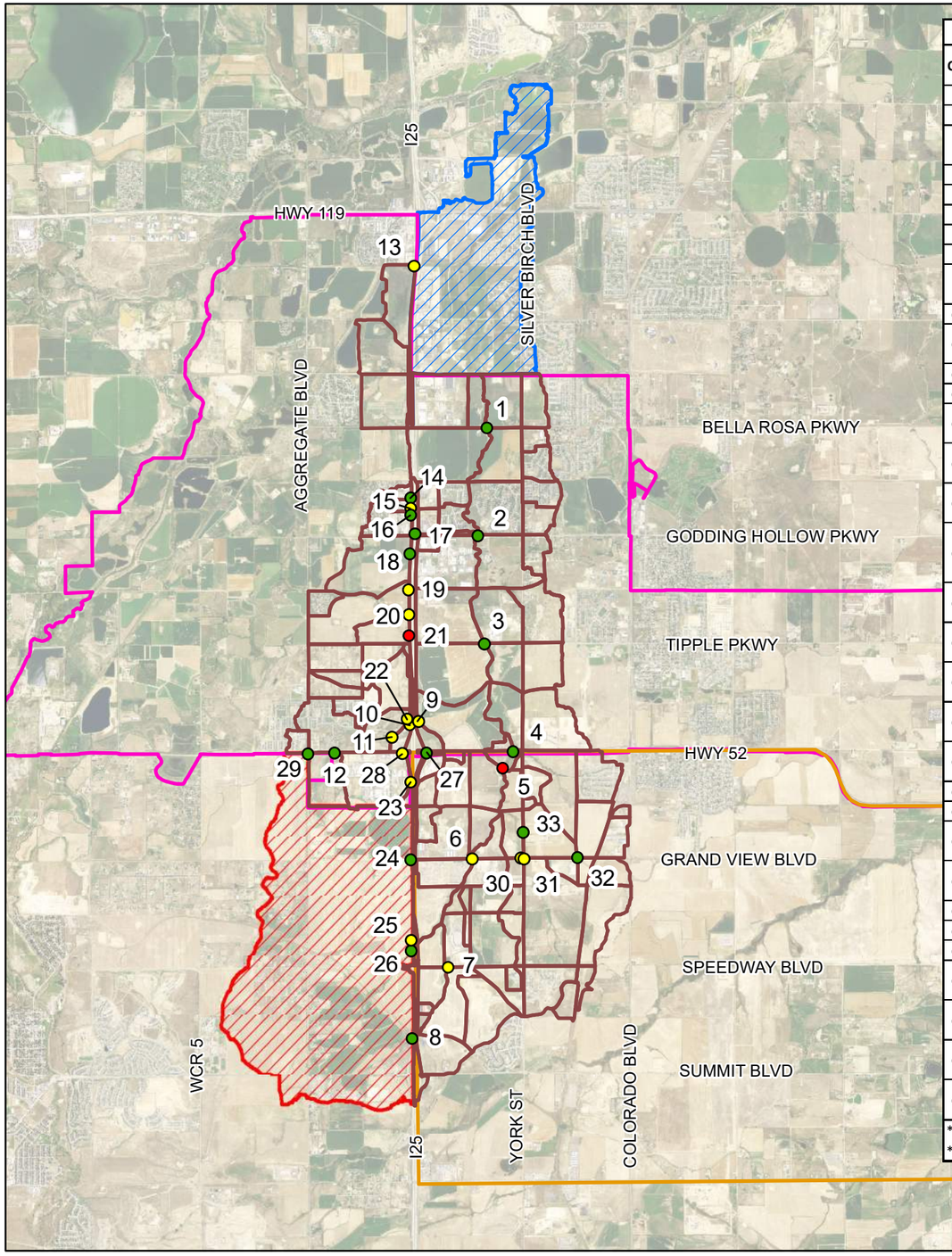
Table D.3.3: Godding Hollow Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Other I-25 Crossings (Continued)																		
GH-C16	I-25, North of Gage Street (Indian Peaks Crossing #3)	446	(2) 42" RCP	4947.0	180	> 100-Year	> 100-Year	27	40	55	135	176	27	40	55	135	176	
GH-C17	I-25, North of County Road 18/ Godding Hollow Parkway (Indian Peaks Crossing #4)	N/A	34" H x 53" W HERCP	4944.8	110	> 100-Year	> 100-Year	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
GH-C18	I-25, South of County Road 18/ Godding Hollow Parkway	449	48" RCP	4946.4	110	> 100-Year	> 100-Year	7	9	12	47	63	7	9	12	47	63	
GH-C19	I-25, South of Access Road Between County Road 18 and 16 #1	451	(2) 38" H x 60" W HERCP	4957.6	220	< 50-Year	< 50-Year	25	37	53	241	353	25	37	53	241	353	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C20	I-25, South of Access Road Between County Road 18 and 16 #2	954	(2) 36" RCP	4962.9	70	< 50-Year	< 50-Year	N/A	N/A	13	171	250	N/A	N/A	13	171	250	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C21	I-25, South of Access Road Between County Road 18 and 16 #3	454	42" RCP	4968.2	50	< 10-Year	< 10-Year	27	39	63	221	300	27	39	63	221	300	Excess flow will be conveyed north along roadside swale to GH-C20 crossing. No proposed improvements for this crossing.
GH-C22	I-25 & Western Frontage Road, North of Highway 52	958	24" RCP	4978.9	20	< 50-Year	< 50-Year	10	13	16	94	133	10	13	16	94	133	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C23	I-25, South of Highway 52	515	4' H x 6' W RCBC	5002.7	120	< 100-Year	< 100-Year	6	11	27	99	139	6	11	27	99	139	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C24	I-25, North of County Road 12	P-1680	4' H x 8' W RCBC	5043.9	230	> 100-Year	> 100-Year	2	7	33	151	214	2	7	33	151	214	
GH-C25	I-25, North of County Road 10 (Crossing #1)	P-679	(2) 36" RCP**	5049.8**	90**	< 100-Year	< 100-Year	1	4	19	82	115	1	4	19	82	115	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C26	I-25, North of County Road 10 (Crossing #2)	P-1679	(2) 6' H x 8' W RCBC	5050.9	790	> 100-Year	> 100-Year	7	23	84	367	517	7	23	84	367	517	
Other Highway 52 Crossings																		
GH-C27	Highway 52, East of I-25 Frontage Road	468	6' H x 8' W RCBC	4988.0	600	> 100-Year	> 100-Year	28	42	66	214	283	28	42	66	214	283	
GH-C28	Highway 52, West of I-25 Frontage Road	470	(2) 48" RCP	4992.6	270	< 50-Year	< 50-Year	147	200	253	545	672	147	200	253	545	672	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
GH-C29	Highway 52, West of County Road 7	P-669	(2) 3' H x 5' W RCBC**	5014.6	160	< 10-Year	> 100-Year	2	5	22	100	145	2	5	22	100	145	Proposed culvert crossing of HWY 52 per Erie OSP.
Other Tributary Crossings																		
GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	493	(3) 3' H x 6' W RCBC	5010.3	450	< 2-Year	< 100-Year	105	136	173	671	942	46	60	75	310	466	Proposed crossing and road raising improvements to eliminate overtopping of York Street up to the 10-year event, and have less than 1.0-feet of overtopping during 100-year event per City of Dacono criteria.
GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	485	(2) 36" RCP	5011.1	120	< 2-Year	< 50-Year	89	115	149	589	824	35	46	58	229	347	Proposed crossing and road raising improvements to eliminate overtopping of Grandview Blvd up to the 10-year event, and have less than 1.0-feet of overtopping during 100-year event per City of Dacono criteria.
GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	487	34" H x 53" W HERCP	5045.0	80	< 2-Year	< 50-Year	34	45	54	211	296	34	45	54	211	296	Proposed crossing and road raising improvements to convey initial 80 cfs to north in proposed channel and reduce flow being conveyed west to York Street (Crossing GH-31).
GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	484	(3) 18" RCPS	5004.0	35	< 2-Year	< 50-Year	22	27	33	141	187	22	27	33	141	187	Existing dual 18" RCPs to remain and one additional 18" RCP to be added, along with road raising, to eliminate overtopping of York Steet up to the 10-year event, and have less than 1.0-feet of overtopping during 100-year event per City of Dacono criteria.

*HY-8 program used to evaluate capacitates unless noted otherwise

**Obtained from Erie OSP

Indicates revised information for proposed improvements



Godding Hollow Basin Crossings

Crossing	Street Name	Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
GH-C1	County Road 20/Bella Rosa Parkway	(10) 5' H x 12' W RCBC*	> 100-Year	4890.4	404
GH-C2	County Road 18/Godding Hollow Parkway	(9) 6' H x 10' W RCBC*	> 100-Year	4916.4	410
GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC 7' H X 11 W RCBC*	> 100-Year	4939.9	414
GH-C4	Highway 52	(2) 8' H x 8' W RCBC*	> 100-Year	4964.0	418
GH-C5	Lower Boulder Ditch	7' H x 7' W RCBC	< 10-Year	4966.2	419/819
GH-C6	County Road 12/Grandview Blvd	(3) 4' H x 12' W RCBC*	< 50-Year	5000.4	423
GH-C7	County Road 10/Speedway Blvd	(2) 5' H x 7' W RCBC*	< 50-Year	5047.7	503
GH-C8	Interstate 25, North of County Road 8	(2) 6' H x 10' W RCBC	> 100-Year	5089.9	P-970
GH-C9	Eastern I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 50-Year	4972.9	467
GH-C10	Interstate 25, North of Highway 52	(3) 6' H x 8' W RCBC	< 100-Year	4975.5	462
GH-C11	Western I-25 Frontage Road, North of Highway 52	(3) 4' H x 8' W RCBC	< 50-Year	4982.0	463
GH-C12	Highway 52	(3) 4' H x 12' W RCBC**	> 100-Year	5009.5	P-675
GH-C13	I-25, South of HWY 119	4' H x 12' W RCBC	< 50-Year	4855.1	431
GH-C14	I-25, North of Rowe Street (Indians Peaks Crossing #1)	42" RCP	> 100-Year	4953.1	443
GH-C15	I-25, South of Rowe Street (Indians Peaks Crossing #2)	24" RCP	< 50-Year	4949.1	444
GH-C16	I-25, North of Gage Street (Indian Peaks Crossing #3)	(2) 42" RCP	> 100-Year	4947.0	446
GH-C17	I-25, North of County Road 18/ Godding Hollow Parkway (Indian Peaks Crossing #4)	34" H x 52" W HERCP	> 100-Year	4944.8	N/A
GH-C18	I-25, South of County Road 18/ Godding Hollow Parkway	48" RCP	> 100-Year	4946.4	449
GH-C19	I-25, South of Access Road Between County Road 18 and 16 #1	(2) 38" H x 60" W HERCP	< 50-Year	4957.6	451
GH-C20	I-25, South of Access Road Between County Road 18 and 16 #2	(2) 36" RCP	< 50-Year	4962.9	954
GH-C21	I-25, South of Access Road Between County Road 18 and 16 #3	42" RCP	< 10-Year	4968.2	454
GH-C22	I-25 & Western Frontage Road, North of Highway 52	24" RCP	< 50-Year	4978.9	958
GH-C23	I-25, South of Highway 52	4' H x 6' W RCBC	< 100-Year	5002.7	515
GH-C24	I-25, North of County Road 12	4' H x 8' W RCBC	> 100-Year	5043.9	P-1680
GH-C25	I-25, North of County Road 10 (Crossing #1)	(2) 36" RCP**	< 100-Year	5049.8**	P-679
GH-C26	I-25, North of County Road 10 (Crossing #2)	(2) 6' H x 8' W RCBC	> 100-Year	5050.9	P-1679
GH-C27	Highway 52, East of I-25 Frontage Road	6' H x 8' W RCBC	> 100-Year	4988.0	468
GH-C28	Highway 52, West of I-25 Frontage Road	(2) 48" RCP	< 50-Year	4992.6	470
GH-C29	Highway 52, West of County Road 7	(3) 3' H x 5' W RCBC**	> 100-Year	5014.6*	P-669
GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	(3) 3' H x 6' W RCBC*	< 100-Year	5010.3*	493
GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	(3) 3' H x 6' W RCBC*	< 100-Year	5011.1*	485
GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	34" H x 52" W HERCP*	> 100-Year	5045.0*	487
GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(3) 18" RCP*	> 100-Year	5004.0	484

*Indicates revised information for proposed improvements
**Obtained from Erie OSP

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Godding Hollow Basin Not Studied
- Godding Hollow Basin Studied By Erie OSP

N

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

GODDING HOLLOW
PROPOSED CONDITION
CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/27/21	
SHEET: GH	INDEX: PI-CROSS

Appendix D.4. Godding Hollow Cost Estimate Documentation

Table D.4.1: Godding Hollow Basin Proposed Improvement Cost Summary

Crossing	Street Name	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
Town of Frederick								
GH-C1	County Road 20/Bella Rosa Parkway	$911,000	$0	$137,000	$46,000	$91,000	$228,000	$1,413,000
GH-C2	County Road 18/Godding Hollow Parkway	$391,000	$0	$59,000	$20,000	$39,000	$98,000	$606,000
GH-C3	County Road 16/Tipple Parkway	$280,000	$0	$42,000	$14,000	$28,000	$70,000	$434,000
GH-C4	Highway 52 - Main Channel (Frederick Portion)	$885,000	$0	$133,000	$44,000	$88,000	$221,000	$1,371,000
GH-C12	Highway 52 - Erie Tributary	$491,000	$0	$74,000	$25,000	$49,000	$123,000	$762,000
GH-C29	Highway 52, West of County Road 7 (Frederick Portion)	$178,000	$0	$27,000	$9,000	$18,000	$45,000	$276,000
Total Cost		**$3,136,000**	**$0**	**$472,000**	**$158,000**	**$313,000**	**$785,000**	**$4,862,000**
City of Dacono								
GH-C4	Highway 52 - Main Channel (Dacono Portion)	$885,000	$135,000	$133,000	$44,000	$88,000	$221,000	$1,506,000
GH-C6	County Road 12/Grandview Boulevard	$394,000	$1,000	$59,000	$20,000	$39,000	$99,000	$612,000
GH-C7	County Road 10/Speedway Boulevard	$356,000	$8,000	$53,000	$18,000	$36,000	$89,000	$560,000
GH-C30 & GH-C31	County Road 12/Grandview Boulevard, West of County Road 7/York Street	$836,000	$26,000	$125,000	$42,000	$84,000	$209,000	$1,322,000
GH-C32	County Road 12/Grandview Boulevard, East of Panoram Circle	$296,000	$1,000	$44,000	$15,000	$30,000	$74,000	$459,000
GH-C33	GH C-33 County Road 7/York Street, North of County Road 12/Grandview Boulevard	$92,000	$0	$14,000	$5,000	$9,000	$23,000	$143,000
GH Pond 728	I-25, North of County Road 10/Speedway Boulevard	$980,000	$2,000	$147,000	$49,000	$98,000	$245,000	$1,520,000
GH Pond 783	County Road 11/York St, North of County Road 12/Grandview Boulevard	$825,000	$12,000	$124,000	$41,000	$82,000	$206,000	$1,290,000
GH Pond 885	County Road 11/York St, South of Grandview Boulevard	$1,313,000	$10,000	$197,000	$66,000	$131,000	$328,000	$2,044,000
Total Cost		**$5,977,000**	**$195,000**	**$896,000**	**$300,000**	**$597,000**	**$1,494,000**	**$9,456,000**
Town of Erie								
GH-C29	Highway 52, West of County Road 7 (Erie Portion)	$170,000	$0	$26,000	$9,000	$17,000	$43,000	$264,000
Total Cost		**$170,000**	**$0**	**$26,000**	**$9,000**	**$17,000**	**$43,000**	**$264,000**

GH-C1 County Road 20/Bella Rosa Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	5	10	48	L.F.	$12,506.08	$600,292.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	10	129.00	2	EA	$12,474.95	$24,950.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	5	10	2	EA	$43,355.61	$86,711.20	
Channel Improvements							
18-inch Riprap, Type H			355	C.Y.	$108.00	$38,340.00	
Removals							
Removal of culvert pipe (48"<D<84")			48	L.F.	$68.00	$3,264.00	Removal of 6'Hx8'W Arch CMP
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			3	ACRE	$1,355.00	$4,065.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$711,953.00
Hydraulic Structures				$0.00
Channel Improvements				$38,340.00
Detention/Water Quality Facilities				$0.00
Removals				$3,264.00
Landscaping and Maintenance Improvements				$4,065.00
Special Items (User Defined)				$0.00
Subtotal Capital Improvement Costs				**$757,622.00**
Additional Capital Improvement Costs				
Dewatering	$26,000.00	L.S.		$26,000.00
Mobilization	5%			$37,881.00
Traffic Control	$26,000.00	L.S.		$26,000.00
Utility Coordination/Relocation	$26,000.00	L.S.		$26,000.00
Stormwater Management/Erosion Control	5%			$37,881.00
Subtotal Additional Capital Improvement Costs				**$153,762.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$136,708.00
Legal/Administrative	5%			$45,569.00
Contract Admin/Construction Management	10%			$91,138.00
Contingency	25%			$227,846.00
Subtotal Other Costs				**$501,261.00**
Total Capital Improvement Costs				**$1,412,645.00**

GH-C2 County Road 18/Godding Hollow Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	6	2	94	L.F.	$2,406.31	$226,193.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	2	23.00	2	EA	$2,238.02	$4,476.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	6	2	2	EA	$18,593.39	$37,186.80	
Channel Improvements							
18-inch Riprap, Type H			105	C.Y.	$108.00	$11,340.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$267,856.00
Hydraulic Structures				$0.00
Channel Improvements				$11,340.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$2,710.00
Special Items (User Defined)				$0.00
Subtotal Capital Improvement Costs				**$281,906.00**
Additional Capital Improvement Costs				
Dewatering	$19,500.00	L.S.		$19,500.00
Mobilization	5%			$14,095.00
Traffic Control	$19,500.00	L.S.		$19,500.00
Utility Coordination/Relocation	$42,000.00	L.S.		$42,000.00
Stormwater Management/Erosion Control	5%			$14,095.00
Subtotal Additional Capital Improvement Costs				**$109,190.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$58,664.00
Legal/Administrative	5%			$19,555.00
Contract Admin/Construction Management	10%			$39,110.00
Contingency	25%			$97,774.00
Subtotal Other Costs				**$215,103.00**
Total Capital Improvement Costs				**$606,199.00**

GH-C3 County Road 16/Tipple Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	7	1	100	L.F.	$1,366.69	$136,669.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	1	13.00	2	EA	$1,264.97	$2,530.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	7	1	2	EA	$17,640.39	$35,280.80	
Channel Improvements							
18-inch Riprap, Type H			94	C.Y.	$108.00	$10,152.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$174,480.00
Hydraulic Structures				$0.00
Channel Improvements				$10,152.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$2,710.00
Special Items (User Defined)				$0.00
Subtotal Capital Improvement Costs				**$187,342.00**
Additional Capital Improvement Costs				
Dewatering	$18,500.00	L.S.		$18,500.00
Mobilization	5%			$9,367.00
Traffic Control	$18,500.00	L.S.		$18,500.00
Utility Coordination/Relocation	$37,000.00	L.S.		$37,000.00
Stormwater Management/Erosion Control	5%			$9,367.00
Subtotal Additional Capital Improvement Costs				**$92,734.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$42,011.00
Legal/Administrative	5%			$14,004.00
Contract Admin/Construction Management	10%			$28,008.00
Contingency	25%			$70,019.00
Subtotal Other Costs				**$154,042.00**
Total Capital Improvement Costs				**$434,118.00**

GH-C4 Highway 52 - Main Channel (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	8	1	62	L.F.	$1,098.79	$68,125.00	Portion of Proposed Crossing in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
8	1	10.00	1	EA	$916.05	$916.00	Outlet located in Frederick
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
8	8	1	1	EA	$20,504.96	$20,505.00	Outlet located in Frederick
Channel Improvements							
18-inch Riprap, Type H			70	C.Y.	$108.00	$7,560.00	Riprap for outlet in Frederick
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	Reseeding along right-of-way
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		4670	S.Y.	$100.00	$467,000.00	1400'L X 30'W (Northern half of road in Frederick)
Road Base Fill	**<----User Defined Items**		780	C.Y.	$80.00	$62,400.00	1400'L X 30'W x 0.5'D (Northern half of road in Frederick)
Other Embankment Fill	**<----User Defined Items**		3655	C.Y.	$33.00	$120,615.00	(Total Fill for half of road = 5215 CY), Subtract Road Base
Cut	**<----User Defined Items**		90	C.Y.	$15.00	$1,350.00	On-site cut to be used for fill

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$89,546.00
Hydraulic Structures						$0.00
Channel Improvements						$7,560.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$1,355.00
Special Items (User Defined)						$651,365.00
Subtotal Capital Improvement Costs						**$749,826.00**
Additional Capital Improvement Costs						
Dewatering			$10,000.00	L.S.		$10,000.00
Mobilization			5%			$37,491.00
Traffic Control			$20,000.00	L.S.		$20,000.00
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00
Stormwater Management/Erosion Control			5%			$37,491.00
Subtotal Additional Capital Improvement Costs						**$134,982.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$132,721.00
Legal/Administrative			5%			$44,240.00
Contract Admin/Construction Management			10%			$88,481.00
Contingency			25%			$221,202.00
Subtotal Other Costs						**$486,644.00**
Total Capital Improvement Costs						**$1,371,452.00**

GH-C4 Highway 52 - Main Channel (Dacono Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	8	1	62	L.F.	$1,098.79	$68,125.00	Portion of Proposed Crossing in Dacono
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
8	1	10.00	1	EA	$916.05	$916.00	Inlet located in Dacono
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
8	8	1	1	EA	$20,504.96	$20,505.00	Inlet located in Dacono
Channel Improvements							
18-inch Riprap, Type H			70	C.Y.	$108.00	$7,560.00	Riprap for inlet in Dacono
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	Reseeding along right-of-way
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		4670	S.Y.	$100.00	$467,000.00	1400'L X 30'W (Southern half of road in Dacono)
Road Base Fill	**<----User Defined Items**		780	C.Y.	$80.00	$62,400.00	1400'L X 30'W x 0.5'D (Southern half of road in Dacono)
Other Embankment Fill	**<----User Defined Items**		3655	C.Y.	$33.00	$120,615.00	(Total Fill for half of road = 5215 CY), Subtract Road Base and asphalt
Cut	**<----User Defined Items**		90	C.Y.	$15.00	$1,350.00	On-site cut to be used for fill
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$135,000.00	$135,000.00	Lump sum for proposed pond land acqusition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$89,546.00
Hydraulic Structures						$0.00
Channel Improvements						$7,560.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$1,355.00
Special Items (User Defined)						$651,365.00
Subtotal Capital Improvement Costs						**$749,826.00**
Additional Capital Improvement Costs						
Dewatering			$10,000.00	L.S.		$10,000.00
Mobilization			5%			$37,491.00
Traffic Control			$20,000.00	L.S.		$20,000.00
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00
Stormwater Management/Erosion Control			5%			$37,491.00
Subtotal Additional Capital Improvement Costs						**$134,982.00**
Land Acquisition Costs						
ROW/Easements						$135,000.00
Subtotal Land Acquisition Costs						**$135,000.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$132,721.00
Legal/Administrative			5%			$44,240.00
Contract Admin/Construction Management			10%			$88,481.00
Contingency			25%			$221,202.00
Subtotal Other Costs						**$486,644.00**
Total Capital Improvement Costs						**$1,506,452.00**

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
12	4	3	42	L.F.	$3,314.95	$139,228.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	3	39.00	2	EA	$3,771.50	$7,543.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	4	3	2	EA	$15,989.00	$31,978.00	
Channel Improvements							
18-inch Riprap, Type H			96	C.Y.	$108.00	$10,368.00	
Removals							
Removal of culvert pipe (D<48")			42	L.F.	$27.00	$1,134.00	Existing 36" CMP
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1.5	ACRE	$1,355.00	$2,033.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		970	S.Y.	$100.00	$97,000.00	290'Lx30'W
Base Course	**<----User Defined Items**		160	C.Y.	$80.00	$12,800.00	290'Lx30'Wx0.5'D
Road Fill	**<----User Defined Items**		195	C.Y.	$33.00	$6,435.00	515 CY of Fill-(290'Lx30'Wx1'D)
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for proposed right of way acquisition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$178,749.00
Hydraulic Structures						$0.00
Channel Improvements						$10,368.00
Detention/Water Quality Facilities						$0.00
Removals						$1,134.00
Landscaping and Maintenance Improvements						$2,033.00
Special Items (User Defined)						$116,235.00
Subtotal Capital Improvement Costs						**$308,519.00**
Additional Capital Improvement Costs						
Dewatering			$20,000.00	L.S.		$20,000.00
Mobilization			5%			$15,426.00
Traffic Control			$15,000.00	L.S.		$15,000.00
Utility Coordination/Relocation			$20,000.00	L.S.		$20,000.00
Stormwater Management/Erosion Control			5%			$15,426.00
Subtotal Additional Capital Improvement Costs						**$85,852.00**
Land Acquisition Costs						
ROW/Easements						$1,000.00
Subtotal Land Acquisition Costs						**$1,000.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$59,156.00
Legal/Administrative			5%			$19,719.00
Contract Admin/Construction Management			10%			$39,437.00
Contingency			25%			$98,593.00
Subtotal Other Costs						**$216,905.00**
Total Capital Improvement Costs						**$612,276.00**

GH-C7 County Road 10/Speedway Boulevard

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
7	5	2	85	L.F.	$1,710.34	$145,379.00	Existing pond limits the culvert capacity.
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
7	2	17.00	2	EA	$1,550.49	$3,101.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
7	5	2	2	EA	$13,502.70	$27,005.40	
Channel Improvements							
18-inch Riprap, Type H			70	C.Y.	$108.00	$7,560.00	
Removals							
Removal of culvert pipe (48"<D<84")			85	L.F.	$68.00	$5,780.00	Existing 60" CMP
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1.5	ACRE	$1,355.00	$2,033.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		610	S.Y.	$100.00	$61,000.00	220'Lx25'W
Base Course	<----User Defined Items		100	C.Y.	$80.00	$8,000.00	220'Lx25'Wx0.5'D
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$8,332.07	$8,332.00	Lump sum for proposed right of way area acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$175,485.00	
Hydraulic Structures						$0.00	
Channel Improvements						$7,560.00	
Detention/Water Quality Facilities						$0.00	
Removals						$5,780.00	
Landscaping and Maintenance Improvements						$2,033.00	
Special Items (User Defined)						$69,000.00	
Subtotal Capital Improvement Costs						**$259,858.00**	
Additional Capital Improvement Costs							
Dewatering			$34,000.00	L.S.		$34,000.00	
Mobilization			5%			$12,993.00	
Traffic Control			$18,000.00	L.S.		$18,000.00	
Utility Coordination/Relocation			$18,000.00	L.S.		$18,000.00	
Stormwater Management/Erosion Control			5%			$12,993.00	
Subtotal Additional Capital Improvement Costs						**$95,986.00**	
Land Acquisition Costs							
ROW/Easements						$8,332.00	
Subtotal Land Acquisition Costs						**$8,332.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$53,377.00	
Legal/Administrative			5%			$17,792.00	
Contract Admin/Construction Management			10%			$35,584.00	
Contingency			25%			$88,961.00	
Subtotal Other Costs						**$195,714.00**	
Total Capital Improvement Costs						**$559,890.00**	

GH-C12 Highway 52 - Erie Tributary

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	3	95	L.F.	$3,314.95	$314,920.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	3	39.00	2	EA	$3,771.50	$7,543.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	3	2	EA	$15,989.00	$31,978.00	
Channel Improvements							
18-inch Riprap, Type H			50	C.Y.	$108.00	$5,400.00	
Removals							
Removal of culvert pipe (D<48")			190	L.F.	$27.00	$5,130.00	Removal of Dual 36" CMPs

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$354,441.00	
Hydraulic Structures						$0.00	
Channel Improvements						$5,400.00	
Detention/Water Quality Facilities						$0.00	
Removals						$5,130.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$364,971.00**	
Additional Capital Improvement Costs							
Dewatering			$20,000.00	L.S.		$20,000.00	
Mobilization			5%			$18,249.00	
Traffic Control			$20,000.00	L.S.		$20,000.00	
Utility Coordination/Relocation			$50,000.00	L.S.		$50,000.00	
Stormwater Management/Erosion Control			5%			$18,249.00	
Subtotal Additional Capital Improvement Costs						**$126,498.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$73,720.00	
Legal/Administrative			5%			$24,573.00	
Contract Admin/Construction Management			10%			$49,147.00	
Contingency			25%			$122,867.00	
Subtotal Other Costs						**$270,307.00**	
Total Capital Improvement Costs						**$761,776.00**	

GH-C29 Highway 52, West of County Road 7 (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
5	3	2	90	L.F.	$1,208.72	$108,785.00	Portion of crossing located in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
5	2	13.00	1	EA	$1,144.07	$1,144.00	Outlet located in Frederick
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
5	3	2	1	EA	$7,790.51	$7,790.50	Outlet located in Frederick
Channel Improvements							
18-inch Riprap, Type H			10	C.Y.	$108.00	$1,080.00	Riprap for Outlet in Frederick
Removals							
Removal of culvert pipe (D<48")			90	L.F.	$27.00	$2,430.00	Removal of existing RCP in Frederick

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$117,720.00	
Hydraulic Structures						$0.00	
Channel Improvements						$1,080.00	
Detention/Water Quality Facilities						$0.00	
Removals						$2,430.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$121,230.00**	
Additional Capital Improvement Costs							
Dewatering			$10,000.00	L.S.		$10,000.00	
Mobilization			5%			$6,062.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$6,062.00	
Subtotal Additional Capital Improvement Costs						**$57,124.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$26,753.00	
Legal/Administrative			5%			$8,918.00	
Contract Admin/Construction Management			10%			$17,835.00	
Contingency			25%			$44,589.00	
Subtotal Other Costs						**$98,095.00**	
Total Capital Improvement Costs						**$276,449.00**	

GH-C29 Highway 52, West of County Road 7 (Erie Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
5	3	2	84	L.F.	$1,208.72	$101,533.00	Portion of crossing located in Erie
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
5	2	13.00	1	EA	$1,144.07	$1,144.00	Inlet located in Erie
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
5	3	2	1	EA	$7,790.51	$7,790.50	Inlet located in Erie
Channel Improvements							
18-inch Riprap, Type H			10	C.Y.	$108.00	$1,080.00	Riprap for Inlet in Erie
Removals							
Removal of culvert pipe (D<48")			84	L.F.	$27.00	$2,268.00	Removal of existing RCP in Erie

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$110,468.00
Hydraulic Structures						$0.00
Channel Improvements						$1,080.00
Detention/Water Quality Facilities						$0.00
Removals						$2,268.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$0.00
Subtotal Capital Improvement Costs						**$113,816.00**
Additional Capital Improvement Costs						
Dewatering			$10,000.00	L.S.		$10,000.00
Mobilization			5%			$5,691.00
Traffic Control			$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control			5%			$5,691.00
Subtotal Additional Capital Improvement Costs						**$56,382.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$25,530.00
Legal/Administrative			5%			$8,510.00
Contract Admin/Construction Management			10%			$17,020.00
Contingency			25%			$42,550.00
Subtotal Other Costs						**$93,610.00**
Total Capital Improvement Costs						**$263,808.00**

GH-C30 & GH-C31 Grandview Boulevard and York Street

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
36-inch	150	2	300	L.F.	$146.00	$43,800.00	York St
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
36-inch	Yes	2	4	EA	$2,182.00	$8,728.00	
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	3	3	56	L.F.	$2,000.86	$112,048.00	Grandview Blvd
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
6	3	21.00	2	EA	$1,915.31	$3,831.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
6	3	3	2	EA	$9,795.33	$19,590.70	
Channel Improvements							
Concrete Low Flow Channel			260	L.F.	$54.00	$14,040.00	
18-inch Riprap, Type H			90	C.Y.	$108.00	$9,720.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,222.00	Assumed to be equal to the land for ROW Acquisition
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		4200	S.Y.	$100.00	$420,000.00	Area determined in CAD where fill exists in the intersection
Road Fill	**<----User Defined Items**		700	C.Y.	$80.00	$56,000.00	Asphalt area x 0.5'D
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$25,920.00	$25,920.00	Lump sum for proposed right of way area acquisition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$52,528.00
Concrete Box Culverts						$135,470.00
Hydraulic Structures						$0.00
Channel Improvements						$23,760.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$2,222.00
Special Items (User Defined)						$476,000.00
Subtotal Capital Improvement Costs						**$689,980.00**
Additional Capital Improvement Costs						
Dewatering			$19,000.00	L.S.		$19,000.00
Mobilization			5%			$34,499.00
Traffic Control			$29,000.00	L.S.		$29,000.00
Utility Coordination/Relocation			$29,000.00	L.S.		$29,000.00
Stormwater Management/Erosion Control			5%			$34,499.00
Subtotal Additional Capital Improvement Costs						**$145,998.00**
Land Acquisition Costs						
ROW/Easements						$25,920.00
Subtotal Land Acquisition Costs						**$25,920.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$125,397.00
Legal/Administrative			5%			$41,799.00
Contract Admin/Construction Management			10%			$83,598.00
Contingency			25%			$208,995.00
Subtotal Other Costs						**$459,789.00**
Total Capital Improvement Costs						**$1,321,687.00**

GH-C32 County Road 12/Grandview Boulevard, East of Panoram Circle

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
42-inch	80	1	80	L.F.	$171.00	$13,680.00	34"Hx53"W HERCP equivalent diameter
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
42-inch	Yes	1	2	EA	$2,304.00	$4,608.00	
Channel Improvements							
18-inch Riprap, Type H			20	C.Y.	$108.00	$2,160.00	
Excavation, Mid Range			1335	C.Y.	$33.00	$44,055.00	Cut to be hauled offsite for both channels
Excavation, Low Range			1505	C.Y.	$15.00	$22,575.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			6	ACRE	$1,355.00	$8,130.00	Reseeding for channel
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		1170	S.Y.	$100.00	$117,000.00	525'Lx20'W
Road Base Fill	**<----User Defined Items**		195	C.Y.	$80.00	$15,600.00	525'Lx20'Wx0.5'D
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for land acquisition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$18,288.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$68,790.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$8,130.00
Special Items (User Defined)						$132,600.00
Subtotal Capital Improvement Costs						**$227,808.00**
Additional Capital Improvement Costs						
Dewatering			$20,000.00	L.S.		$20,000.00
Mobilization			5%			$11,390.00
Traffic Control			$10,000.00	L.S.		$10,000.00
Utility Coordination/Relocation			$15,000.00	L.S.		$15,000.00
Stormwater Management/Erosion Control			5%			$11,390.00
Subtotal Additional Capital Improvement Costs						**$67,780.00**
Land Acquisition Costs						
ROW/Easements						$1,000.00
Subtotal Land Acquisition Costs						**$1,000.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$44,338.00
Legal/Administrative			5%			$14,779.00
Contract Admin/Construction Management			10%			$29,559.00
Contingency			25%			$73,897.00
Subtotal Other Costs						**$162,573.00**
Total Capital Improvement Costs						**$459,161.00**

GH-C33 County Road 7/York Street, North of County Road 12/Grandview Boulevard

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
18-inch	60	1	60	L.F.	$73.00	$4,380.00	Additional 18" RCP
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
18-inch	Yes	1	2	EA	$1,247.00	$2,494.00	
Channel Improvements							
18-inch Riprap, Type H			10	C.Y.	$108.00	$1,080.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Road Base Fill	<----User Defined Items		650	C.Y.	$80.00	$52,000.00	Road raise assumed for new culvert for clearance (no paving)

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$6,874.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$1,080.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$1,355.00	
Special Items (User Defined)						$52,000.00	
Subtotal Capital Improvement Costs						**$61,309.00**	
Additional Capital Improvement Costs							
Dewatering			$5,000.00	L.S.		$5,000.00	
Mobilization			5%			$3,065.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$10,000.00	L.S.		$10,000.00	
Stormwater Management/Erosion Control			5%			$3,065.00	
Subtotal Additional Capital Improvement Costs						**$31,130.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$13,866.00	
Legal/Administrative			5%			$4,622.00	
Contract Admin/Construction Management			10%			$9,244.00	
Contingency			25%			$23,110.00	
Subtotal Other Costs						**$50,842.00**	
Total Capital Improvement Costs						**$143,281.00**	

GH Pond 728 I-25, North of County Road 10/Speedway Boulevard

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
60-inch	105	1	105	L.F.	$325.00	$34,125.00	Assumed to be equivalent cost to outlet structure needed
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
60-inch	Yes	1	2	EA	$2,146.55	$4,293.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
60-inch		1	2	EA	$12,049.68	$24,099.00	
Detention/Water Quality Facilities							
Detention (User Entered Quantities)							
Excavation, Low Range			4185	C.Y.	$15.00	$62,775.00	Available cut to be placed on site
Excavation, Mid Range			20425	C.Y.	$33.00	$674,025.00	Additional fill to be brought from offsite (24610 CY unadjusted fill)
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			11	ACRE	$1,355.00	$14,363.00	
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,555.00	$1,555.00	Lump sum for proposed area

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$62,517.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$736,800.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$14,363.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$813,680.00**	
Additional Capital Improvement Costs							
Dewatering			$37,000.00	L.S.		$37,000.00	
Mobilization			5%			$40,684.00	
Traffic Control			$10,500.00	L.S.		$10,500.00	
Utility Coordination/Relocation			$37,000.00	L.S.		$37,000.00	
Stormwater Management/Erosion Control			5%			$40,684.00	
Subtotal Additional Capital Improvement Costs						**$165,868.00**	
Land Acquisition Costs							
ROW/Easements						$1,555.00	
Subtotal Land Acquisition Costs						**$1,555.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$146,932.00	
Legal/Administrative			5%			$48,977.00	
Contract Admin/Construction Management			10%			$97,955.00	
Contingency			25%			$244,887.00	
Subtotal Other Costs						**$538,751.00**	
Total Capital Improvement Costs						**$1,519,854.00**	

GH 783 County Road 11/York Street, North of County Road 12/Grandview Boulevard

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
66-inch	168	1	168	L.F.	$358.00	$60,144.00	Assumed to be equal cost to outlet structure
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
66-inch	Yes	1	2	EA	$2,362.80	$4,726.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
66-inch		1	2	EA	$13,971.96	$27,944.00	
Detention/Water Quality Facilities							
Detention (User Entered Quantities)							
Excavation, Low Range			2655	C.Y.	$15.00	$39,825.00	Cut to be placed on site
Excavation, Mid Range			15530	C.Y.	$33.00	$512,490.00	Fill to be brought on site (18185 CY unadjusted)
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			15	ACRE	$1,355.00	$19,919.00	
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$11,725.00	$11,725.00	Lump sum for proposed pond area

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$92,814.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$552,315.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$19,919.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$665,048.00**	
Additional Capital Improvement Costs							
Dewatering			$53,000.00	L.S.		$53,000.00	
Mobilization			5%			$33,252.00	
Traffic Control			$13,500.00	L.S.		$13,500.00	
Utility Coordination/Relocation			$26,500.00	L.S.		$26,500.00	
Stormwater Management/Erosion Control			5%			$33,252.00	
Subtotal Additional Capital Improvement Costs						**$159,504.00**	
Land Acquisition Costs							
ROW/Easements						$11,725.00	
Subtotal Land Acquisition Costs						**$11,725.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$123,683.00	
Legal/Administrative			5%			$41,228.00	
Contract Admin/Construction Management			10%			$82,455.00	
Contingency			25%			$206,138.00	
Subtotal Other Costs						**$453,504.00**	
Total Capital Improvement Costs						**$1,289,781.00**	

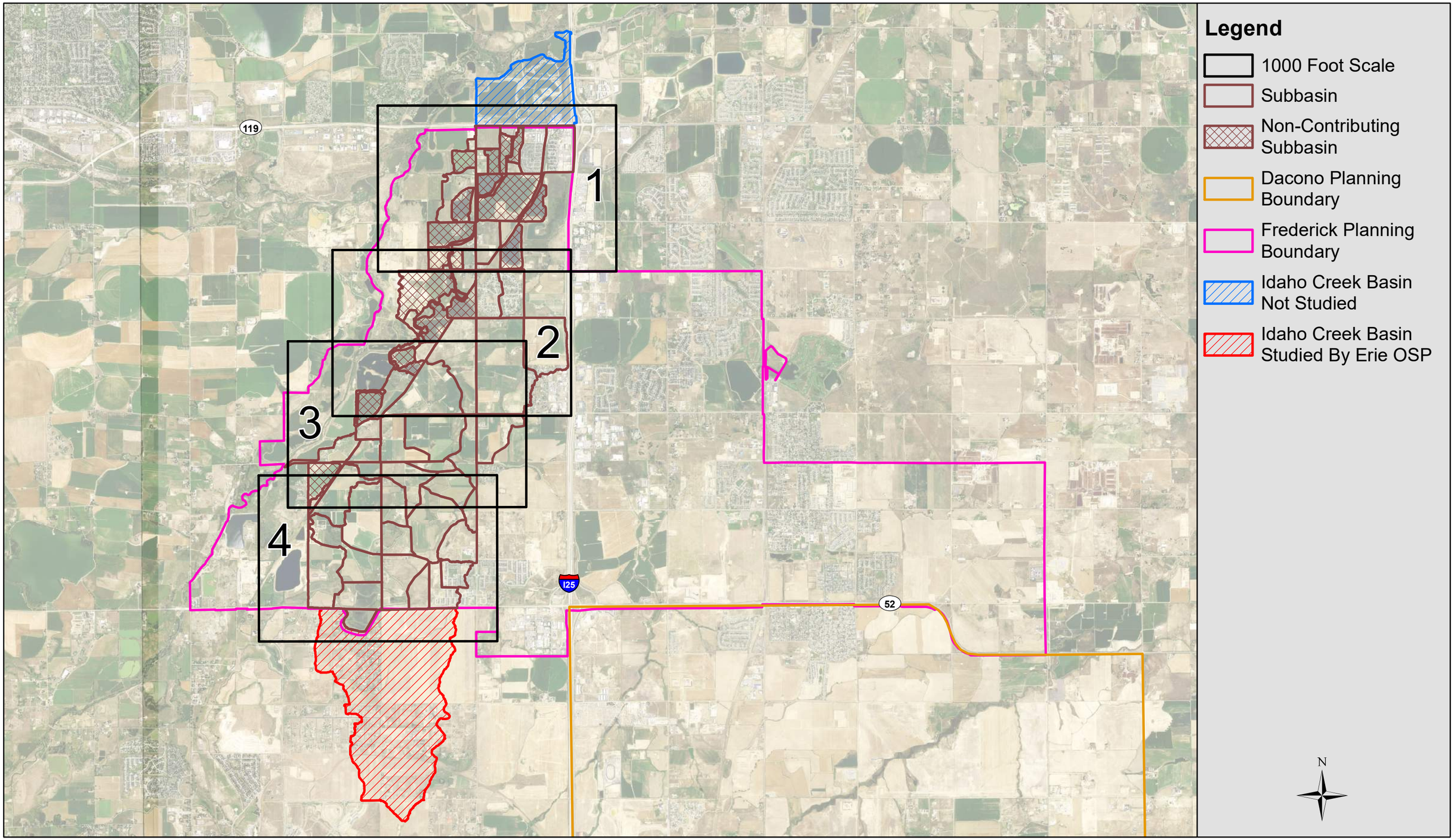
GH Pond 885 County Road 11/York Street, South of Grandview Boulevard

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
12-inch	150	1	150	L.F.	$49.00	$7,350.00	Assumed to be equal to the outlet required.
Flare End Sections							
Diameter (in)	**Applicable**	**No. of Barrels**					
12-inch	Yes	1	2	EA	$962.00	$1,924.00	
Detention/Water Quality Facilities							
Detention (User Entered Quantities)							
Excavation, Low Range			16885	C.Y.	$15.00	$253,275.00	Fill to be placed from cut onsite
Excavation, Mid Range			25240	C.Y.	$33.00	$832,920.00	Cut to be hauled offsite (42125 cut unadjusted cut)
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			13	ACRE	$1,355.00	$17,751.00	
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$9,685.00	$9,685.00	Lump sum for proposed pond area acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$9,274.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$0.00	
Detention/Water Quality Facilities						$1,086,195.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$17,751.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$1,113,220.00**	
Additional Capital Improvement Costs							
Dewatering			$56,000.00	L.S.		$56,000.00	
Mobilization			5%			$55,661.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$22,000.00	L.S.		$22,000.00	
Stormwater Management/Erosion Control			5%			$55,661.00	
Subtotal Additional Capital Improvement Costs						**$199,322.00**	
Land Acquisition Costs							
ROW/Easements						$9,685.00	
Subtotal Land Acquisition Costs						**$9,685.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$196,881.00	
Legal/Administrative			5%			$65,627.00	
Contract Admin/Construction Management			10%			$131,254.00	
Contingency			25%			$328,136.00	
Subtotal Other Costs						**$721,898.00**	
Total Capital Improvement Costs						**$2,044,125.00**	

Appendix E. Idaho Creek Basin Documentation

Appendix E.1. Idaho Creek Existing Condition Documentation



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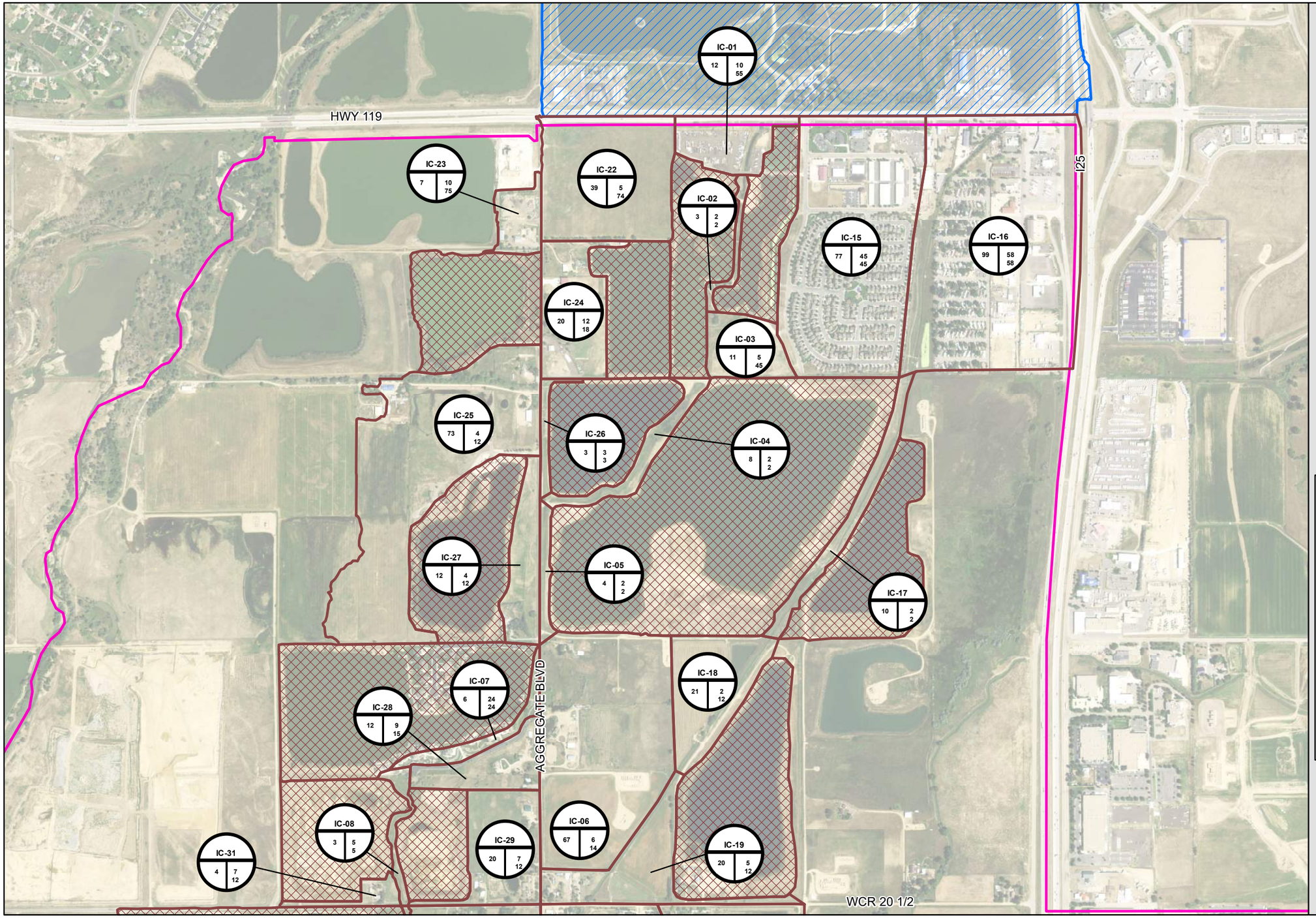
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

IDAHO CREEK
SUBBASIN MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/28/2021	
SHEET: IC	INDEX: SB-INDEX

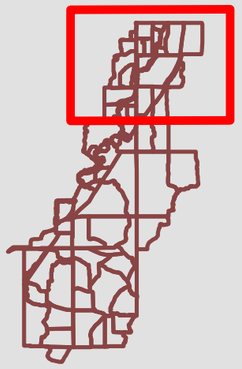


Legend

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

XX — Subcatchment ID
XX | X — % Impervousness (Existing Condition)
X — % Impervousness (Future Condition)
Acreage

Key Map



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Feet

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OUTFALL SYSTEM PLAN

IDAHO CREEK
SUBBASIN MAPS

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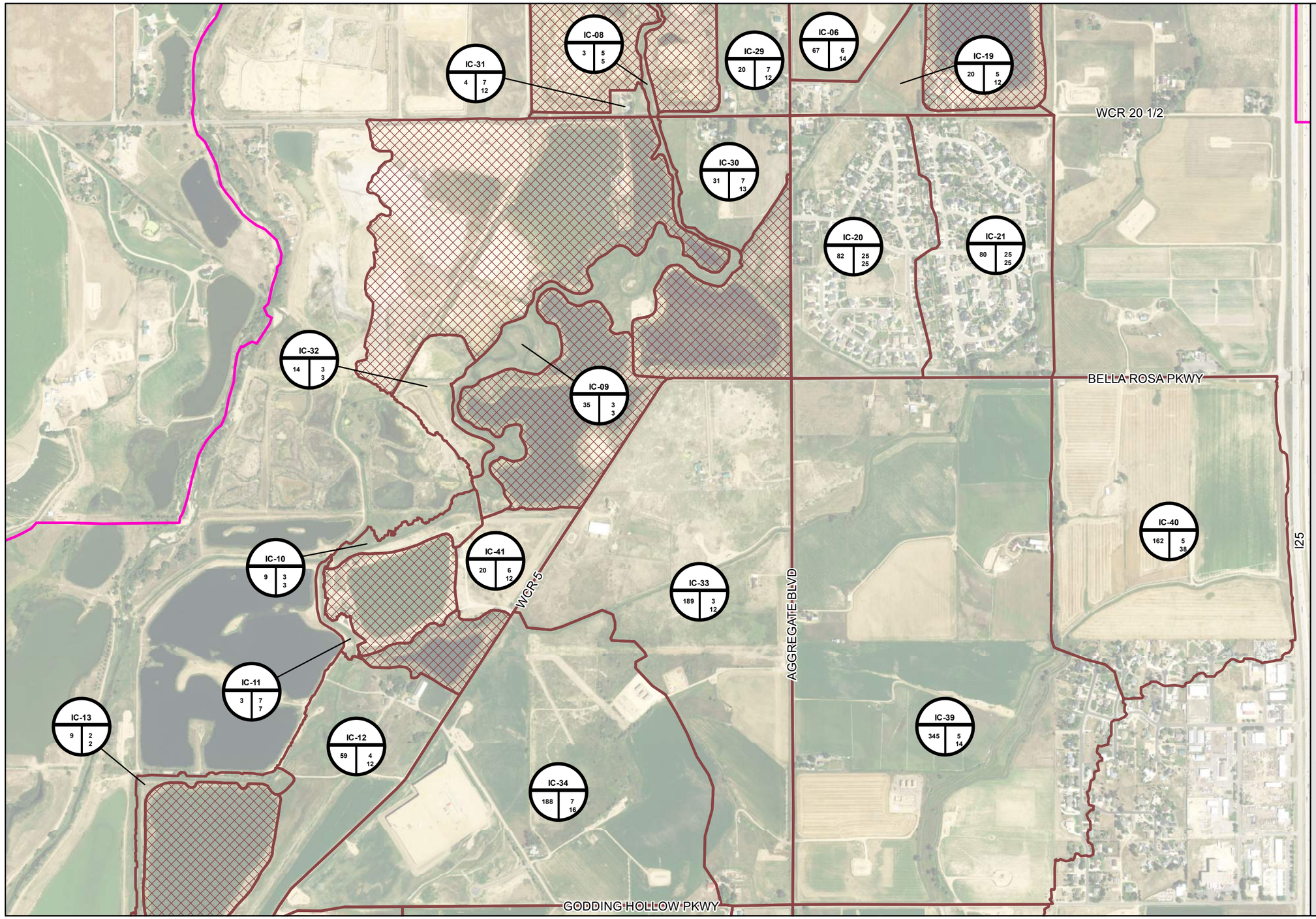

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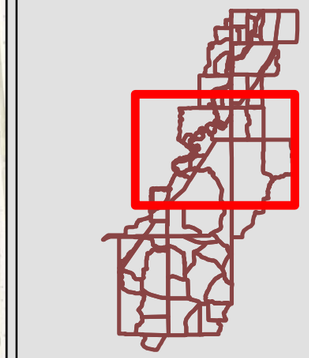
Acreage

Key Map



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IDAHO CREEK
SUBBASIN MAPS

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CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
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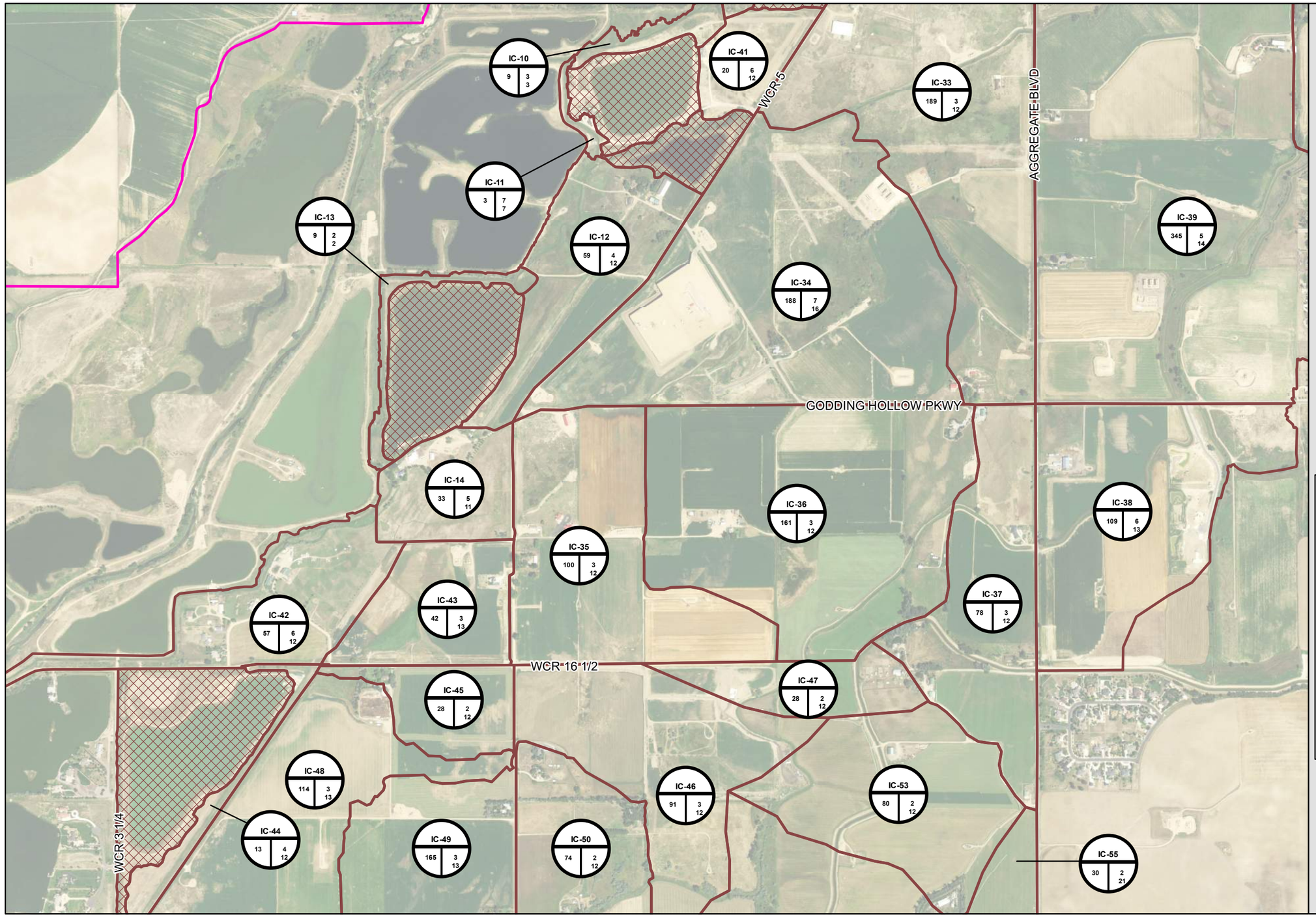
SHEET: IC	INDEX: SB-2



Legend

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- Non-Contributing Subbasin
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- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

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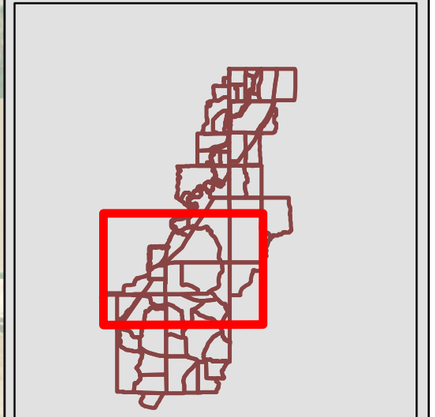
Acreage

Key Map



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IDAHO CREEK
SUBBASIN MAPS

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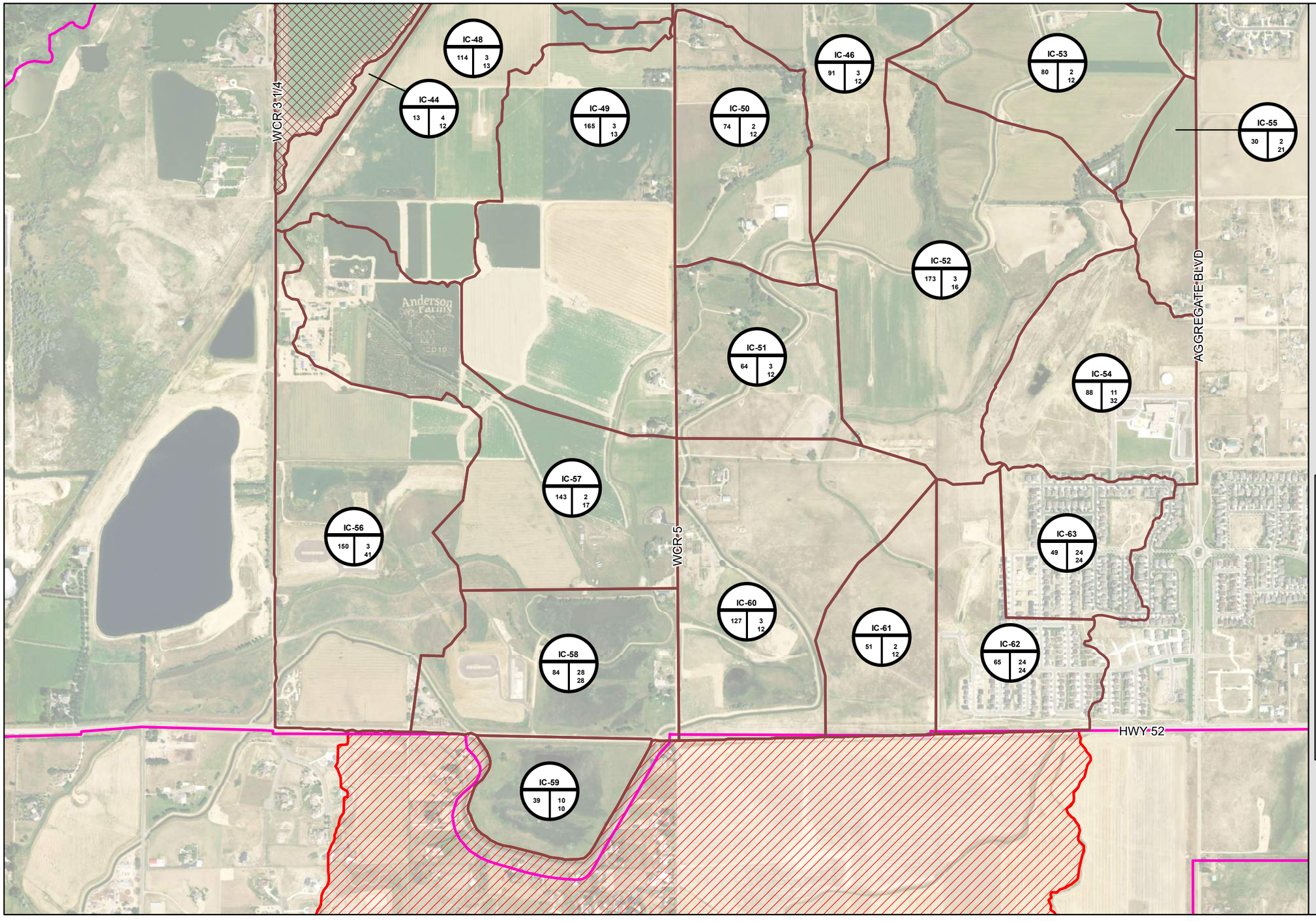
SHEET: IC	INDEX: SB-3



Legend

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
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- Idaho Creek Basin Not Studied
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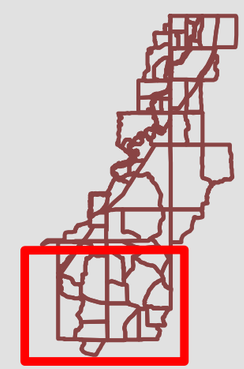
Acreage

Key Map



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Feet

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OUTFALL SYSTEM PLAN

IDAHO CREEK
SUBBASIN MAPS

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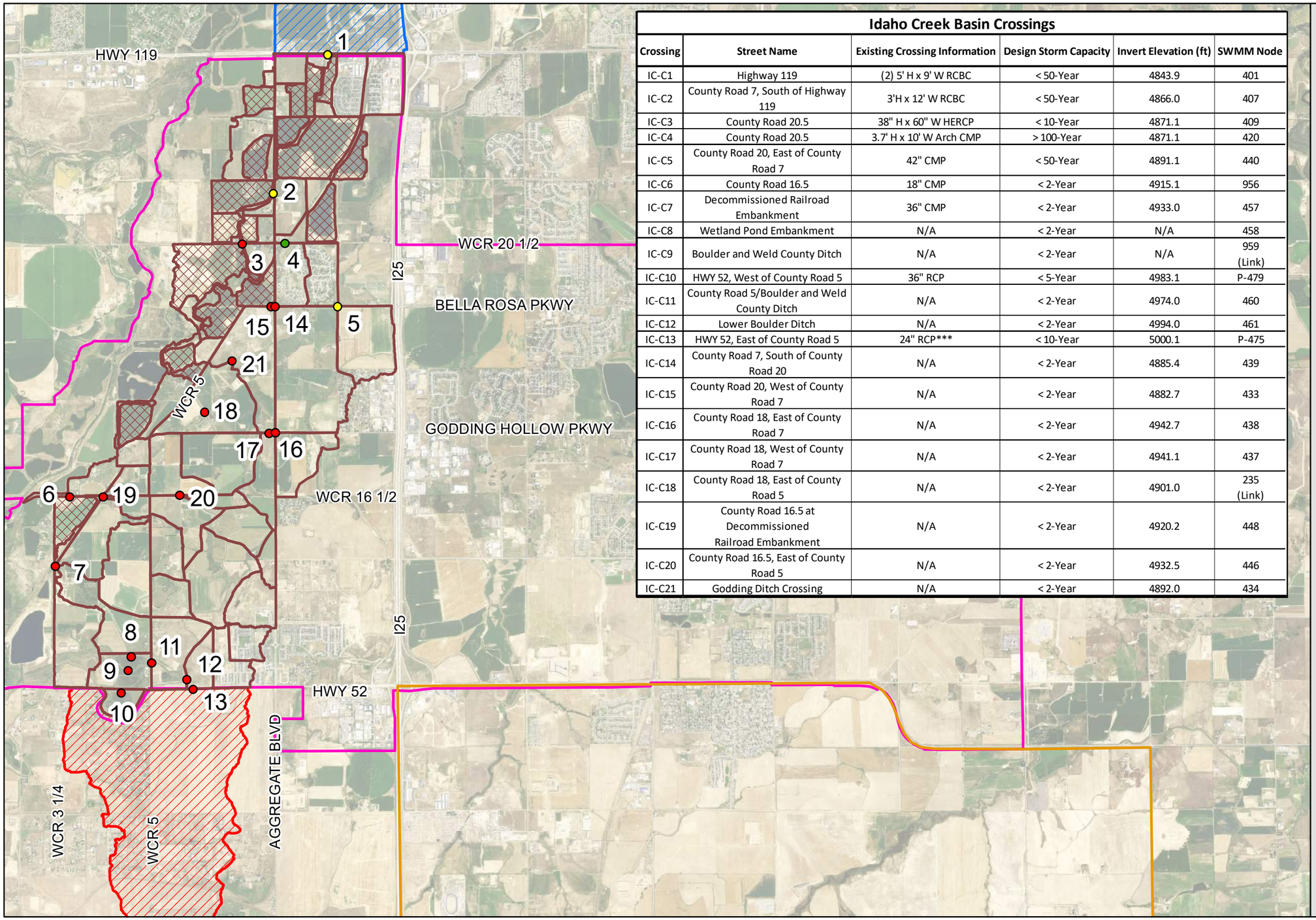
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 5/27/2021	
SHEET: IC	INDEX: SB-4

TABLE E.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
IDAHO CREEK																				
IC-01	401	0.01918	12.3	0.07933	419	0.15422	814	0.0026	10	0.40	0.05	5.00	0.0007	1.00	8.18	0.67	4.28	0.52	0.20	0.13
IC-02	402	0.00398	2.5	0.20464	1080	0.25494	1346	0.0031	2	0.40	0.05	5.00	0.0007	1.00	0.40	0.16	0.17	0.00	0.00	0.00
IC-03	403	0.01763	11.3	0.09971	526	0.17882	944	0.0066	5	0.40	0.05	4.25	0.0011	0.81	10.84	0.96	6.66	0.38	0.21	0.05
IC-04	404	0.01177	7.5	0.17235	910	0.37565	1983	0.0026	2	0.40	0.05	3.83	0.0013	0.71	3.52	0.47	2.16	0.07	0.03	0.01
IC-05	405	0.00548	3.5	0.11435	604	0.21470	1134	0.0037	2	0.40	0.05	3.80	0.0014	0.70	1.98	0.56	1.23	0.05	0.02	0.01
IC-06	406	0.10441	66.8	0.25567	1350	0.43716	2308	0.0042	6	0.40	0.05	3.48	0.0015	0.62	70.67	1.06	48.29	7.25	2.11	0.96
IC-07	407	0.00900	5.8	0.17656	932	0.27216	1437	0.0034	24	0.35	0.05	5.00	0.0007	1.00	2.49	0.43	1.55	0.42	0.29	0.18
IC-08	408	0.00538	3.4	0.19717	1041	0.25122	1326	0.0044	5	0.40	0.05	5.00	0.0007	1.00	0.73	0.21	0.34	0.02	0.01	0.00
IC-09	409	0.05464	35.0	0.48683	2570	1.23096	6499	0.0019	3	0.40	0.05	3.06	0.0018	0.52	13.23	0.38	8.97	1.76	0.26	0.10
IC-10	410	0.01380	8.8	0.12093	638	0.25041	1322	0.0019	3	0.40	0.05	3.00	0.0018	0.50	6.94	0.79	4.72	1.02	0.18	0.06
IC-11	411	0.00481	3.1	0.14032	741	0.17161	906	0.0029	7	0.40	0.05	3.00	0.0018	0.50	1.99	0.65	1.36	0.32	0.09	0.04
IC-12	412	0.09153	58.6	0.23918	1263	0.44911	2371	0.0040	4	0.40	0.05	3.00	0.0018	0.50	64.68	1.10	45.69	10.35	2.13	0.74
IC-13	413	0.01402	9.0	0.20720	1094	0.53492	2824	0.0014	2	0.40	0.05	3.00	0.0018	0.50	3.83	0.43	2.60	0.53	0.08	0.02
IC-14	414	0.05103	32.7	0.17255	911	0.31971	1688	0.0032	5	0.40	0.05	3.00	0.0018	0.50	36.05	1.10	25.46	5.97	1.38	0.52
IC-15	415	0.12002	76.8	0.29051	1534	0.49422	2609	0.0050	45	0.35	0.10	3.18	0.0017	0.54	161.19	2.10	123.59	51.10	33.22	21.21
IC-16	416	0.15489	99.1	0.25986	1372	0.47630	2515	0.0010	58	0.35	0.10	3.21	0.0017	0.55	218.90	2.21	169.87	76.11	53.40	36.38
IC-17	417	0.01501	9.6	0.34450	1819	0.55814	2947	0.0010	2	0.40	0.05	3.00	0.0018	0.50	3.03	0.32	2.06	0.42	0.06	0.02
IC-18	418	0.03355	21.5	0.16811	888	0.29122	1538	0.0088	2	0.40	0.05	3.00	0.0018	0.50	25.27	1.18	17.89	3.91	0.59	0.15
IC-19	419	0.03172	20.3	0.23234	1227	0.29457	1555	0.0017	5	0.40	0.05	3.00	0.0018	0.50	15.53	0.77	10.67	2.40	0.56	0.21
IC-20	620	0.12819	82.0	0.28309	1495	0.49184	2597	0.0061	25	0.35	0.05	3.00	0.0018	0.50	122.85	1.50	91.36	32.45	18.53	9.90
IC-21	621	0.12476	79.8	0.33767	1783	0.54339	2869	0.0060	25	0.35	0.05	3.51	0.0018	0.53	104.76	1.31	77.41	25.87	14.41	8.18
IC-22	422	0.06029	38.6	0.19034	1005	0.27598	1457	0.0028	5	0.40	0.05	3.56	0.0015	0.64	39.90	1.03	27.21	3.45	0.98	0.43
IC-23	423	0.01105	7.1	0.06569	347	0.12682	670	0.0010	10	0.40	0.05	3.00	0.0018	0.50	7.60	1.07	5.47	1.42	0.47	0.22
IC-24	424	0.03186	20.4	0.14646	773	0.24841	1312	0.0034	12	0.40	0.05	3.32	0.0016	0.58	22.28	1.09	15.75	3.44	1.34	0.72
IC-25	425	0.11336	72.5	0.44512	2350	0.69156	3651	0.0017	4	0.40	0.05	3.14	0.0018	0.51	49.47	0.68	33.68	6.99	1.29	0.51
IC-26	426	0.00436	2.8	0.09765	516	0.20953	1106	0.0023	3	0.40	0.05	4.49	0.0014	0.73	1.37	0.49	0.83	0.03	0.02	0.01
IC-27	427	0.01942	12.4	0.21776	1150	0.33655	1777	0.0022	4	0.40	0.05	3.64	0.0017	0.59	7.43	0.60	4.91	0.71	0.15	0.06
IC-28	428	0.01904	12.2	0.13688	723	0.24789	1309	0.0022	9	0.40	0.05	4.77	0.0008	0.94	5.95	0.49	3.26	0.33	0.16	0.07
IC-29	429	0.03164	20.2	0.12402	655	0.20987	1108	0.0074	7	0.40	0.05	3.53	0.0015	0.63	26.37	1.30	18.16	2.83	0.93	0.43
IC-30	430	0.04815	30.8	0.16525	873	0.26419	1395	0.0028	7	0.40	0.05	3.28	0.0016	0.57	33.94	1.10	23.73	4.59	1.23	0.61
IC-31	431	0.00552	3.5	0.08631	456	0.11017	582	0.0096	7	0.40	0.05	3.93	0.0013	0.73	3.46	0.98	2.28	0.18	0.11	0.04
IC-32	432	0.02223	14.2	0.12746	673	0.17551	927	0.0038	3	0.40	0.05	3.81	0.0014	0.70	13.98	0.98	9.19	0.46	0.19	0.07
IC-33	433	0.29557	189.2	0.45994	2428	0.85005	4488	0.0077	3	0.40	0.05	3.54	0.0016	0.62	190.57	1.01	128.30	16.25	2.86	1.26
IC-34	434	0.29411	188.2	0.47234	2494	0.55428	2927	0.0086	7	0.40	0.05	3.68	0.0014	0.67	219.44	1.17	148.88	18.38	7.33	3.18
IC-35	435	0.15654	100.2	0.29217	1543	0.47789	2523	0.0110	3	0.40	0.05	4.23	0.0013	0.76	114.86	1.15	72.92	2.56	1.47	0.48
IC-36	436	0.25215	161.4	0.35933	1897	0.61293	3236	0.0202	3	0.40	0.05	4.75	0.0009	0.92	146.78	0.91	80.55	2.99	1.38	0.18
IC-37	437	0.12171	77.9	0.41923	2214	0.61929	3270	0.0191	3	0.40	0.05	4.49	0.0017	0.64	81.23	1.04	54.47	5.60	1.17	0.51
IC-38	438	0.17047	109.1	0.41416	2187	0.49163	2596	0.0168	6	0.40	0.05	4.14	0.0015	0.68	135.59	1.24	91.24	9.29	3.82	1.62
IC-39	439	0.53890	344.9	0.57140	3017	0.88637	4680	0.0206	5	0.40	0.05	4.46	0.0013	0.76	386.37	1.12	248.28	14.03	8.05	2.78
IC-40	440	0.25298	161.9	0.34222	1807	0.57446	3033	0.0236	5	0.40	0.05	3.92	0.0015	0.66	240.54	1.49	164.24	19.33	6.01	2.62
IC-41	441	0.03198	20.5	0.19111	1009	0.26881	1419	0.0045	6	0.40	0.05	3.00	0.0018	0.50	21.06	1.03	14.88	3.54	0.90	0.36
IC-42	442	0.08919	57.1	0.31396	1658	0.38789	2048	0.0031	6	0.40	0.05	3.12	0.0017	0.53	56.21	0.98	39.11	8.38	1.77	0.90
IC-43	443	0.06619	42.4	0.19339	1021	0.29151	1539	0.0100	3	0.40	0.05	3.73	0.0014	0.68	53.11	1.25	35.56	2.77	0.78	0.32
IC-44	444	0.02100	13.4	0.38667	2042	0.64691	3416	0.0038	4	0.40	0.05	3.00	0.0018	0.50	5.97	0.44	4.08	0.89	0.18	0.06
IC-45	445	0.04314	27.6	0.26083	1377	0.40397	2133	0.0101	2	0.40	0.05	4.61	0.0013	0.78	20.88	0.76	12.80	0.30	0.16	0.05
IC-46	446	0.14145	90.5	0.44554	2352	0.77421	4088	0.0126	3	0.40	0.05	4.30	0.0016	0.66	81.42	0.90	53.60	4.46	1.14	0.47
IC-47	447	0.04399	28.2	0.29940	1581	0.51621	2726	0.0270	2	0.40	0.05	4.89	0.0009	0.91	16.91	0.60	8.95	0.22	0.10	0.01
IC-48	448	0.17814	114.0	0.46833	2473	0.70405	3717	0.0064	3	0.40	0.05	4.05	0.0017	0.60	105.68	0.93	71.41	9.65	1.58	0.70
IC-49	449	0.25792	165.1	0.39003	2059	0.78022	4120	0.0125	3	0.40	0.05	4.15	0.0017	0.61	193.88	1.17	132.39	17.87	2.95	1.33
IC-50	450	0.11515	73.7	0.29022	1532	0.52157	2754	0.0225	2	0.40	0.05	4.38	0.0014	0.73	86.32	1.17	55.71	1.31	0.78	0.28
IC-51	451	0.10027	64.2	0.21502	1135	0.37349	1972	0.0328	3	0.40	0.05	4.32	0.0015	0.69	99.18	1.55	66.96	4.64	1.48	0.60
IC-52	452	0.27032	173.0	0.44317	2340	0.79970	4222	0.0204	3	0.40	0.05	4.43	0.0011	0.82	166.66	0.96	100.97	3.52	1.87	0.41
IC-53	453	0.12559	80.4	0.32005	1690	0.52722	2784	0.0222	2	0.40	0.05	4.85	0.0009	0.92	65.28	0.81	35.00	0.87	0.39	0.04
IC-54	654	0.13689	87.6	0.11211	592	0.38359	2025	0.0061	11	0.40	0.05	4.68	0.0014	0.75	141.33	1.61	95.90	11.42	7.04	3.02
IC-55	455	0.04687	30.0	0.19374	1023	0.30653	1618	0.0105	2	0.40	0.05	4.53	0.0017	0.62	34.58	1.15	23.50	2.66	0.35	0.15
IC-56	456	0.23488	150.3	0.62686	3310	0.98671	5210	0.0164	3	0.40	0.05	4.49	0.0018	0.62	138.77	0.92	93.03	11.32	2.03	0.89
IC-57	457	0.22305	142.7	0.53575	2829	0.84281	4450	0.0064	2	0.40	0.05	4.08	0.0017	0.59	124.41	0.87	83.26	10.96	1.24	0.55
IC-58	458	0.13153	84.2	0.19485	1029	0.40873	2158	0.0091	28	0.40	0.05	4.25	0.0017	0.61	160.79	1.91	118.43	35.78	21.34	13.23
IC-59	459	0.06055	38.8	0.10126	535	0.25283	1335	0.0089	10	0.40	0.05	4.50	0.0018	0.60	67.79	1.75	48.48	9.80	3.50	1.70
IC-60	460	0.19815	126.8	0.33442	1766	0.64720	3417	0.0203	3	0.40	0.05	4.15	0.0015	0.66	164.87	1.30	110.72	10.03	2.42	1.01
IC-61	461	0.08004	51.2	0.13418	708	0.42237	2230	0.0212	2	0.40	0.05	4.09	0.0017	0.60	82.05	1.60	56.63	7.98	0.89	0.41
IC-62	662	0.10100	64.6	0.21698	1146	0.44354	2342	0.0146	24	0.35	0.05	3.52	0.0017	0.56	112.26	1.74	82.66	27.28	14.57	8.56
IC-63	463	0.07680	49.2	0.23774	1255	0.42435	2241	0.0096	24	0.35	0.05	3.72	0.0018	0.55	71.31	1.45	52.50	17.16	9.26	5.42
Totals/Averages			**3992.5**						**8**						**74.20**	**1.17**	**50.42**	**8.52**	**3.86**	**2.15**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3



Idaho Creek Basin Crossings

Crossing	Street Name	Existing Crossing Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
IC-C1	Highway 119	(2) 5' H x 9' W RCBC	< 50-Year	4843.9	401
IC-C2	County Road 7, South of Highway 119	3'H x 12' W RCBC	< 50-Year	4866.0	407
IC-C3	County Road 20.5	38" H x 60" W HERCP	< 10-Year	4871.1	409
IC-C4	County Road 20.5	3.7' H x 10' W Arch CMP	> 100-Year	4871.1	420
IC-C5	County Road 20, East of County Road 7	42" CMP	< 50-Year	4891.1	440
IC-C6	County Road 16.5	18" CMP	< 2-Year	4915.1	956
IC-C7	Decommissioned Railroad Embankment	36" CMP	< 2-Year	4933.0	457
IC-C8	Wetland Pond Embankment	N/A	< 2-Year	N/A	458
IC-C9	Boulder and Weld County Ditch	N/A	< 2-Year	N/A	959 (Link)
IC-C10	HWY 52, West of County Road 5	36" RCP	< 5-Year	4983.1	P-479
IC-C11	County Road 5/Boulder and Weld County Ditch	N/A	< 2-Year	4974.0	460
IC-C12	Lower Boulder Ditch	N/A	< 2-Year	4994.0	461
IC-C13	HWY 52, East of County Road 5	24" RCP***	< 10-Year	5000.1	P-475
IC-C14	County Road 7, South of County Road 20	N/A	< 2-Year	4885.4	439
IC-C15	County Road 20, West of County Road 7	N/A	< 2-Year	4882.7	433
IC-C16	County Road 18, East of County Road 7	N/A	< 2-Year	4942.7	438
IC-C17	County Road 18, West of County Road 7	N/A	< 2-Year	4941.1	437
IC-C18	County Road 18, East of County Road 5	N/A	< 2-Year	4901.0	235 (Link)
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	N/A	< 2-Year	4920.2	448
IC-C20	County Road 16.5, East of County Road 5	N/A	< 2-Year	4932.5	446
IC-C21	Godding Ditch Crossing	N/A	< 2-Year	4892.0	434

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

N

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FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

IDAHO CREEK
EXISTING CONDITION
CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/26/2021	
SHEET: IC	INDEX: EC-CROSS

Table E.1.2: Idaho Creek Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Main Flow Path - Lower Idaho Creek																		
IC-C1	Highway 119	401	(2) 5' H x 9' W RCBC	4843.9	1000	< 50-Year	< 50-Year	51	79	176	1068	1777	53	92	228	1237	1962	Good Condition
IC-C2	County Road 7, South of Highway 119	407	3'H x 12' W RCBC	4866.0	220	< 50-Year	< 10-Year	33	66	175	1060	1737	45	89	223	1215	1907	Good Condition - Built in 2005 Excess flow will be conveyed north along roadside channel and overtop County Road 7.
IC-C3	County Road 20.5	409	38" H x 60" W HERCP	4871.1	160	< 10-Year	< 10-Year	32	66	177	1067	1743	45	90	225	1221	1913	Good Condition
Rural Ditch																		
IC-C4	County Road 20.5	420	3.7' H x 10' W Arch CMP	4871.1	170	> 100-Year	> 100-Year	2	3	7	17	39	2	3	7	17	39	Good Condition - Irrigation base flow is not included in peak discharge values.
IC-C5	County Road 20, East of County Road 7	440	42" CMP	4891.1	100	< 50-Year	< 50-Year	3	6	19	164	241	12	15	19	166	237	Good Condition - Excess flow will be conveyed west along roadside ditch and overtop County Road 20.
Main Flow Path - Upper Idaho Creek																		
IC-C6	County Road 16.5	956	18" CMP	4915.1***	5**	< 2-Year	< 2-Year	48	96	239	1146	1740	57	117	263	1220	1837	Poor Condition. Pipe is squashed.
IC-C7	Decommissioned Railroad Embankment	457	36" CMP	4933.0***	5***	< 2-Year	< 2-Year	47	109	263	1181	1782	60	127	286	1259	1883	Good Condition. Heavy vegetation on upstream side.
IC-C8	Wetland Pond Embankment	458	N/A	N/A	N/A	< 2-Year	< 2-Year	50	120	286	1204	1751	54	128	296	1228	1787	Culvert crossing in wetland pond not accessible. Major flood events will overtop embankment on north side of pond.
IC-C9	Boulder and Weld County Ditch	959 (Link)	N/A	N/A	N/A	< 2-Year	< 2-Year	47	108	237	878	1242	47	108	237	878	1242	Culvert crossing in wetland pond not accessible. Major flood events will overtop ditch embankment.
IC-C10	HWY 52, West of County Road 5	P-479	36" RCP	4983.1***	50	< 5-Year	< 5-Year	48	111	240	888	1252	48	111	240	888	1252	Fair Condition. No flared end section on upstream end and end of concrete pipe starting to deteriorate.
IC-C11	County Road 5/Boulder and Weld County Ditch	460	N/A	4974.0***	N/A	< 2-Year	< 2-Year	2	9	54	332	496	7	17	59	354	518	Existing crossing culvert could not be located. Overtopping of road and ditch will occur during flood events.
IC-C12	Lower Boulder Ditch	461	N/A	4994.0***	N/A	< 2-Year	< 2-Year	2	9	51	254	362	4	13	53	261	369	Existing crossing culvert could not be located. Overtopping of ditch will occur during flood events.
IC-C13	HWY 52, East of County Road 5	P-475	24" RCP***	5000.1***	30***	< 10-Year	< 5-Year	2	9	46	205	288	2	9	46	205	288	Fair Condition - FES Broken
Other Tributary Crossings																		
IC-C14	County Road 7, South of County Road 20	439	N/A	4885.4	N/A	< 2-Year	< 2-Year	3	8	14	268	446	6	10	14	260	439	Existing crossing culvert could not be located. Overtopping of County Road 7 will occur to west.
IC-C15	County Road 20, West of County Road 7	433	N/A	4882.7	N/A	< 2-Year	< 2-Year	4	11	38	596	1079	18	36	67	698	1253	Existing crossing culvert could not be located. Overtopping of County Road 20 will occur to north.
IC-C16	County Road 18, East of County Road 7	438	N/A	4942.7	N/A	< 2-Year	< 2-Year	2	4	9	91	136	3	6	9	93	134	Existing crossing culvert could not be located. Overtopping of County Road 18 will occur to northwest across intersection.

Table E.1.2: Idaho Creek Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Other Tributary Crossings (Continued)																		
IC-C17	County Road 18, West of County Road 7	437	N/A	4941.1	N/A	< 2-Year	< 2-Year	1	1	6	70	106	3	5	8	68	105	Existing crossing culvert could not be located. Overtopping of County Road 18 will occur to north.
IC-C18	County Road 18, East of County Road 5	235 (Link)	N/A	4901.0	N/A	< 2-Year	< 2-Year	1	2	7	208	403	10	16	22	304	555	Existing crossing culvert could not be located. Overtopping of County Road 18 will occur to northwest.
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	448	N/A	4920.2***	N/A	< 2-Year	< 2-Year	2	4	25	274	435	8	16	31	298	457	Existing crossing culvert could not be located. Overtopping of County Road 16.5 will occur to north.
IC-C20	County Road 16.5, East of County Road 5	446	N/A	4932.5***	N/A	< 2-Year	< 2-Year	1	3	7	185	317	10	15	20	292	457	Existing crossing culvert could not be located as road turns at this location. Potential location of future crossing if road is extended.
IC-C21	Godding Ditch Crossing	434	N/A	4892	N/A	< 2-Year	< 2-Year	3	9	27	382	705	12	24	42	481	874	Existing crossing culvert of ditch could not be located. Overtopping of Ditch will occur to north.

*HY-8 Program used to evaluate capacities unless otherwise noted
**Capacities evaluated in EPA-SWMM or StormCAD
***Obtained from Erie OSP

Idaho Creek Basin Existing Detention Ponds						
Pond Number	Name	Max Depth at Spillway (ft)	Max Volume to Spillway (ac-ft)	Invert Elevation (ft)	SWMM Node	Notes
IC-620	Rinn Valley Ranch West	2.74	7.04	4872.8	620	-
IC-621	Rinn Valley Ranch East	4.51	8.67	4869.7	621	-
IC-654	Grand View Elementary School Retention Pond	-	194.34	5001.0	654	Old mine depression that retains runoff
IC-662	Wyndham Hill Detention Pond B	5.90	9.77	5008.9	662	-
*Refer to detention pond spreadsheets for more information						

HWY 119
WCR 20 1/2
620
621
I25
BELLA ROSA PKWY
WCR 5
GODDING HOLLOW PKWY
WCR 16 1/2
654
662
HWY 52
WCR 3 1/4
WCR 5
AGGREGATE BLVD

Legend

- Detention Pond with Sufficient Volume for 100-Year Flow Event
- Detention Pond Anticipated to Overtop in 100-Year Flow Event
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

N

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dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

IDAHO CREEK DETENTION POND MAP

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 10/27/21	
SHEET: IC	INDEX: POND

IDAHO CREEK EXISTING POND 620 - RINN VALLEY POND 1 (WEST)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4872.81	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4873.00	75076	1.72	0.19	4755	0.11	0.12	0.00	0.12	
4874.00	82377	1.89	1.19	83453	1.92	4.15	0.00	4.15	
4875.00	165781	3.81	2.19	205125	4.71	11.00	0.00	11.00	
4875.55	204058	4.68	2.74	306649	7.04	13.49	0.00	13.49	Emergency Spillway Elevation
4876.00	207492	4.76	3.19	399246	9.17	14.89	16.11	31.00	
4876.50	269919	6.20	3.69	518258	11.90	8.87	201.13	210.00	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 24" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

IDAHO CREEK EXISTING POND 621 - RINN VALLEY POND 1 (EAST)

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
4869.74	0	0.00	0.0	0	0.00	0.00	0.00	0.00	No Water Quality Outlet
4870.00	225	0.01	0.26	19	0.00	0.10	0.00	0.10	
4871.00	16082	0.37	1.26	6089	0.14	5.50	0.00	5.50	
4872.00	84885	1.95	2.26	52061	1.20	15.55	0.00	15.55	
4873.00	141288	3.24	3.26	163956	3.76	23.65	0.00	23.65	
4874.00	188320	4.32	4.26	328198	7.53	29.45	0.00	29.45	
4874.25	207676	4.77	4.51	377678	8.67	30.69	0.00	30.69	Emergency Spillway Elevation
4874.50	312666	7.18	4.76	442274	10.15	31.75	266.96	298.71	

[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]100-Year discharge based 24" outlet pipe with no orifice plate (HY-8 utilized to develop discharge curve)

[4]Weir flow approximated as a broad crested weir

IDAHO CREEK EXISTING POND 654 - OLD MINE DEPRESSION

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5000.97	0	0.00	0.0	0	0.00	0.00	0.00	0.00	
5003.00	63317	1.45	2.03	42929	0.99	0.00	0.00	0.00	
5004.00	79317	1.82	3.03	114096	2.62	0.00	0.00	0.00	
5005.00	95798	2.20	4.03	201524	4.63	0.00	0.00	0.00	
5006.00	113527	2.61	5.03	306061	7.03	0.00	0.00	0.00	
5007.00	152648	3.50	6.03	438667	10.07	0.00	0.00	0.00	
5008.00	207889	4.77	7.03	618226	14.19	0.00	0.00	0.00	
5009.00	242773	5.57	8.03	843332	19.36	0.00	0.00	0.00	
5010.00	276330	6.34	9.03	1102703	25.31	0.00	0.00	0.00	
5011.00	307509	7.06	10.03	1394484	32.01	0.00	0.00	0.00	
5012.00	334831	7.69	11.03	1715557	39.38	0.00	0.00	0.00	
5013.00	357649	8.21	12.03	2061734	47.33	0.00	0.00	0.00	
5014.00	382900	8.79	13.03	2431937	55.83	0.00	0.00	0.00	
5015.00	410272	9.42	14.03	2828444	64.93	0.00	0.00	0.00	
5016.00	463383	10.64	15.03	3265003	74.95	0.00	0.00	0.00	
5017.00	503963	11.57	16.03	3748534	86.05	0.00	0.00	0.00	
5018.00	535719	12.30	17.03	4268294	97.99	0.00	0.00	0.00	
5019.00	569813	13.08	18.03	4820972	110.67	0.00	0.00	0.00	
5020.00	602282	13.83	19.03	5406944	124.13	0.00	0.00	0.00	
5021.00	633284	14.54	20.03	6024662	138.31	0.00	0.00	0.00	
5022.00	666171	15.29	21.03	6674320	153.22	0.00	0.00	0.00	
5023.00	852461	19.57	22.03	7431725	170.61	0.00	0.00	0.00	
5023.40	894223	20.53	22.43	8465276	194.34	0.00	0.00	0.00	

[1]Invert based on 2013 LiDAR Contours

[2]Based on 2013 LiDAR contours

[3]Depression has not outlet and is large enough to retain all runoff

[4]No Weir flow as depression is large enough to retain all runoff

IDAHO CREEK EXISTING POND 662 - WYNDAM HILL POND B

Stage (NAVD 88) (ft)[1]	AutoCAD Area (ft^2)[2]	AutoCAD Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Pipe Discharge (cfs)[3]	Weir Discharge (cfs)[4]	Total Discharge (cfs)	Notes:
5008.9	0	0.00	0.0	0	0.00	0.00	0.00	0.00	Water Quality Release Not Modeled
5009.0	897	0.02	0.10	30	0.00	0.00	0.00	0.00	
5010.0	17130	0.39	1.10	7345	0.17	0.00	0.00	0.00	
5011.0	54396	1.25	2.10	41362	0.95	0.00	0.00	0.00	
5012.0	83917	1.93	3.10	109988	2.52	0.00	0.00	0.00	
5012.1	85783	1.97	3.20	118473	2.72	0.00	0.00	0.00	Invert of 10-Year Opening
5013.0	109817	2.52	4.10	206270	4.74	10.36	0.00	10.36	Weir Flow Through 10-Year Opening
5014.0	124692	2.86	5.10	323446	7.43	31.79	0.00	31.79	
5014.5	127952	2.94	5.60	386605	8.88	45.13	0.00	45.13	Top of Inlet Box for 100-Year Opening
5014.8	131221	3.01	5.90	425480	9.77	50.98	0.00	50.98	Orifice Flow Through 100-Year Opening Emergency Spillway Elevation
5015.0	140093	3.22	6.10	452606	10.39	52.07	71.11	123.18	
5015.3	144494	3.32	6.40	495293	11.37	53.65	281.10	334.75	

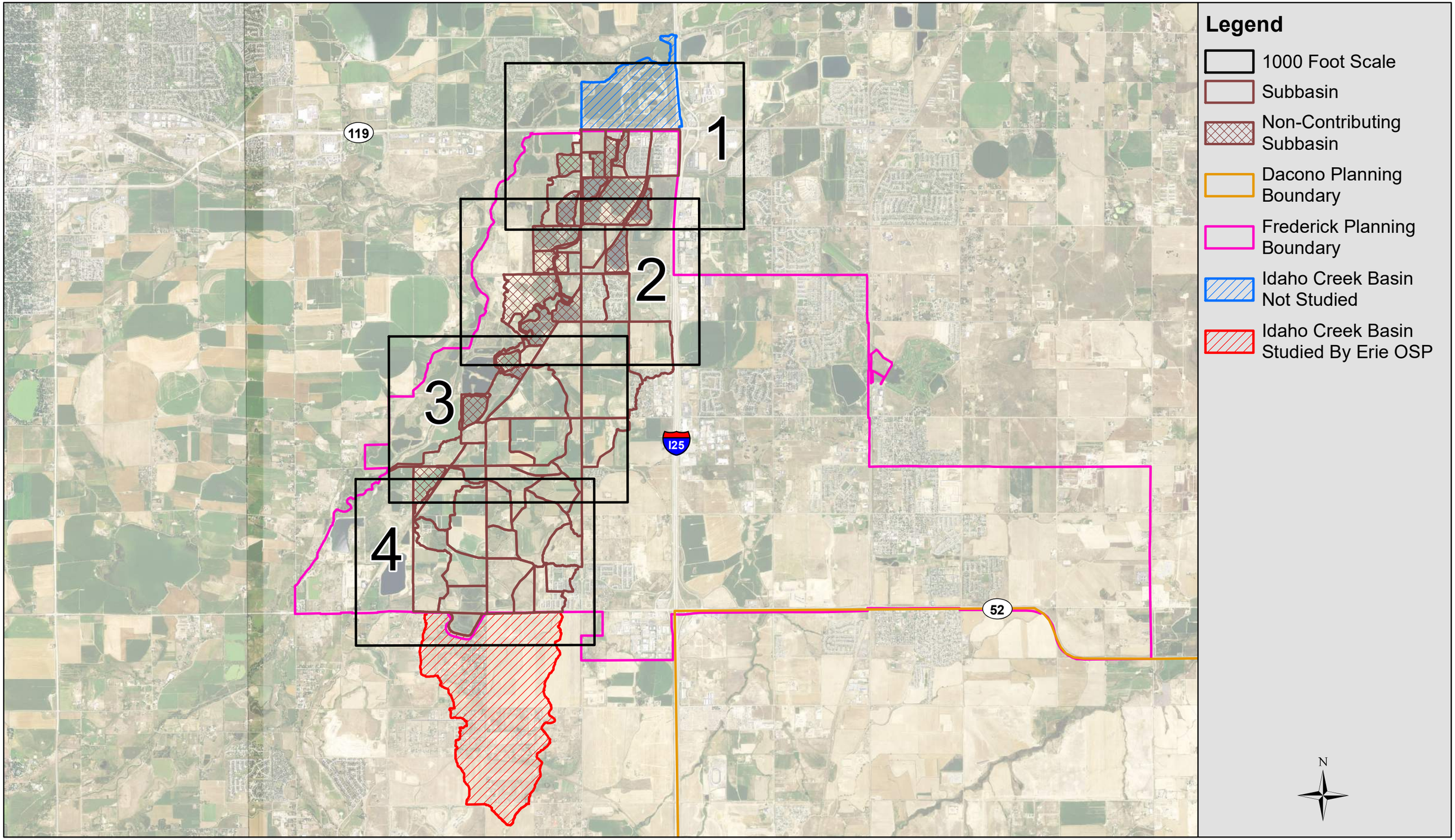
[1]Invert based on survey

[2]Based on 2013 LiDAR contours or information provided in drainage report

[3]10-Year discharge based on 3.67' wide x 2.4' high rectangular weir

[3]100-Year discharge based 30" outlet pipe with no orifice plate

[4]Weir flow approximated as a broad crested weir



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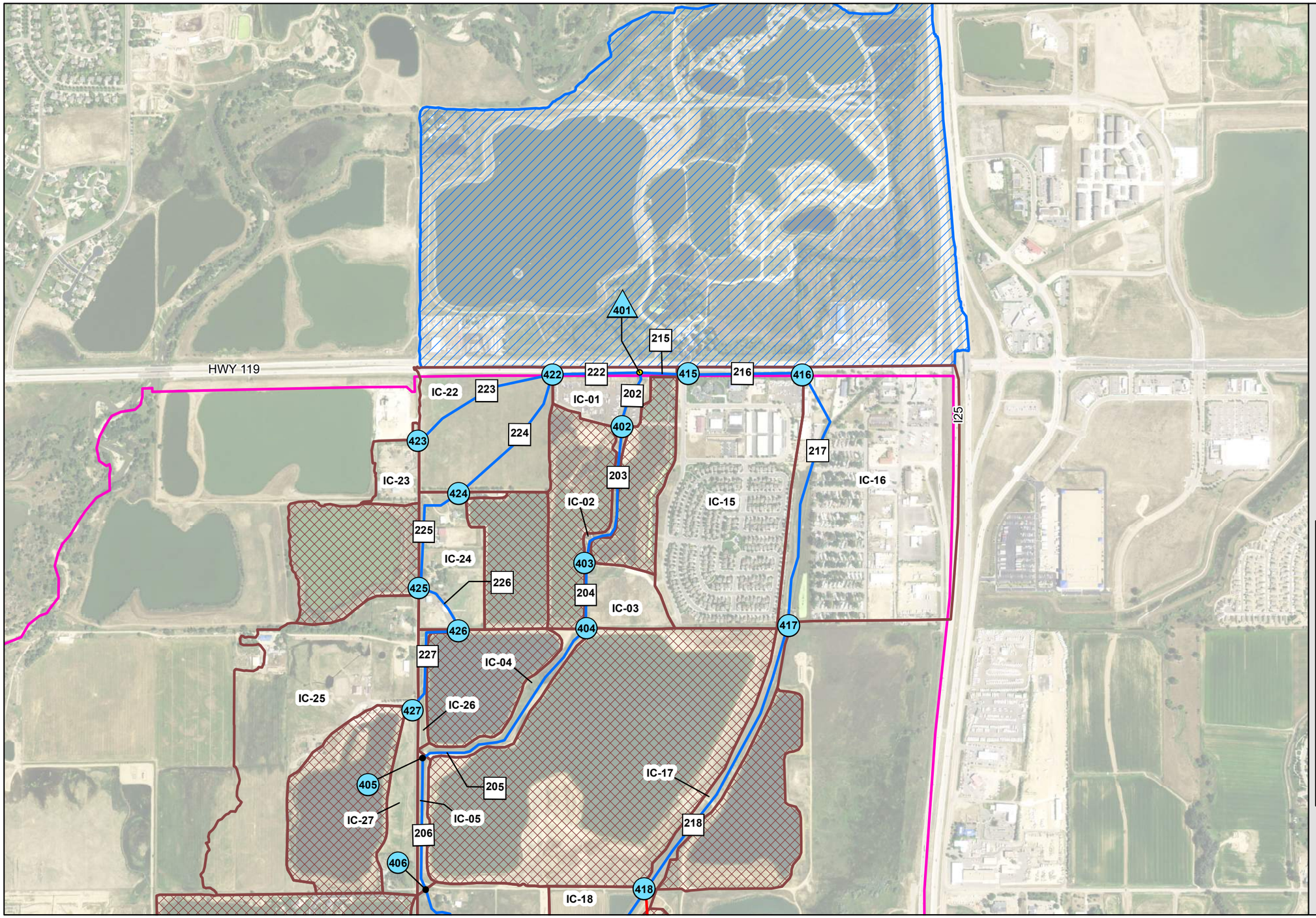
OUTFALL SYSTEM PLAN

IDAHO CREEK
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	EK
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/26/2021	
SHEET: IC	INDEX: C-INDEX



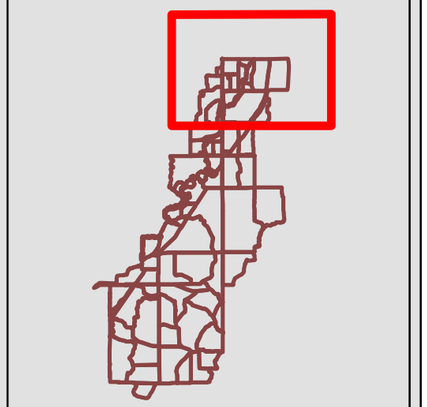
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

Key Map



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Feet

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IDAHO CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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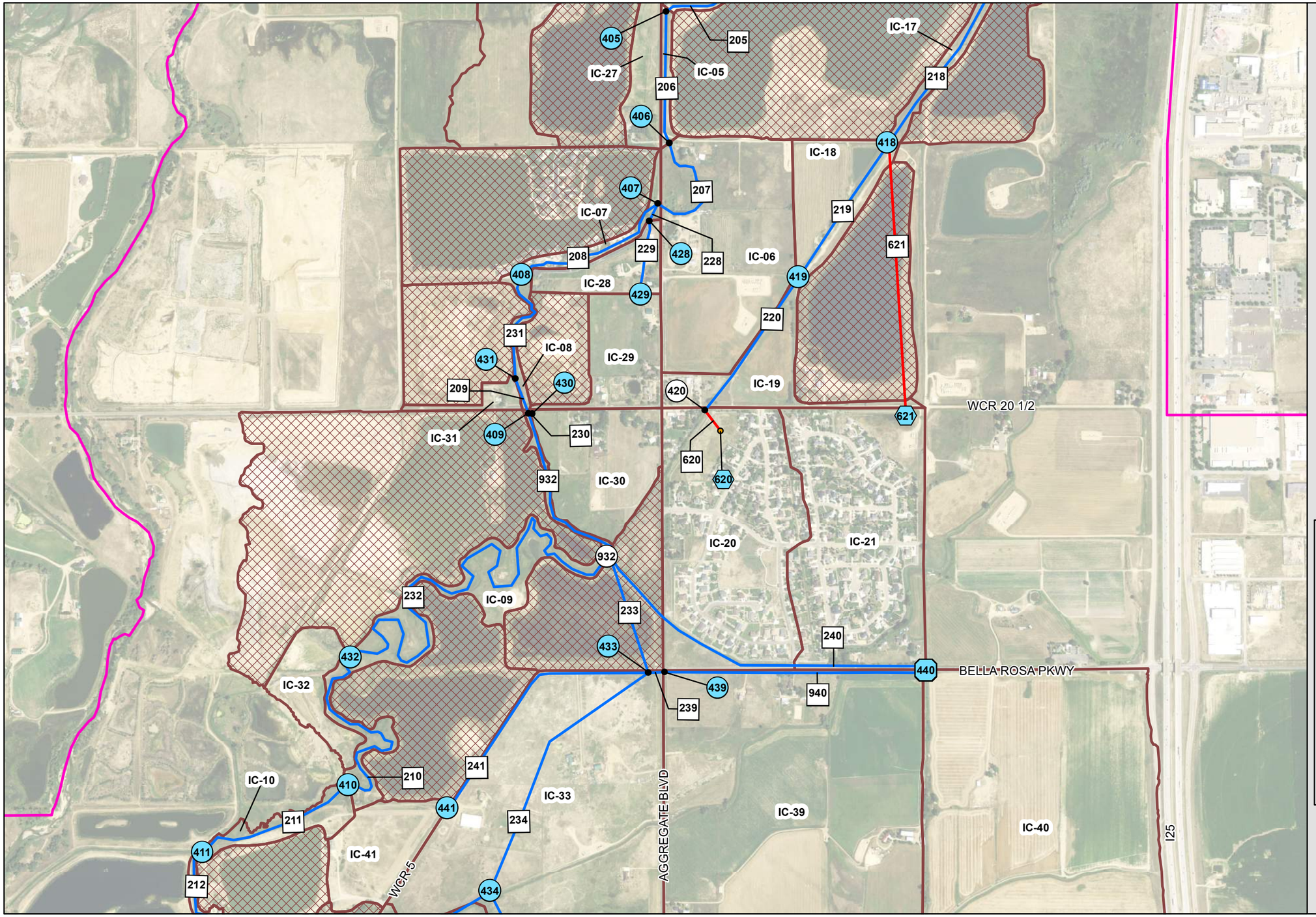
SHEET: IC	INDEX: EC-1



Legend

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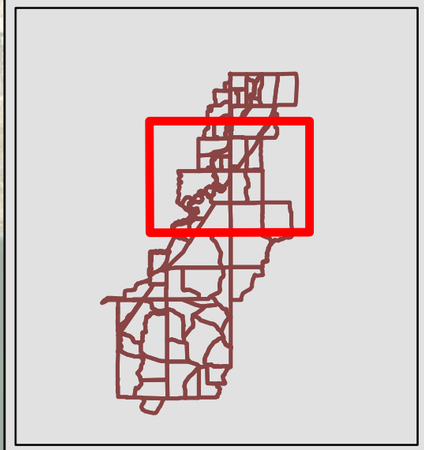
Key Map



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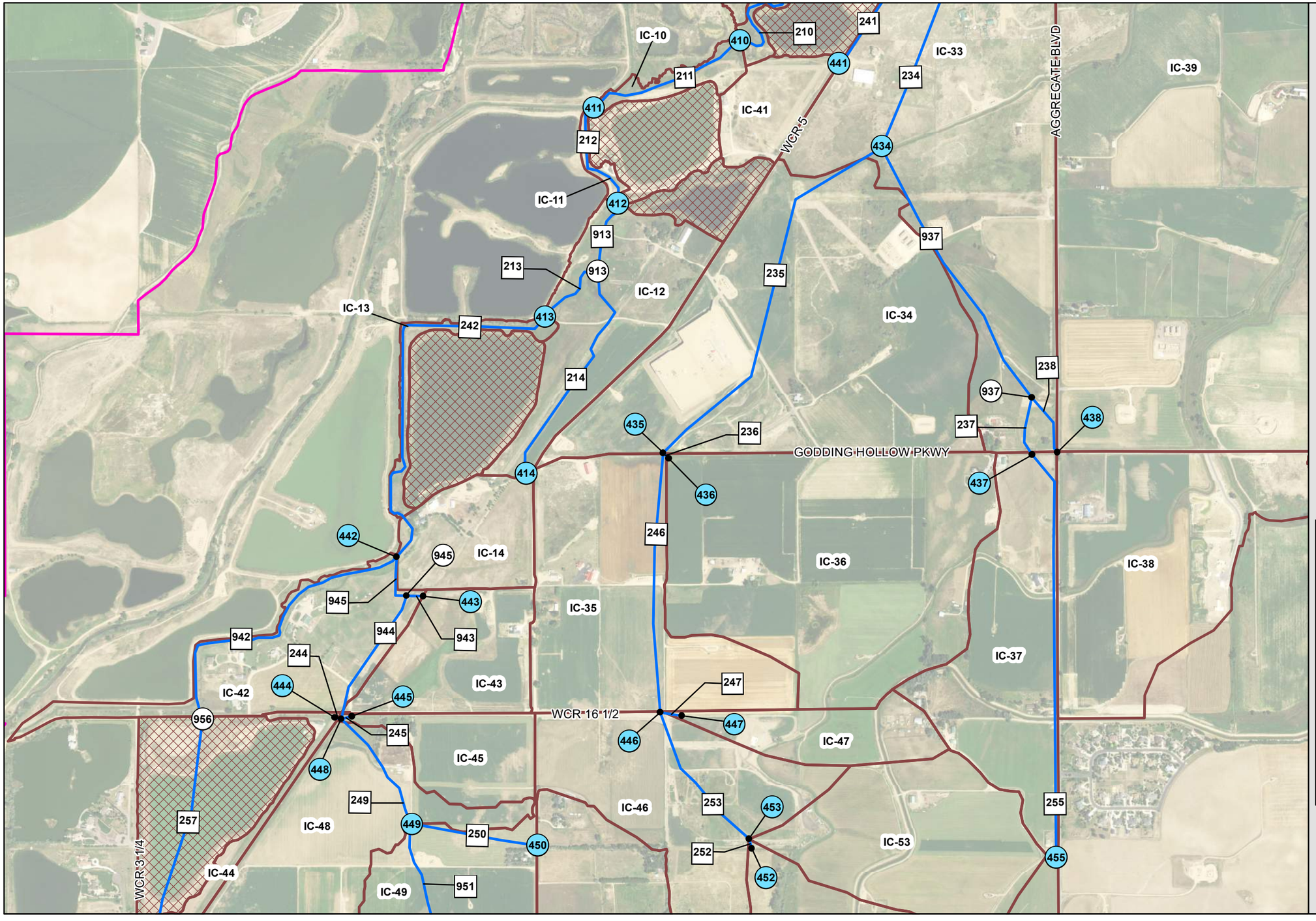

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

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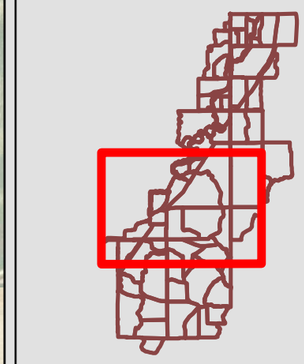
- Idaho Creek Studied By Erie OSP

Key Map



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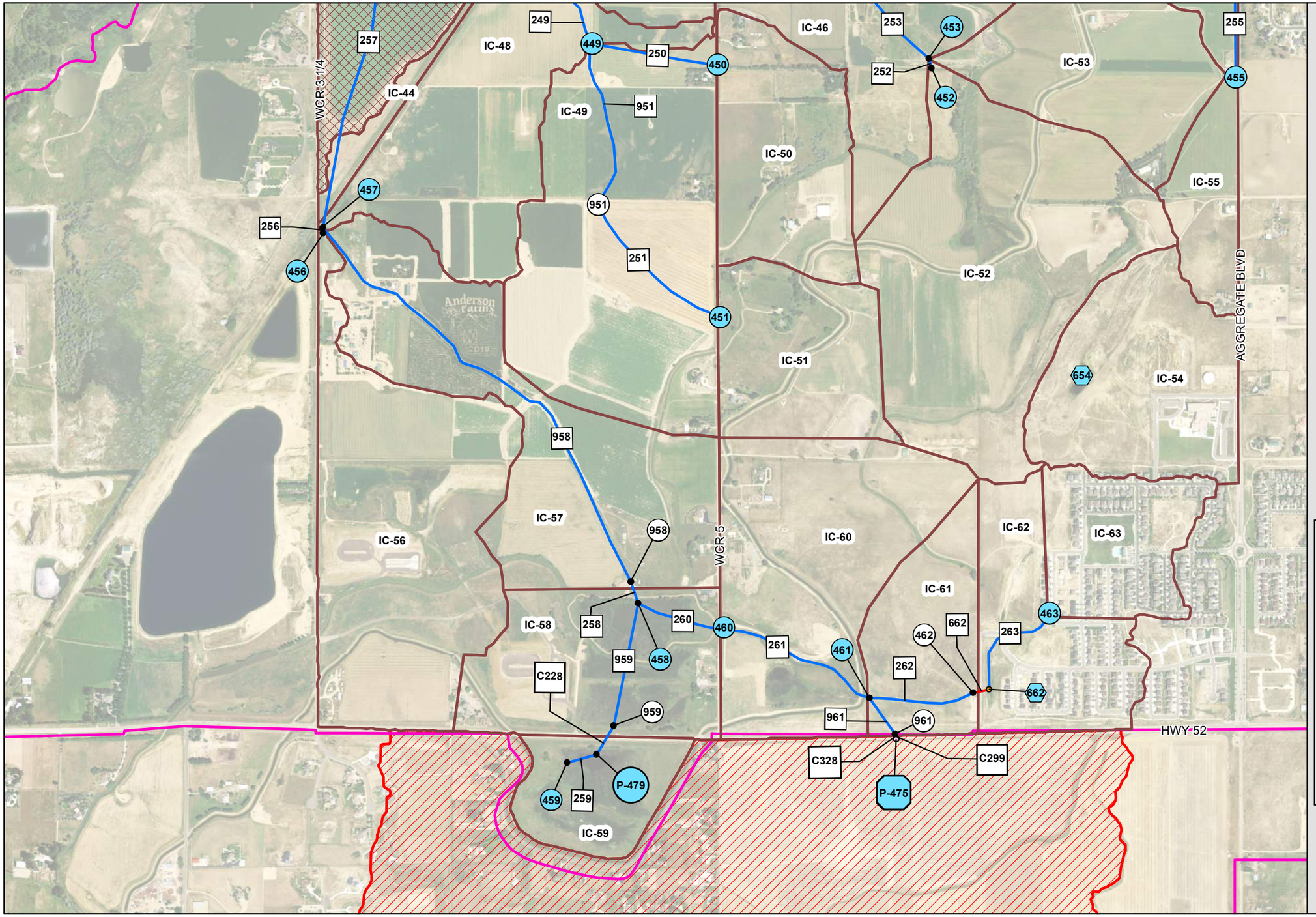

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
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- Dacono Planning Boundary
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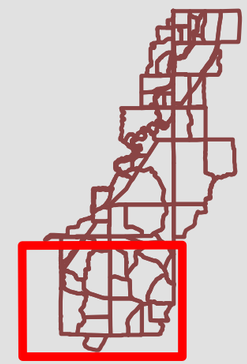
Key Map



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Feet

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Table E.1.3: Idaho Creek Basin Peak Discharge Comparison: Existing Conditions CR 2008 Study and 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	CR 2008 Study Existing Condition SWMM Model Peak Discharge (cfs)					Existing Condition SWMM Model Peak Discharge (cfs)					Difference (2022 OSP - CR 2008 Study) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path - Lower Idaho Creek																		
Highway 119/ Frederick Planning Boundary	401	5348	43	272	577	1996	2721	51	79	176	1068	1777	8	-193	-401	-928	-944	
County Road 7, South of Highway 119	407	4701	28	216	470	1726	2370	33	66	175	1060	1737	5	-150	-295	-666	-633	
County Road 20.5	409	4656	28	208	453	1698	2336	32	66	177	1067	1743	4	-142	-276	-631	-593	
Rural Ditch																		
County Road 20.5	420	82	6	11	14	85	118	2	3	7	17	39	-4	-8	-7	-68	-79	
County Road 20, East of County Road 7	440	162	1	28	54	152	196	3	6	19	164	241	2	-22	-35	12	45	
Main Flow Path - Upper Idaho Creek																		
Country Road 16.5	956	2064	18	101	200	1123	1674	48	96	239	1146	1740	30	-5	39	23	66	
Decommissioned Railroad Embankment	457	2064	15	90	179	1141	1697	47	109	263	1181	1782	32	19	84	40	85	
HWY 52, West of County Road 5	P-479	1181	56	90	239	1021	1379	48	111	240	888	1252	-8	21	1	-133	-127	Existing Condition inflows from Erie OSP.
County Road 5/Boulder and Weld County Ditch	460	506	17	101	180	549	722	2	9	54	332	496	-15	-92	-126	-217	-226	
HWY 52, East of County Road 5	P-475	214	3	56	97	245	310	2	9	46	205	288	-1	-47	-51	-40	-22	Existing Condition inflows from Erie OSP.
Other Tributary Crossings																		
County Road 7, South of County Road 20	439	345	2	41	84	254	331	3	8	14	268	446	1	-33	-70	14	115	
County Road 20, West of County Road 7	433	1631	N/A	N/A	N/A	N/A	N/A	4	11	38	596	1079	N/A	N/A	N/A	N/A	N/A	
County Road 18, East of County Road 5	235 (Link)	721	15	70	164	663	745	1	2	7	208	403	-14	-68	-157	-455	-342	
County Road 16.5, East of County Road 5	446	460	17	66	135	552	580	1	3	7	185	317	-16	-63	-128	-367	-263	
County Road 16.5 at Decommissioned Railroad Embankment	448	458	2	51	111	367	745	2	4	25	274	435	-1	-47	-86	-93	-310	

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

Appendix E.2. Idaho Creek Future Condition Documentation

TABLE E.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
IDAHO CREEK																				
IC-01	701	0.01918	12.3	0.07933	419	0.15422	814	0.0026	55	0.35	0.10	5.00	0.0007	1.00	26.58	2.17	19.62	8.74	6.64	4.88
IC-02	402	0.00398	2.5	0.20464	1080	0.25494	1346	0.0031	2	0.40	0.05	5.00	0.0007	1.00	0.40	0.16	0.17	0.00	0.00	0.00
IC-03	703	0.01763	11.3	0.09971	526	0.17882	944	0.0066	45	0.35	0.10	4.25	0.0011	0.81	23.44	2.08	17.41	6.30	4.65	3.05
IC-04	404	0.01177	7.5	0.17235	910	0.37565	1983	0.0026	2	0.40	0.05	3.83	0.0013	0.71	3.52	0.47	2.16	0.07	0.03	0.01
IC-05	405	0.00548	3.5	0.11435	604	0.21470	1134	0.0037	2	0.40	0.05	3.80	0.0014	0.70	1.98	0.56	1.23	0.05	0.02	0.01
IC-06	706	0.10441	66.8	0.25567	1350	0.43716	2308	0.0042	14	0.40	0.05	3.48	0.0015	0.62	75.48	1.13	53.18	11.09	5.21	2.82
IC-07	407	0.00900	5.8	0.17656	932	0.27216	1437	0.0034	24	0.35	0.05	5.00	0.0007	1.00	2.49	0.43	1.55	0.42	0.29	0.18
IC-08	408	0.00538	3.4	0.19717	1041	0.25122	1326	0.0044	5	0.40	0.05	5.00	0.0007	1.00	0.73	0.21	0.34	0.02	0.01	0.00
IC-09	409	0.05464	35.0	0.48683	2570	1.23096	6499	0.0019	3	0.40	0.05	3.06	0.0018	0.52	13.23	0.38	8.97	1.76	0.26	0.10
IC-10	410	0.01380	8.8	0.12093	638	0.25041	1322	0.0019	3	0.40	0.05	3.00	0.0018	0.50	6.94	0.79	4.72	1.02	0.18	0.06
IC-11	411	0.00481	3.1	0.14032	741	0.17161	906	0.0029	7	0.40	0.05	3.00	0.0018	0.50	1.99	0.65	1.36	0.32	0.09	0.04
IC-12	712	0.09153	58.6	0.23918	1263	0.44911	2371	0.0040	12	0.40	0.05	3.00	0.0018	0.50	68.16	1.16	48.87	13.26	4.88	2.42
IC-13	413	0.01402	9.0	0.20720	1094	0.53492	2824	0.0014	2	0.40	0.05	3.00	0.0018	0.50	3.83	0.43	2.60	0.53	0.08	0.02
IC-14	714	0.05103	32.7	0.17255	911	0.31971	1688	0.0032	11	0.40	0.05	3.00	0.0018	0.50	37.42	1.15	26.91	7.17	2.52	1.20
IC-15	415	0.12002	76.8	0.29051	1534	0.49422	2609	0.0050	45	0.35	0.10	3.18	0.0017	0.54	161.19	2.10	123.59	51.10	33.22	21.21
IC-16	416	0.15489	99.1	0.25986	1372	0.47630	2515	0.0010	58	0.35	0.10	3.21	0.0017	0.55	218.90	2.21	169.87	76.11	53.40	36.38
IC-17	417	0.01501	9.6	0.34450	1819	0.55814	2947	0.0010	2	0.40	0.05	3.00	0.0018	0.50	3.03	0.32	2.06	0.42	0.06	0.02
IC-18	718	0.03355	21.5	0.16811	888	0.29122	1538	0.0088	12	0.40	0.05	3.00	0.0018	0.50	26.94	1.25	19.47	5.29	1.94	0.97
IC-19	719	0.03172	20.3	0.23234	1227	0.29457	1555	0.0017	12	0.40	0.05	3.00	0.0018	0.50	16.40	0.81	11.42	3.01	1.13	0.54
IC-20	620	0.12819	82.0	0.28309	1495	0.49184	2597	0.0061	25	0.35	0.05	3.00	0.0018	0.50	122.85	1.50	91.36	32.45	18.53	9.90
IC-21	621	0.12476	79.8	0.33767	1783	0.54339	2869	0.0060	25	0.35	0.05	3.51	0.0018	0.53	104.76	1.31	77.41	25.87	14.41	8.18
IC-22	722	0.06029	38.6	0.19034	1005	0.27598	1457	0.0028	74	0.35	0.10	3.56	0.0015	0.64	110.44	2.86	88.04	44.41	33.18	23.33
IC-23	723	0.01105	7.1	0.06569	347	0.12682	670	0.0010	75	0.35	0.10	3.00	0.0018	0.50	18.98	2.68	15.15	7.87	5.88	4.07
IC-24	724	0.03186	20.4	0.14646	773	0.24841	1312	0.0034	18	0.40	0.05	3.32	0.0016	0.58	23.72	1.16	17.00	4.34	2.10	1.26
IC-25	725	0.11336	72.5	0.44512	2350	0.69156	3651	0.0017	12	0.40	0.05	3.14	0.0018	0.51	52.49	0.72	36.50	9.29	3.40	1.70
IC-26	426	0.00436	2.8	0.09765	516	0.20953	1106	0.0023	3	0.40	0.05	4.49	0.0014	0.73	1.37	0.49	0.83	0.03	0.02	0.01
IC-27	727	0.01942	12.4	0.21776	1150	0.33655	1777	0.0022	12	0.40	0.05	3.64	0.0017	0.59	7.97	0.64	5.40	1.10	0.46	0.23
IC-28	728	0.01904	12.2	0.13688	723	0.24789	1309	0.0022	15	0.40	0.05	4.77	0.0008	0.94	6.69	0.55	3.91	0.67	0.41	0.19
IC-29	729	0.03164	20.2	0.12402	655	0.20987	1108	0.0074	12	0.40	0.05	3.53	0.0015	0.63	27.53	1.36	19.20	3.75	1.64	0.84
IC-30	730	0.04815	30.8	0.16525	873	0.26419	1395	0.0028	13	0.40	0.05	3.28	0.0016	0.57	35.71	1.16	25.34	5.87	2.33	1.30
IC-31	731	0.00552	3.5	0.08631	456	0.11017	582	0.0096	12	0.40	0.05	3.93	0.0013	0.73	3.64	1.03	2.44	0.31	0.20	0.09
IC-32	432	0.02223	14.2	0.12746	673	0.17551	927	0.0038	3	0.40	0.05	3.81	0.0014	0.70	13.98	0.98	9.19	0.46	0.19	0.07
IC-33	733	0.29557	189.2	0.45994	2428	0.85005	4488	0.0077	12	0.40	0.05	3.54	0.0016	0.62	203.00	1.07	141.74	27.67	11.94	6.06
IC-34	734	0.29411	188.2	0.47234	2494	0.55428	2927	0.0086	16	0.40	0.05	3.68	0.0014	0.67	239.68	1.27	167.32	32.80	18.48	10.09
IC-35	735	0.15654	100.2	0.29217	1543	0.47789	2523	0.0110	12	0.40	0.05	4.23	0.0013	0.76	124.23	1.24	82.87	10.59	6.60	2.93
IC-36	736	0.25215	161.4	0.35933	1897	0.61293	3236	0.0202	12	0.40	0.05	4.75	0.0009	0.92	168.78	1.05	100.75	13.55	7.59	2.90
IC-37	737	0.12171	77.9	0.41923	2214	0.61929	3270	0.0191	12	0.40	0.05	4.49	0.0017	0.64	86.81	1.11	60.28	10.64	4.97	2.52
IC-38	738	0.17047	109.1	0.41416	2187	0.49163	2596	0.0168	13	0.40	0.05	4.14	0.0015	0.68	143.73	1.32	98.73	16.29	8.94	4.54
IC-39	739	0.53890	344.9	0.57140	3017	0.88637	4680	0.0206	14	0.40	0.05	4.46	0.0013	0.76	423.69	1.23	284.00	41.10	26.39	12.99
IC-40	740	0.25298	161.9	0.34222	1807	0.57446	3033	0.0236	38	0.35	0.10	3.92	0.0015	0.66	405.60	2.51	305.04	109.44	68.28	44.79
IC-41	741	0.03198	20.5	0.19111	1009	0.26881	1419	0.0045	12	0.40	0.05	3.00	0.0018	0.50	21.97	1.07	15.72	4.25	1.56	0.77
IC-42	742	0.08919	57.1	0.31396	1658	0.38789	2048	0.0031	12	0.40	0.05	3.12	0.0017	0.53	58.61	1.03	41.58	10.34	3.58	1.97
IC-43	743	0.06619	42.4	0.19339	1021	0.29151	1539	0.0100	13	0.40	0.05	3.73	0.0014	0.68	57.92	1.37	39.92	6.70	3.63	1.85
IC-44	744	0.02100	13.4	0.38667	2042	0.64691	3416	0.0038	12	0.40	0.05	3.00	0.0018	0.50	6.39	0.48	4.45	1.19	0.45	0.21
IC-45	745	0.04314	27.6	0.26083	1377	0.40397	2133	0.0101	12	0.40	0.05	4.61	0.0013	0.78	23.20	0.84	15.06	1.88	1.14	0.50
IC-46	746	0.14145	90.5	0.44554	2352	0.77421	4088	0.0126	12	0.40	0.05	4.30	0.0016	0.66	87.48	0.97	59.88	9.63	4.87	2.41
IC-47	747	0.04399	28.2	0.29940	1581	0.51621	2726	0.0270	12	0.40	0.05	4.89	0.0009	0.91	19.82	0.70	11.62	1.53	0.87	0.34
IC-48	748	0.17814	114.0	0.46833	2473	0.70405	3717	0.0064	13	0.40	0.05	4.05	0.0017	0.60	114.13	1.00	79.43	16.60	7.22	3.79
IC-49	749	0.25792	165.1	0.39003	2059	0.78022	4120	0.0125	13	0.40	0.05	4.15	0.0017	0.61	208.12	1.26	146.97	30.80	13.40	7.12
IC-50	750	0.11515	73.7	0.29022	1532	0.52157	2754	0.0225	12	0.40	0.05	4.38	0.0014	0.73	93.85	1.27	63.48	8.04	5.13	2.41
IC-51	751	0.10027	64.2	0.21502	1135	0.37349	1972	0.0328	12	0.40	0.05	4.32	0.0015	0.69	107.21	1.67	74.86	11.54	6.31	3.07
IC-52	752	0.27032	173.0	0.44317	2340	0.79970	4222	0.0204	16	0.40	0.05	4.43	0.0011	0.82	194.79	1.13	126.50	21.30	13.61	6.68
IC-53	753	0.12559	80.4	0.32005	1690	0.52722	2784	0.0222	12	0.40	0.05	4.85	0.0009	0.92	76.06	0.95	45.20	6.11	3.40	1.32
IC-54	754	0.13689	87.6	0.11211	592	0.38359	2025	0.0061	32	0.35	0.05	4.68	0.0014	0.75	201.17	2.30	146.39	44.26	29.88	18.84
IC-55	755	0.04687	30.0	0.19374	1023	0.30653	1618	0.0105	21	0.35	0.05	4.53	0.0017	0.62	41.85	1.40	30.34	8.57	4.32	2.65
IC-56	756	0.23488	150.3	0.62686	3310	0.98671	5210	0.0164	41	0.35	0.10	4.49	0.0018	0.62	258.70	1.72	194.02	72.26	45.55	30.22
IC-57	757	0.22305	142.7	0.53575	2829	0.84281	4450	0.0064	17	0.35	0.10	4.08	0.0017	0.59	143.60	1.01	102.19	26.90	11.45	6.72
IC-58	458	0.13153	84.2	0.19485	1029	0.40873	2158	0.0091	28	0.40	0.05	4.25	0.0017	0.61	160.79	1.91	118.43	35.78	21.34	13.23
IC-59	459	0.06055	38.8	0.10126	535	0.25283	1335	0.0089	10	0.40	0.05	4.50	0.0018	0.60	67.79	1.75	48.48	9.80	3.50	1.70
IC-60	760	0.19815	126.8	0.33442	1766	0.64720	3417	0.0203	12	0.40	0.05	4.15	0.0015	0.66	175.42	1.38	121.87	20.76	10.25	5.11
IC-61	761	0.08004	51.2	0.13418	708	0.42237	2230	0.0212	12	0.40	0.05	4.09	0.0017	0.60	87.83	1.71	63.07	13.61	5.50	2.83
IC-62	662	0.10100	64.6	0.21698	1146	0.44354	2342	0.0146	24	0.35	0.05	3.52	0.0017	0.56	112.26	1.74	82.66	27.28	14.57	8.56
IC-63	463	0.07680	49.2	0.23774	1255	0.42435	2241	0.0096	24	0.35	0.05	3.72	0.0018	0.55	71.31	1.45	52.50	17.16	9.26	5.42
Totals/Averages			**3992.5**						**18**						**85.85**	**1.35**	**60.84**	**15.74**	**9.07**	**5.39**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

CONCEPTUAL POND 701 FOR IDAHO CREEK SUBBASIN IC-01

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4844.91	0	0.00	0.0		0.00	0.00	Bottom
4848.66	15000	0.34	3.75	27351	0.63	0.52	Top of 10-Year Detention Zone
4849.91	25000	0.57	5.00	52670	1.21	8.18	Top of 100-Year Detention Zone

CONCEPTUAL POND 703 FOR IDAHO CREEK SUBBASIN IC-03

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4854.40	0	0.00	0.0	0	0.00	0.00	Bottom
4858.15	12000	0.28	3.75	21048	0.48	0.38	Top of 10-Year Detention Zone
4859.40	21000	0.48	5.00	42602	0.98	10.84	Top of 100-Year Detention Zone

CONCEPTUAL POND 706 FOR IDAHO CREEK SUBBASIN IC-06

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4865.40	0	0.00	0.0	0	0.00	0.00	Bottom
4868.90	8000	0.18	3.50	13813	0.32	7.25	Top of 10-Year Detention Zone
4870.40	32000	0.73	5.00	43504	1.00	70.67	Top of 100-Year Detention Zone

CONCEPTUAL POND 712 FOR IDAHO CREEK SUBBASIN IC-12

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4895.50	0	0.00	0.0	0	0.00	0.00	Bottom
4899.00	6200	0.14	3.50	10765	0.25	10.35	Top of 10-Year Detention Zone
4900.50	27000	0.62	5.00	35275	0.81	64.68	Top of 100-Year Detention Zone

CONCEPTUAL POND 714 FOR IDAHO CREEK SUBBASIN IC-14

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4909.70	0	0.00	0.0	0	0.00	0.00	Bottom
4913.20	2500	0.06	3.50	4348	0.10	5.97	Top of 10-Year Detention Zone
4914.70	13000	0.30	5.00	15797	0.36	36.05	Top of 100-Year Detention Zone

CONCEPTUAL POND 718 FOR IDAHO CREEK SUBBASIN IC-18

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4863.70	0	0.00	0.0	0	0.00	0.00	Bottom
4867.20	2700	0.06	3.50	4669	0.11	3.91	Top of 10-Year Detention Zone
4868.70	10000	0.23	5.00	14173	0.33	25.27	Top of 100-Year Detention Zone

CONCEPTUAL POND 719 FOR IDAHO CREEK SUBBASIN IC-19

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4870.90	0	0.00	0.0	0	0.00	0.00	Bottom
4874.40	2250	0.05	3.50	3860	0.09	2.40	Top of 10-Year Detention Zone
4875.90	8000	0.18	5.00	11458	0.26	15.53	Top of 100-Year Detention Zone

CONCEPTUAL POND 722 FOR IDAHO CREEK SUBBASIN IC-22

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4849.90	0	0.00	0.0	0	0.00	0.00	Bottom
4853.90	64000	1.47	4.00	125888	2.89	3.45	Top of 10-Year Detention Zone
4854.90	125000	2.87	5.00	219865	5.05	39.90	Top of 100-Year Detention Zone

CONCEPTUAL POND 723 FOR IDAHO CREEK SUBBASIN IC-23

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4853.70	0	0.00	0.0	0	0.00	0.00	Bottom
4857.45	11000	0.25	3.75	19878	0.46	1.42	Top of 10-Year Detention Zone
4858.70	17000	0.39	5	37765	0.87	7.60	Top of 100-Year Detention Zone

CONCEPTUAL POND 724 FOR IDAHO CREEK SUBBASIN IC-24

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4855.40	0	0.00	0.0	0	0.00	0.00	Bottom
4858.90	2000	0.05	3.50	3420	0.08	3.44	Top of 10-Year Detention Zone
4860.40	10000	0.23	5.00	12346	0.28	22.28	Top of 100-Year Detention Zone

CONCEPTUAL POND 725 FOR IDAHO CREEK SUBBASIN IC-25

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4857.50	0	0.00	0.0	0	0.00	0.00	Bottom
4861.00	9000	0.21	3.50	15405	0.35	6.99	Top of 10-Year Detention Zone
4862.50	29000	0.67	5.00	43655	1.00	49.47	Top of 100-Year Detention Zone

CONCEPTUAL POND 727 FOR IDAHO CREEK SUBBASIN IC-27

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4863.50	0	0.00	0.0	0	0.00	0.00	Bottom
4867.00	1700	0.04	3.50	2786	0.06	0.71	Top of 10-Year Detention Zone
4868.50	4500	0.10	5.00	7568	0.17	7.43	Top of 100-Year Detention Zone

CONCEPTUAL POND 728 FOR IDAHO CREEK SUBBASIN IC-28

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4869.40	0	0.00	0.0	0	0.00	0.00	Bottom
4872.90	1150	0.03	3.50	1934	0.04	0.33	Top of 10-Year Detention Zone
4874.40	4500	0.10	5.00	6160	0.14	5.95	Top of 100-Year Detention Zone

CONCEPTUAL POND 729 FOR IDAHO CREEK SUBBASIN IC-29

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4872.90	0	0.00	0.0	0	0.00	0.00	Bottom
4876.40	1300	0.03	3.50	2251	0.05	2.83	Top of 10-Year Detention Zone
4877.90	7000	0.16	5.00	8403	0.19	26.37	Top of 100-Year Detention Zone

CONCEPTUAL POND 730 FOR IDAHO CREEK SUBBASIN IC-30

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4876.40	0	0.00	0.0	0	0.00	0.00	Bottom
4879.90	2500	0.06	3.50	4319	0.10	4.59	Top of 10-Year Detention Zone
4881.40	13000	0.30	5.00	15840	0.36	33.94	Top of 100-Year Detention Zone

CONCEPTUAL POND 731 FOR IDAHO CREEK SUBBASIN IC-31

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4871.80	0	0.00	0.0	0	0.00	0.00	Bottom
4875.30	350	0.01	3.50	550	0.01	0.18	Top of 10-Year Detention Zone
4876.80	1250	0.03	5.00	1789	0.04	3.46	Top of 100-Year Detention Zone

CONCEPTUAL POND 733 FOR IDAHO CREEK SUBBASIN IC-33

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4883.70	0	0.00	0.0	0	0.00	0.00	Bottom
4887.20	25000	0.57	3.50	43233	0.99	16.25	Top of 10-Year Detention Zone
4888.70	88000	2.02	5.00	126847	2.91	190.57	Top of 100-Year Detention Zone

CONCEPTUAL POND 734 FOR IDAHO CREEK SUBBASIN IC-34

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4893.00	0	0.00	0.0	0	0.00	0.00	Bottom
4896.50	28000	0.64	3.50	48928	1.12	18.38	Top of 10-Year Detention Zone
4898.00	100000	2.30	5.00	142916	3.28	219.44	Top of 100-Year Detention Zone

CONCEPTUAL POND 735 FOR IDAHO CREEK SUBBASIN IC-35

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4906.00	0	0.00	0.0	0	0.00	0.00	Bottom
4909.50	17000	0.39	3.50	29156	0.67	2.56	Top of 10-Year Detention Zone
4911.00	42000	0.96	5.00	73318	1.68	114.86	Top of 100-Year Detention Zone

CONCEPTUAL POND 736 FOR IDAHO CREEK SUBBASIN IC-36

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4906.50	0	0.00	0.0	0	0.00	0.00	Bottom
4910.00	19000	0.44	3.50	32272	0.74	2.99	Top of 10-Year Detention Zone
4911.50	70000	1.61	5.00	98866	2.27	146.78	Top of 100-Year Detention Zone

CONCEPTUAL POND 737 FOR IDAHO CREEK SUBBASIN IC-37

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4942.10	0	0.00	0.0	0	0.00	0.00	Bottom
4945.60	11000	0.25	3.50	18833	0.43	5.60	Top of 10-Year Detention Zone
4947.10	37000	0.85	5.00	54470	1.25	81.23	Top of 100-Year Detention Zone

CONCEPTUAL POND 738 FOR IDAHO CREEK SUBBASIN IC-38

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4943.70	0	0.00	0.0	0	0.00	0.00	Bottom
4947.20	12000	0.28	3.50	20971	0.48	9.29	Top of 10-Year Detention Zone
4948.70	46000	1.06	5.00	63540	1.46	135.59	Top of 100-Year Detention Zone

CONCEPTUAL POND 739 FOR IDAHO CREEK SUBBASIN IC-39

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4886.40	0	0.00	0.0	0	0.00	0.00	Bottom
4889.90	57000	1.31	3.50	99674	2.29	14.03	Top of 10-Year Detention Zone
4891.40	160000	3.67	5.00	259674	5.96	386.37	Top of 100-Year Detention Zone

CONCEPTUAL POND 740 FOR IDAHO CREEK SUBBASIN IC-40

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4892.30	0	0.00	0.0	0	0.00	0.00	Bottom
4895.80	129000	2.96	3.5	224318	5.15	19.33	Top of 10-Year Detention Zone
4897.30	230000	5.28	5	488815	11.22	240.54	Top of 100-Year Detention Zone

CONCEPTUAL POND 741 FOR IDAHO CREEK SUBBASIN IC-41

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4891.70	0	0.00	0.0	0	0.00	0.00	Bottom
4895.20	1700	0.04	3.5	2940	0.07	3.54	Top of 10-Year Detention Zone
4896.70	8500	0.20	5	10510	0.24	21.06	Top of 100-Year Detention Zone

CONCEPTUAL POND 742 FOR IDAHO CREEK SUBBASIN IC-42

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4907.80	0	0.00	0.0	0	0.00	0.00	Bottom
4911.30	4500	0.10	3.5	7826	0.18	8.38	Top of 10-Year Detention Zone
4912.80	24000	0.55	5	28827	0.66	56.21	Top of 100-Year Detention Zone

CONCEPTUAL POND 743 FOR IDAHO CREEK SUBBASIN IC-43

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4915.50	0	0.00	0.0	0	0.00	0.00	Bottom
4919.00	7100	0.16	3.5	12320	0.28	2.77	Top of 10-Year Detention Zone
4920.50	20000	0.46	5	32415	0.74	53.11	Top of 100-Year Detention Zone

CONCEPTUAL POND 744 FOR IDAHO CREEK SUBBASIN IC-44

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4922.00	0	0.00	0.0	0	0.00	0.00	Bottom
4925.50	1700	0.04	3.5	2862	0.07	0.89	Top of 10-Year Detention Zone
4927.00	4500	0.10	5	7562	0.17	5.97	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run

CONCEPTUAL POND 745 FOR IDAHO CREEK SUBBASIN IC-45

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4922.00	0	0.00	0.0	0	0.00	0.00	Bottom
4925.50	5500	0.13	3.5	9170	0.21	0.30	Top of 10-Year Detention Zone
4927.00	13000	0.30	5	23183	0.53	20.88	Top of 100-Year Detention Zone

CONCEPTUAL POND 746 FOR IDAHO CREEK SUBBASIN IC-46

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4933.50	0	0.00	0.0	0	0.00	0.00	Bottom
4937.00	13500	0.31	3.5	23536	0.54	4.46	Top of 10-Year Detention Zone
4938.50	43000	0.99	5	65180	1.50	81.42	Top of 100-Year Detention Zone

CONCEPTUAL POND 747 FOR IDAHO CREEK SUBBASIN IC-47

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4936.00	0	0.00	0.0	0	0.00	0.00	Bottom
4939.50	4500	0.10	3.5	6929	0.16	0.22	Top of 10-Year Detention Zone
4941.00	12000	0.28	5	20087	0.46	16.91	Top of 100-Year Detention Zone

CONCEPTUAL POND 748 FOR IDAHO CREEK SUBBASIN IC-48

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4921.20	0	0.00	0.0	0	0.00	0.00	Bottom
4924.70	17000	0.39	3.5	29571	0.68	9.65	Top of 10-Year Detention Zone
4926.20	55000	1.26	5	83149	1.91	105.68	Top of 100-Year Detention Zone

CONCEPTUAL POND 749 FOR IDAHO CREEK SUBBASIN IC-49

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4930.60	0	0.00	0.0	0	0.00	0.00	Bottom
4934.10	23500	0.54	3.5	40859	0.94	17.87	Top of 10-Year Detention Zone
4935.60	80000	1.84	5	117395	2.70	193.88	Top of 100-Year Detention Zone

CONCEPTUAL POND 750 FOR IDAHO CREEK SUBBASIN IC-50

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4939.00	0	0.00	0.0	0	0.00	0.00	Bottom
4942.50	15500	0.36	3.5	26630	0.61	1.31	Top of 10-Year Detention Zone
4944.00	30000	0.69	5	60935	1.40	86.32	Top of 100-Year Detention Zone

CONCEPTUAL POND 751 FOR IDAHO CREEK SUBBASIN IC-51

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4968.94	0	0.00	0.0	0	0.00	0.00	Bottom
4972.44	9250	0.21	3.5	16103	0.37	4.64	Top of 10-Year Detention Zone
4973.94	30000	0.69	5	45204	1.04	99.18	Top of 100-Year Detention Zone

CONCEPTUAL POND 752 FOR IDAHO CREEK SUBBASIN IC-52

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4956.00	0	0.00	0.0	0	0.00	0.00	Bottom
4959.50	44000	1.01	3.5	75885	1.74	3.52	Top of 10-Year Detention Zone
4961.00	95000	2.18	5	178814	4.11	166.66	Top of 100-Year Detention Zone

CONCEPTUAL POND 753 FOR IDAHO CREEK SUBBASIN IC-53

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4954.50	0	0.00	0.0	0	0.00	0.00	Bottom
4958.00	11250	0.26	3.5	19063	0.44	0.87	Top of 10-Year Detention Zone
4959.50	35000	0.80	5	53852	1.24	65.28	Top of 100-Year Detention Zone

CONCEPTUAL POND 754 FOR IDAHO CREEK SUBBASIN IC-54

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5000.97	0	0.00	0.0	0	0.00	0.00	Bottom
5004.47	44500	1.02	3.50	77217	1.77	11.42	Top of 10-Year Detention Zone
5005.96	100000	2.30	5	183993	4.22	141.33	Top of 100-Year Detention Zone

CONCEPTUAL POND 755 FOR IDAHO CREEK SUBBASIN IC-55

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5013.80	0	0.00	0.0	0	0.00	0.00	Bottom
5017.30	13000	0.30	3.50	22168	0.51	2.66	Top of 10-Year Detention Zone
5018.80	22000	0.51	5	48462	1.11	34.58	Top of 100-Year Detention Zone

CONCEPTUAL POND 756 FOR IDAHO CREEK SUBBASIN IC-56

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4934.10	0	0.00	0.0	0	0.00	0.00	Bottom
4937.60	150000	3.44	3.5	261700	6.01	11.32	Top of 10-Year Detention Zone
4939.10	225000	5.17	5	536610	12.32	138.77	Top of 100-Year Detention Zone

CONCEPTUAL POND 757 FOR IDAHO CREEK SUBBASIN IC-57

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4934.00	0	0.00	0.0	0	0.00	0.00	Bottom
4937.50	45500	1.04	3.50	79294	1.82	10.96	Top of 10-Year Detention Zone
4939.00	90000	2.07	5.00	178534	4.10	124.41	Top of 100-Year Detention Zone

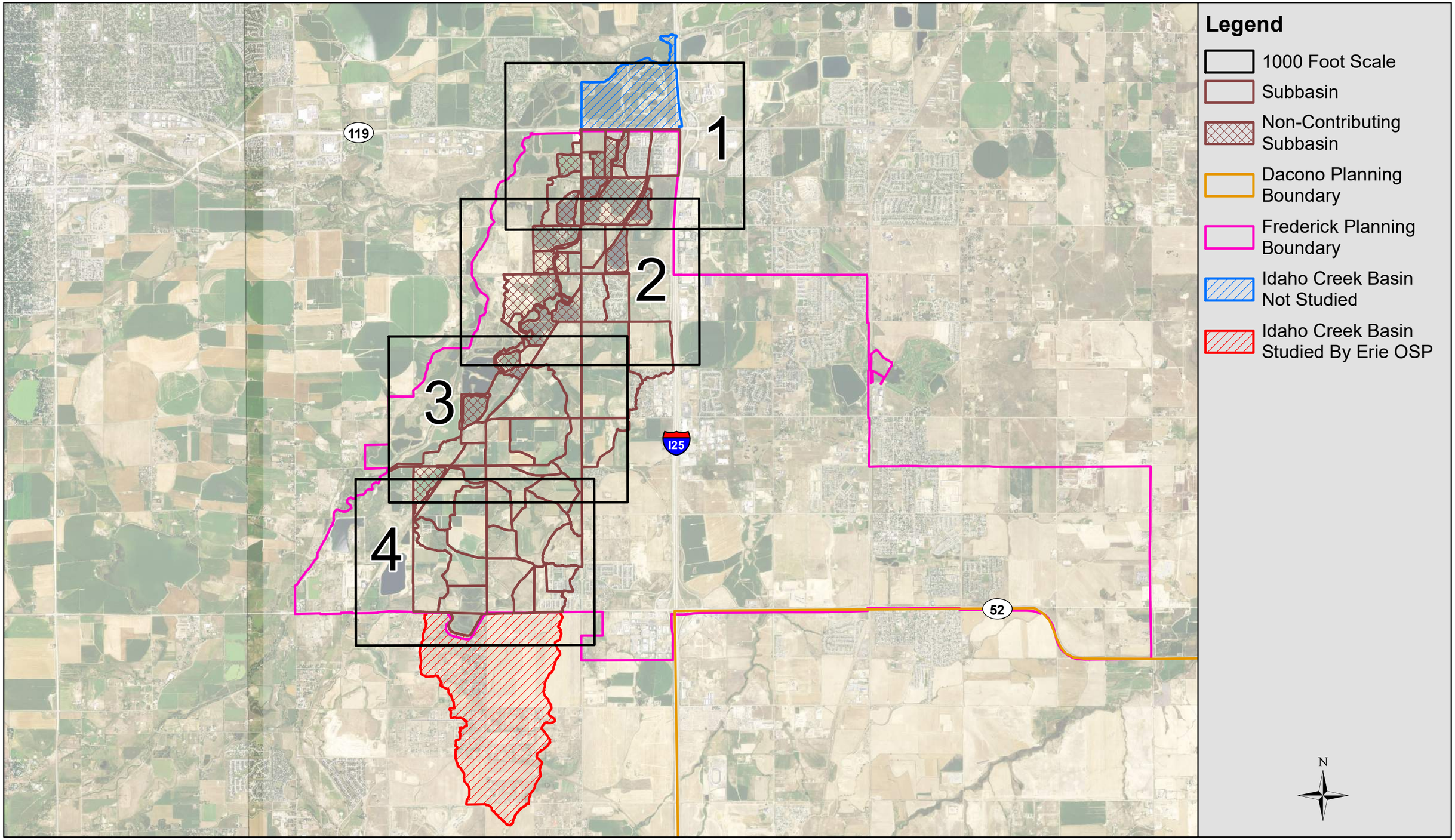
CONCEPTUAL POND 760 FOR IDAHO CREEK SUBBASIN IC-60

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4974.97	0	0.00	0.0	0	0.00	0.00	Bottom
4978.47	17500	0.40	3.50	30555	0.70	10.03	Top of 10-Year Detention Zone
4979.97	56000	1.29	5.00	84694	1.94	164.87	Top of 100-Year Detention Zone

CONCEPTUAL POND 761 FOR IDAHO CREEK SUBBASIN IC-61

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4995.00	0	0.00	0.0	0	0.00	0.00	Bottom
4998.50	6400	0.15	3.50	11093	0.25	7.98	Top of 10-Year Detention Zone
5000.00	25000	0.57	5.00	34290	0.79	82.05	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run



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OUTFALL SYSTEM PLAN

IDAHO CREEK
SWMM CONVEYANCE
ELEMENT MAPS

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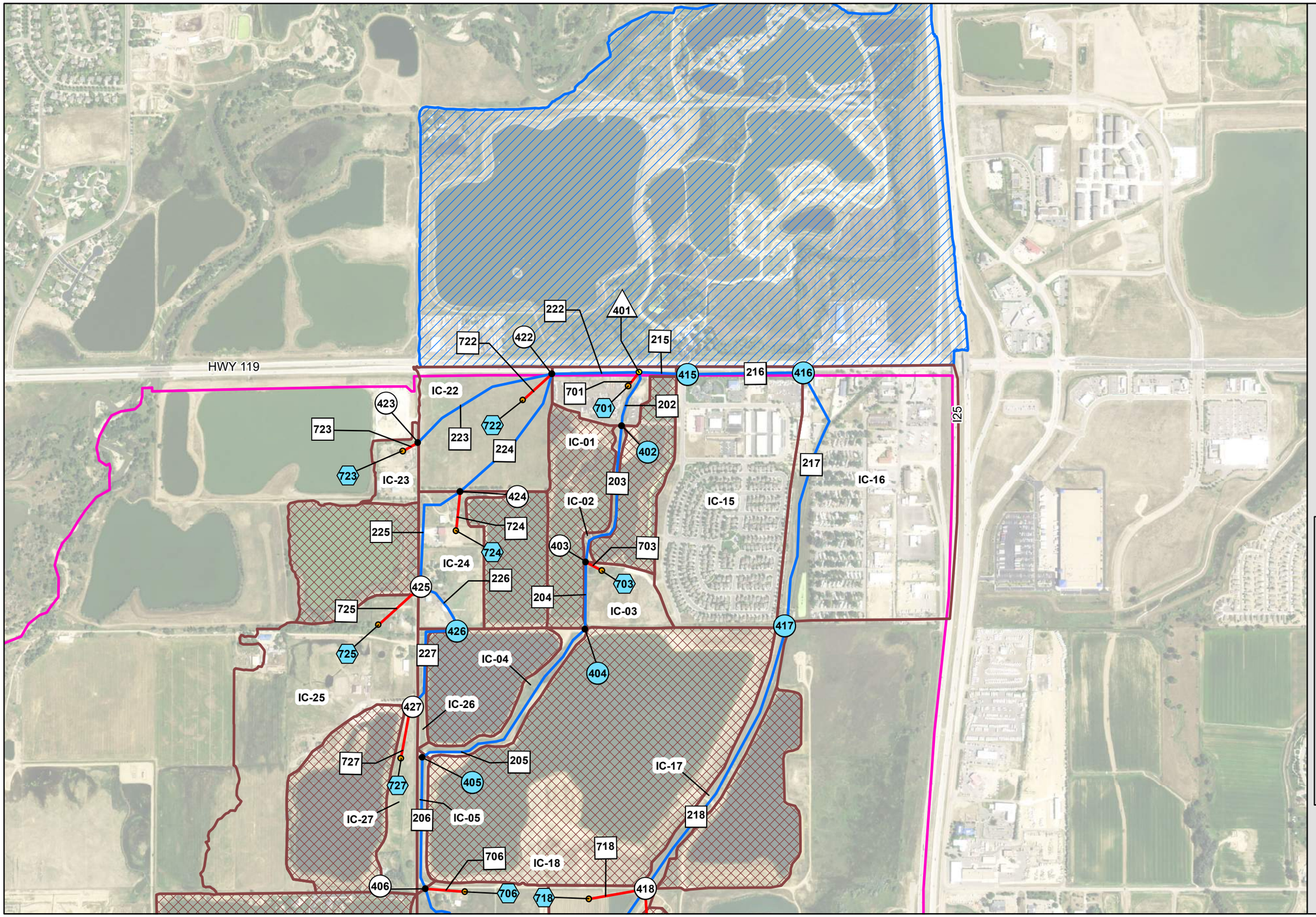
DESIGNED BY:	BS & CK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/26/2021	
SHEET: IC	INDEX: C-INDEX



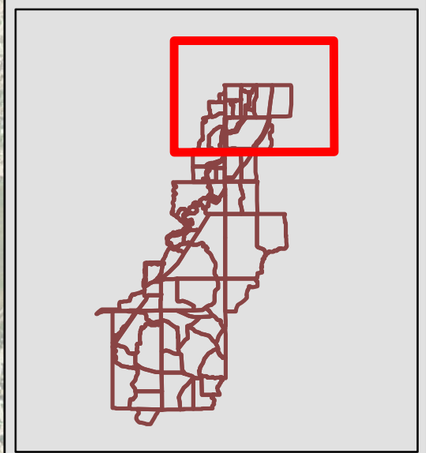
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

Key Map



N

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Feet

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IDAHO CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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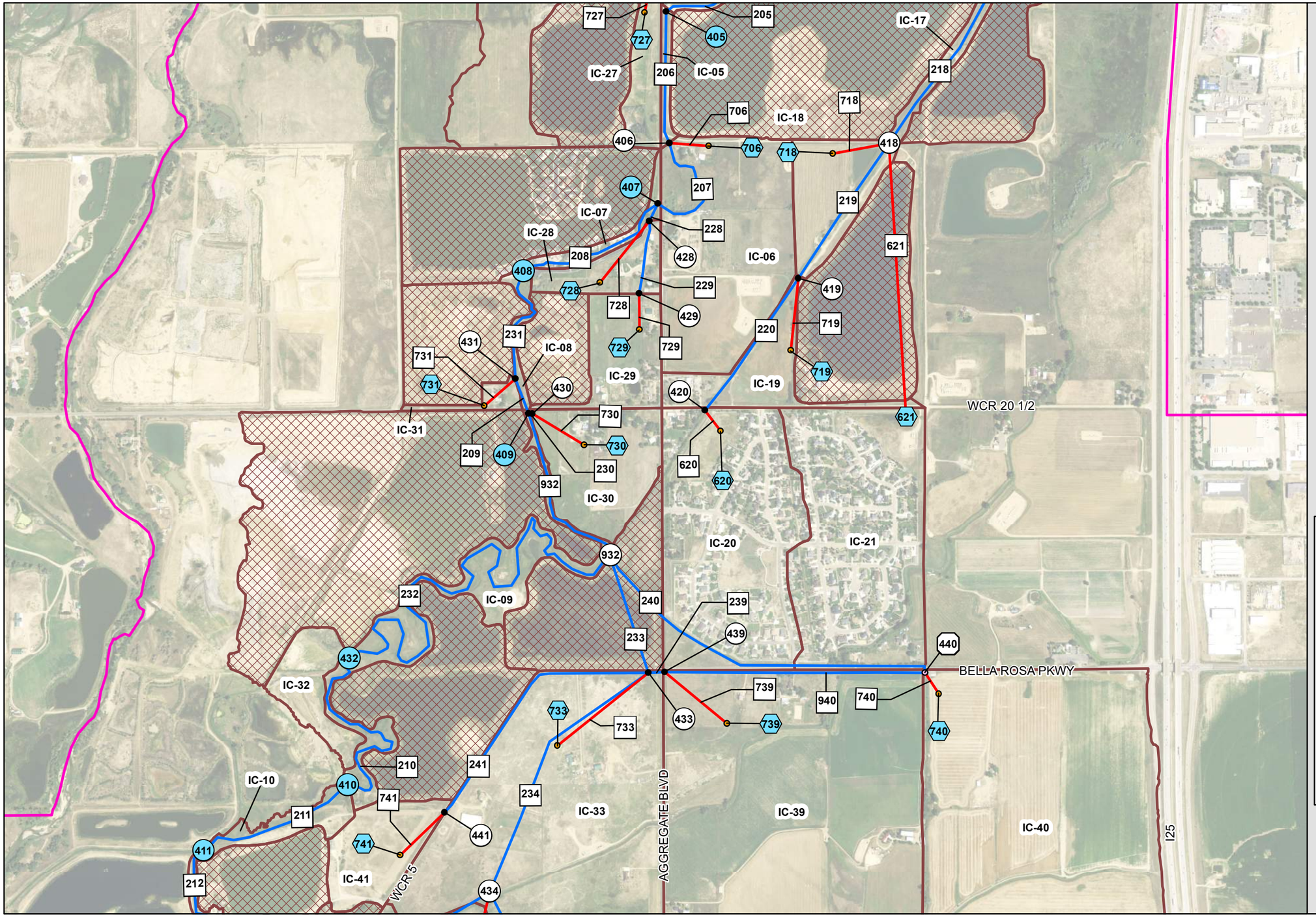


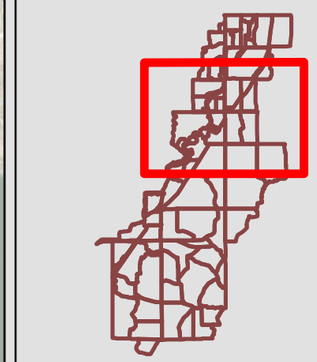
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

Key Map



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Feet

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SWMM CONVEYANCE
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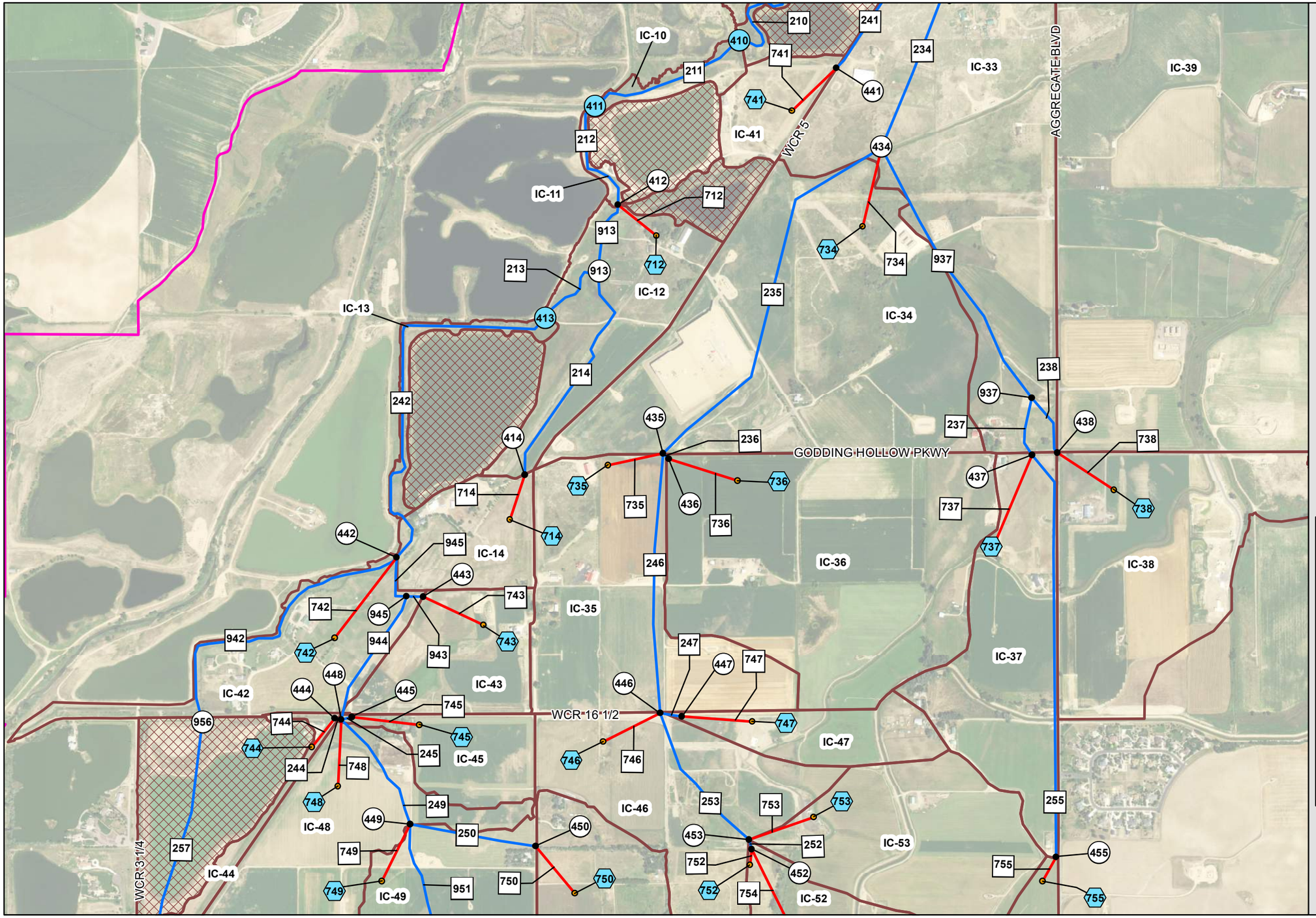


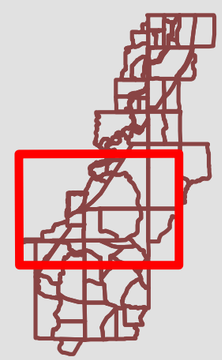
Legend

- Junction (X)
- Flow Diversion Node (X)
- Outfall (X)
- Detention Pond (X)
- Outlet (X)
- Link (X)

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

Key Map



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Feet

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SWMM CONVEYANCE
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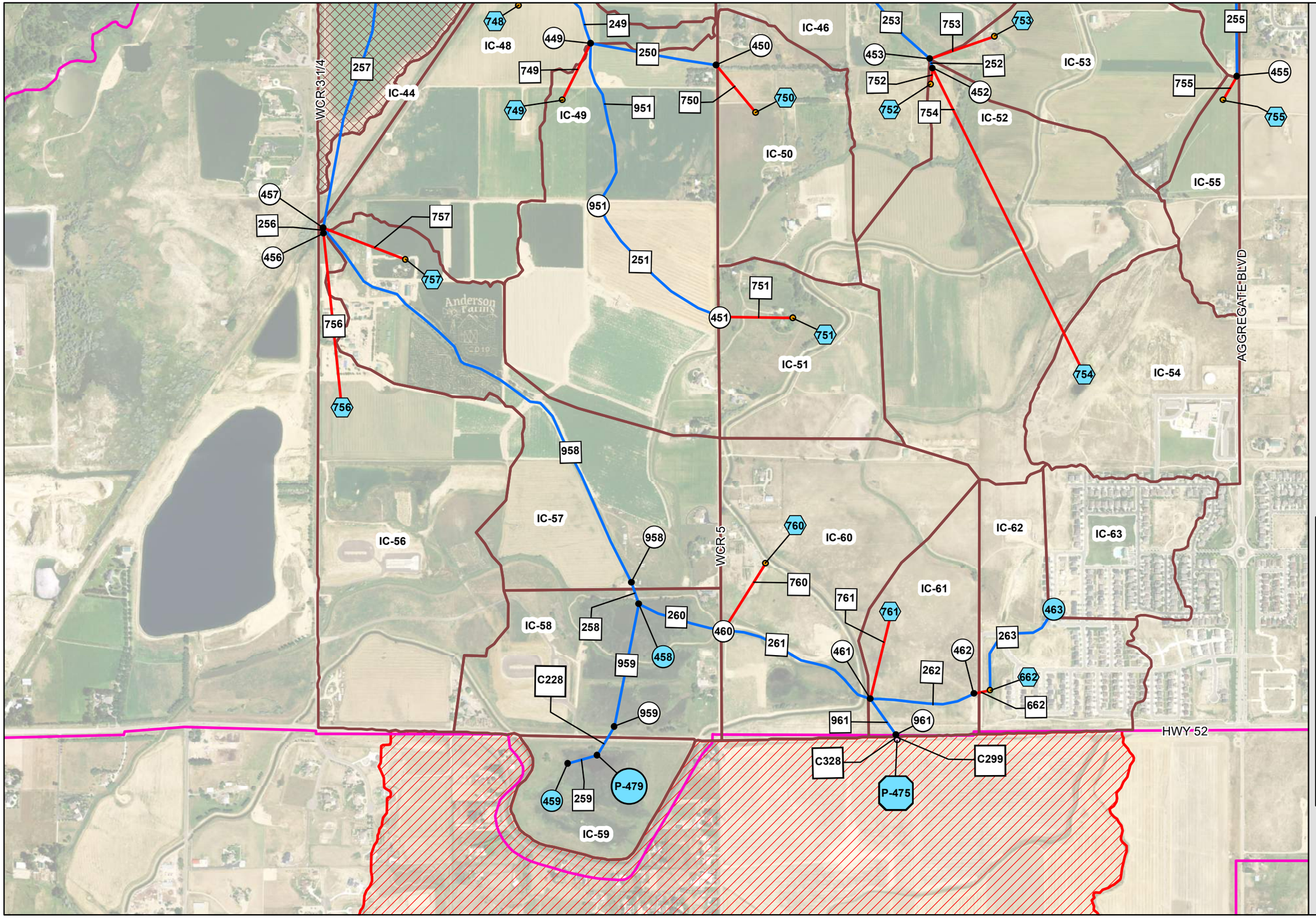


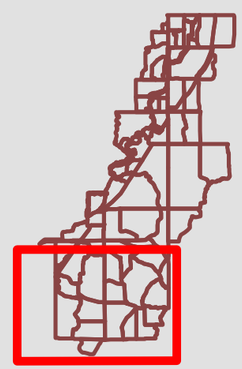
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

Key Map



N

0 500 1,000 2,000
Feet

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IDAHO CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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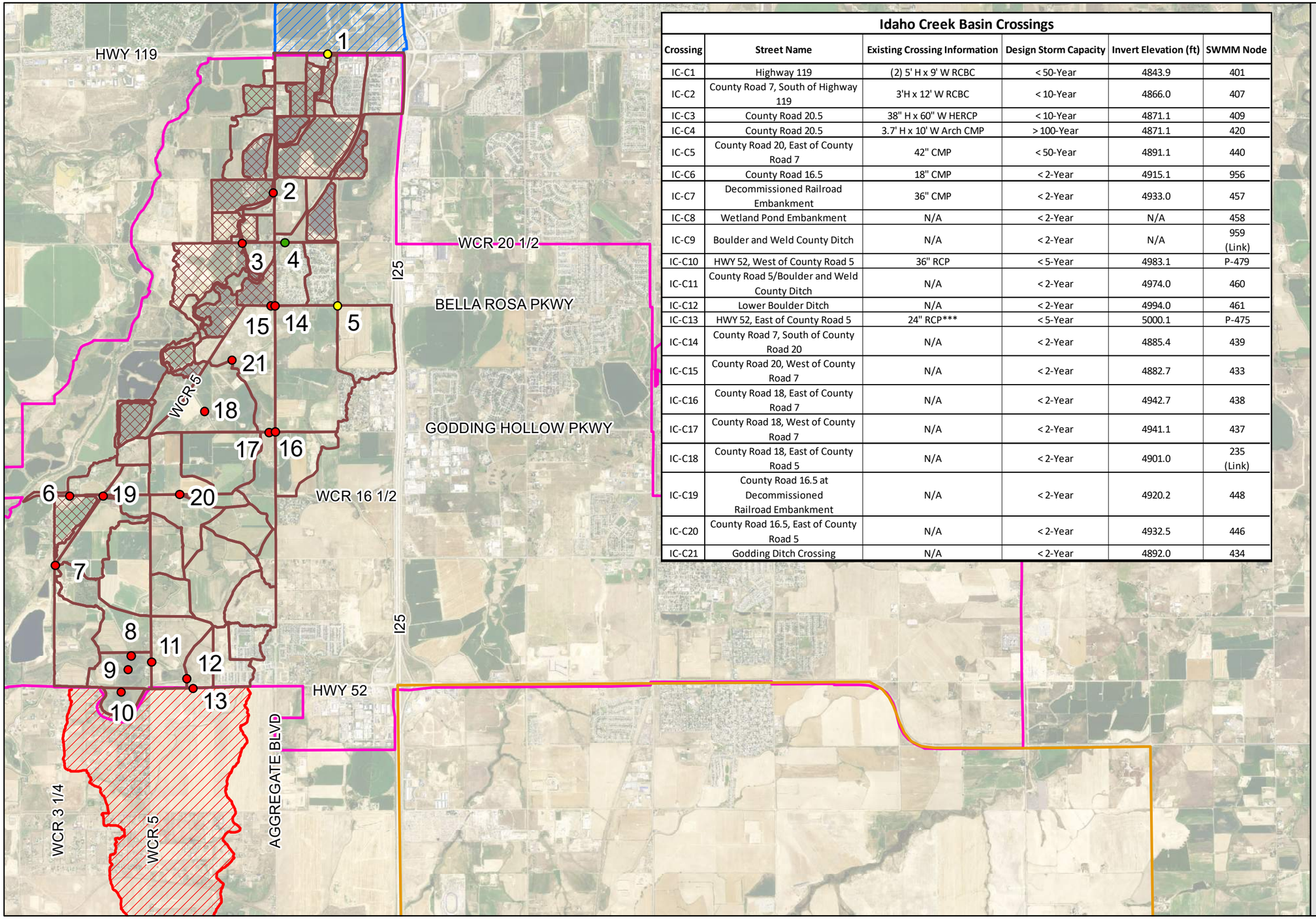

Idaho Creek Basin Crossings

Crossing	Street Name	Existing Crossing Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
IC-C1	Highway 119	(2) 5' H x 9' W RCBC	< 50-Year	4843.9	401
IC-C2	County Road 7, South of Highway 119	3'H x 12' W RCBC	< 10-Year	4866.0	407
IC-C3	County Road 20.5	38" H x 60" W HERCP	< 10-Year	4871.1	409
IC-C4	County Road 20.5	3.7' H x 10' W Arch CMP	> 100-Year	4871.1	420
IC-C5	County Road 20, East of County Road 7	42" CMP	< 50-Year	4891.1	440
IC-C6	County Road 16.5	18" CMP	< 2-Year	4915.1	956
IC-C7	Decommissioned Railroad Embankment	36" CMP	< 2-Year	4933.0	457
IC-C8	Wetland Pond Embankment	N/A	< 2-Year	N/A	458
IC-C9	Boulder and Weld County Ditch	N/A	< 2-Year	N/A	959 (Link)
IC-C10	HWY 52, West of County Road 5	36" RCP	< 5-Year	4983.1	P-479
IC-C11	County Road 5/Boulder and Weld County Ditch	N/A	< 2-Year	4974.0	460
IC-C12	Lower Boulder Ditch	N/A	< 2-Year	4994.0	461
IC-C13	HWY 52, East of County Road 5	24" RCP***	< 5-Year	5000.1	P-475
IC-C14	County Road 7, South of County Road 20	N/A	< 2-Year	4885.4	439
IC-C15	County Road 20, West of County Road 7	N/A	< 2-Year	4882.7	433
IC-C16	County Road 18, East of County Road 7	N/A	< 2-Year	4942.7	438
IC-C17	County Road 18, West of County Road 7	N/A	< 2-Year	4941.1	437
IC-C18	County Road 18, East of County Road 5	N/A	< 2-Year	4901.0	235 (Link)
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	N/A	< 2-Year	4920.2	448
IC-C20	County Road 16.5, East of County Road 5	N/A	< 2-Year	4932.5	446
IC-C21	Godding Ditch Crossing	N/A	< 2-Year	4892.0	434

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

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FUTURE CONDITION
CROSSING MAP

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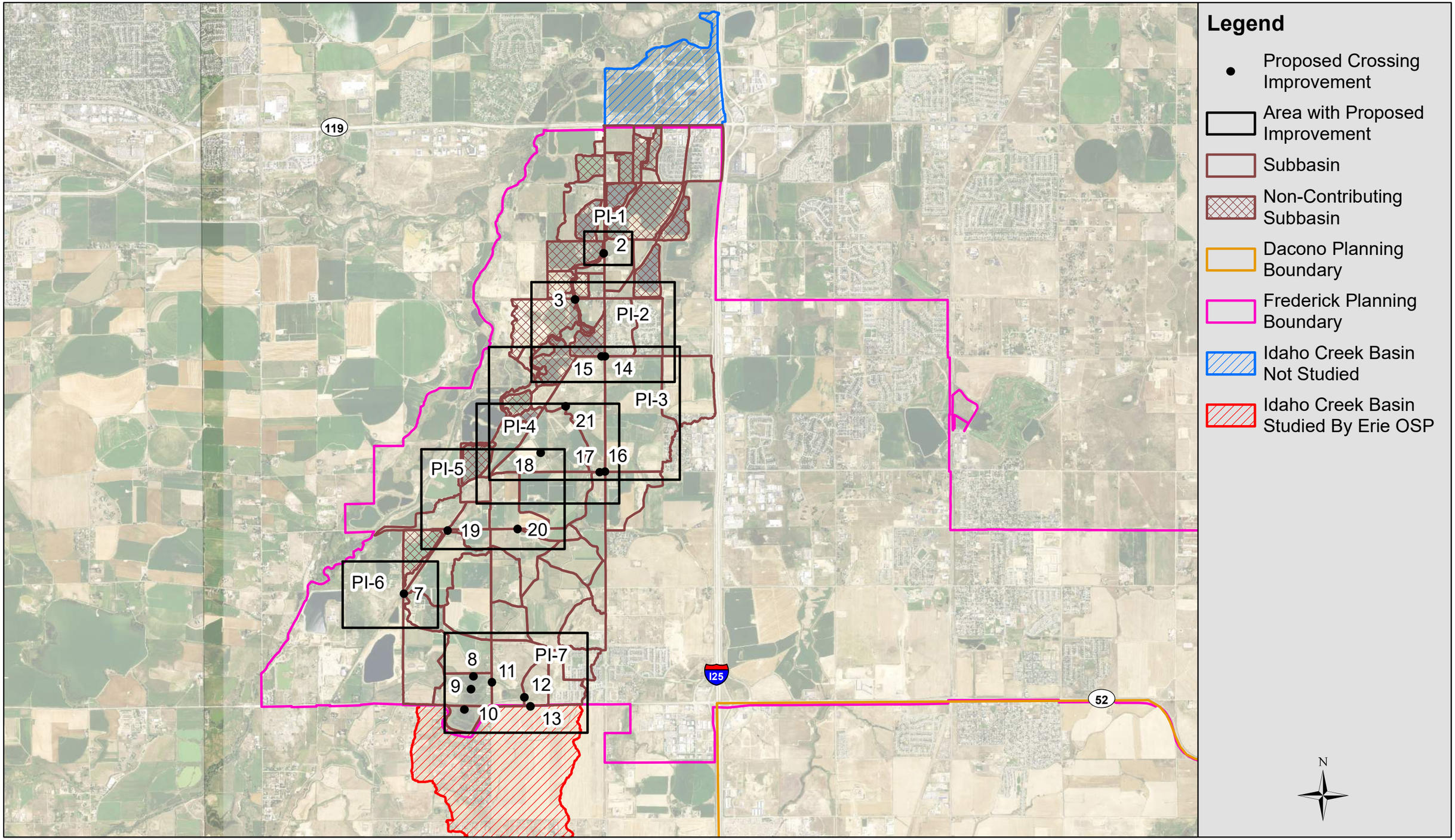
Table E.2.2: Idaho Creek Basin Peak Discharge Comparison: Existing Conditions 2022 OSP and Future Conditions 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Difference (Future Condition - Existing Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path - Lower Idaho Creek																		
Highway 119/ Frederick Planning Boundary	401	5348	51	79	176	1068	1777	53	92	228	1237	1962	1	13	52	169	185	
County Road 7, South of Highway 119	407	4701	33	66	175	1060	1737	45	89	223	1215	1907	12	23	48	155	170	
County Road 20.5	409	4656	32	66	177	1067	1743	45	90	225	1221	1913	13	24	48	154	170	
Rural Ditch																		
County Road 20.5	420	82	2	3	7	17	39	2	3	7	17	39	0	0	0	0	0	
County Road 20, East of County Road 7	440	162	3	6	19	164	241	12	15	19	166	237	9	9	0	2	-4	
Main Flow Path - Upper Idaho Creek																		
Country Road 16.5	956	2064	48	96	239	1146	1740	57	117	263	1220	1837	9	21	24	75	97	
Decommissioned Railroad Embankment	457	2064	47	109	263	1181	1782	60	127	286	1259	1883	13	18	23	79	101	
HWY 52, West of County Road 5	P-479	1181	48	111	240	888	1252	48	111	240	888	1252	0	0	0	0	0	Existing Condition inflows from Erie OSP.
County Road 5/Boulder and Weld County Ditch	460	506	2	9	54	332	496	7	17	59	354	518	5	8	5	22	22	
HWY 52, East of County Road 5	P-475	214	2	9	46	205	288	2	9	46	205	288	0	0	0	0	0	Existing Condition inflows from Erie OSP.
Other Tributary Crossings																		
County Road 7, South of County Road 20	439	345	3	8	14	268	446	6	10	14	260	439	4	2	0	-8	-7	
County Road 20, West of County Road 7	433	1631	4	11	38	596	1079	18	36	67	698	1253	14	25	28	101	174	
County Road 18, East of County Road 5	235 (Link)	721	1	2	7	208	403	10	16	22	304	555	10	13	16	96	153	
County Road 16.5, East of County Road 5	446	460	1	3	7	185	317	10	15	20	292	457	10	12	13	106	140	Erie Mine (Subbasin 54) assumed to be filled in and contribute runoff to flow path.
County Road 16.5 at Decommissioned Railroad Embankment	448	458	2	4	25	274	435	8	16	31	298	457	7	12	6	24	22	

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

Appendix E.3. Idaho Creek Proposed Improvement Documentation



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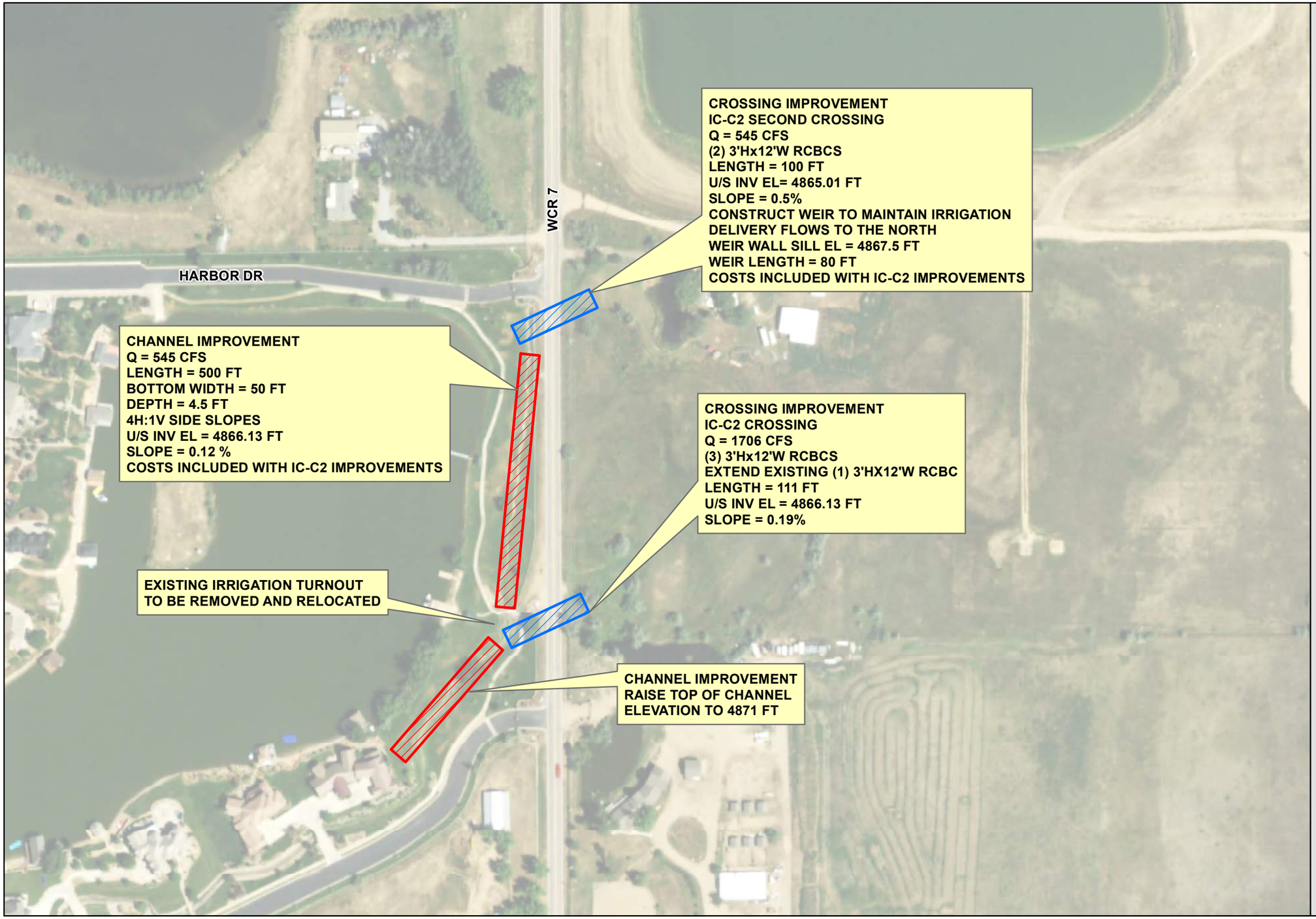
IDAHO CREEK
PROPOSED
IMPROVEMENTS
INDEX

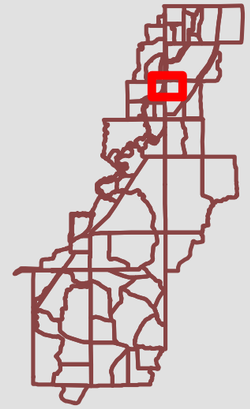
DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 1/3/2022	
SHEET: IC	INDEX: PI-INDEX



Legend

- Crossing Improvement
- Channel Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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PROJECT NUMBER: COTOF.03	
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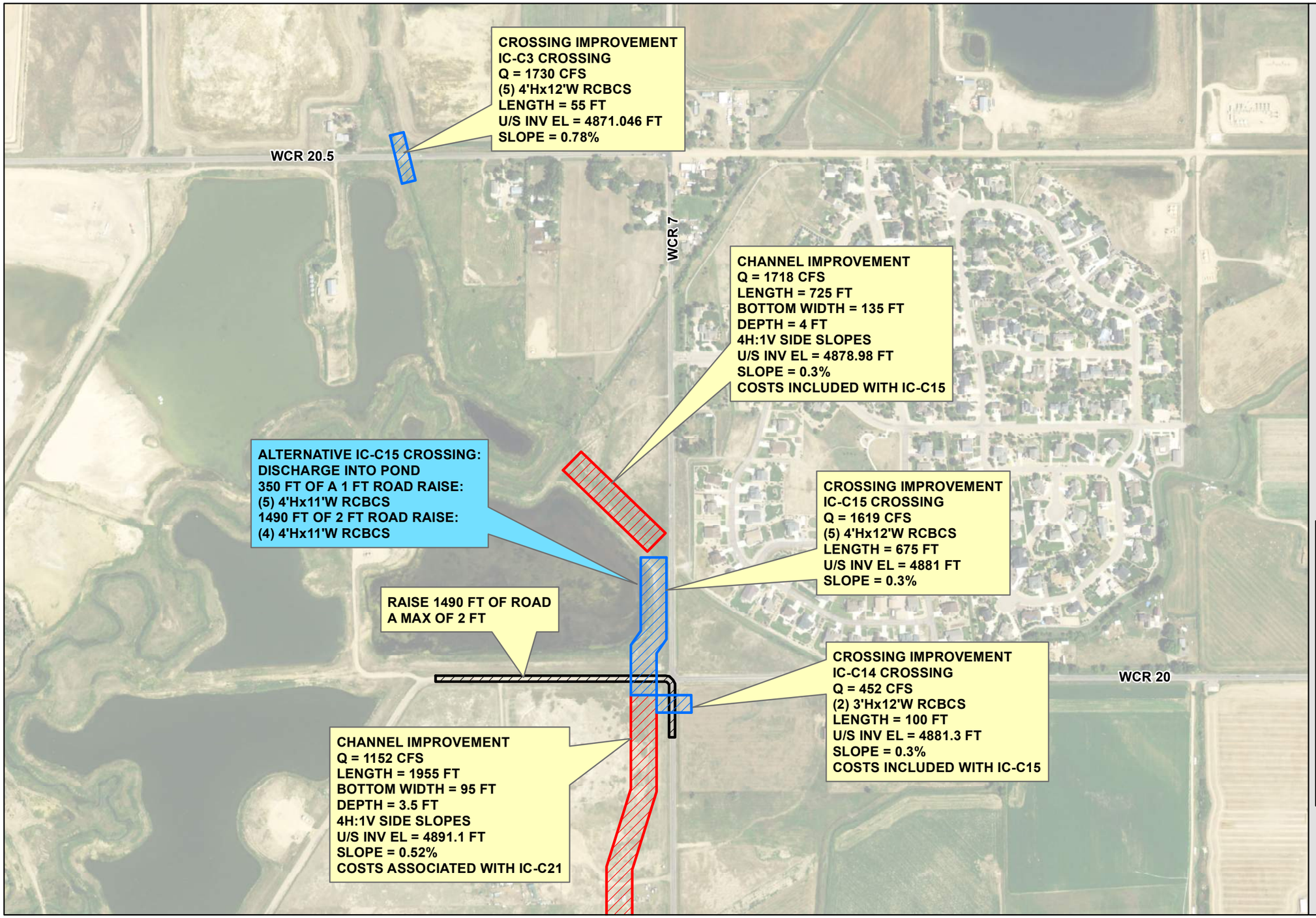
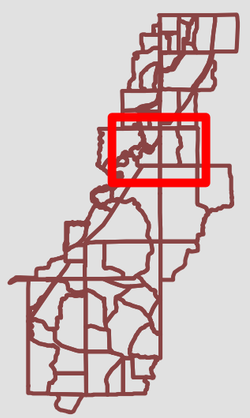
SHEET: IC	INDEX: PI-1



Legend

- Crossing Improvement
- Channel Improvement
- Road Raise
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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IDAHO CREEK
PROPOSED
IMPROVEMENTS

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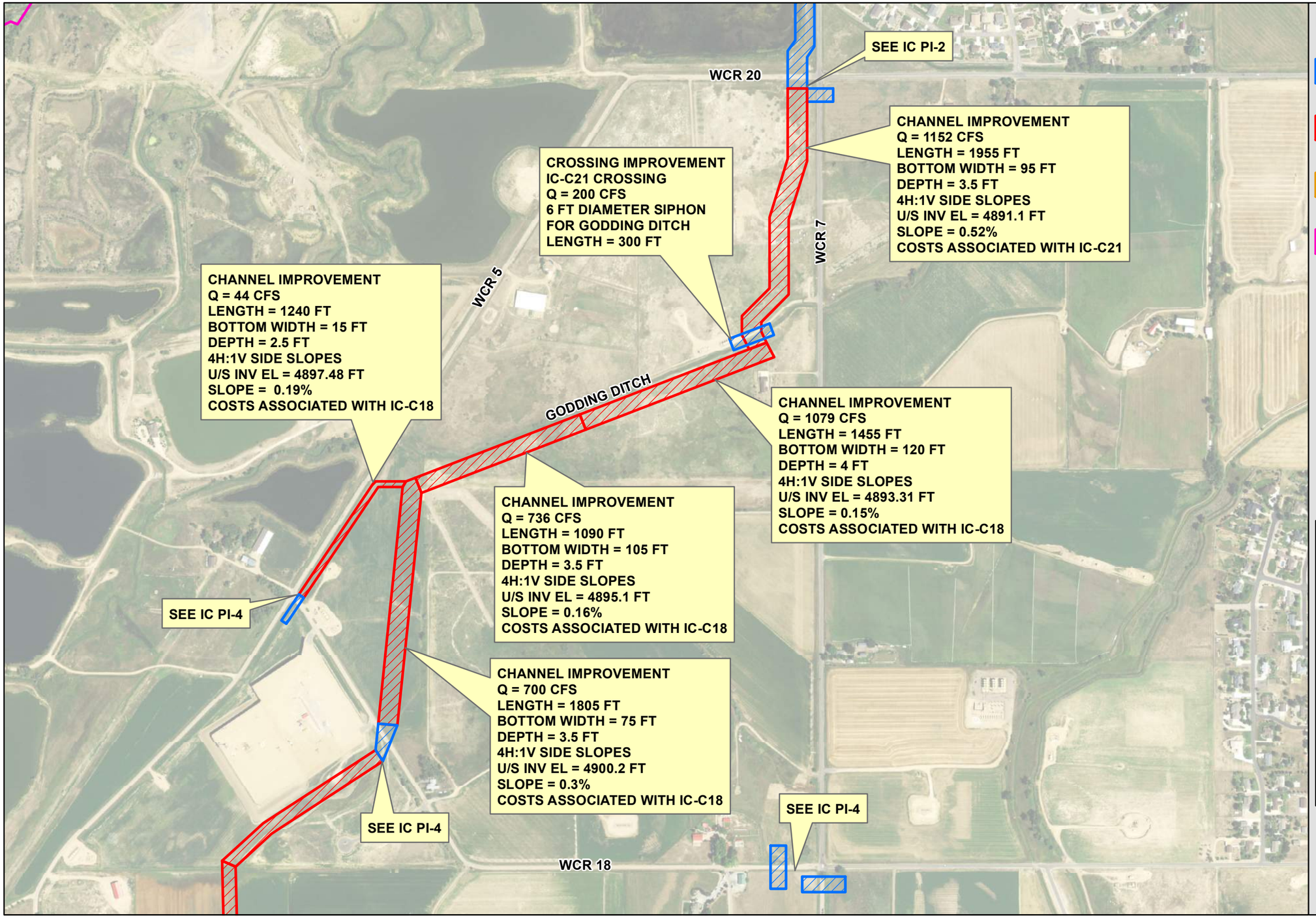
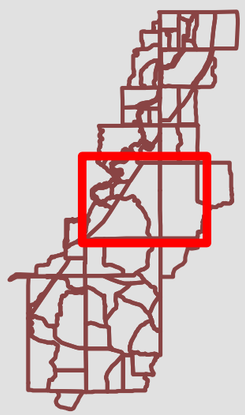


Legend

- Crossing Improvement
- Channel Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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CHANNEL IMPROVEMENT
Q = 44 CFS
LENGTH = 1240 FT
BOTTOM WIDTH = 15 FT
DEPTH = 2.5 FT
4H:1V SIDE SLOPES
U/S INV EL = 4897.48 FT
SLOPE = 0.19%
COSTS ASSOCIATED WITH IC-C18

WCR 5

SEE IC PI-3

CHANNEL IMPROVEMENT
Q = 700 CFS
LENGTH = 1805 FT
BOTTOM WIDTH = 75 FT
DEPTH = 3.5 FT
4H:1V SIDE SLOPES
U/S INV EL = 4900.2 FT
SLOPE = 0.3%
COSTS ASSOCIATED WITH IC-C18

RAISE 50 FT OF ROAD
A MAX OF 1 FT
COSTS ASSOCIATED WITH IC-C18

CROSSING IMPROVEMENT
IC-C18 SECONDARY CROSSING
Q = 44 CFS
(1) 2'Hx5'W RCBC
LENGTH = 75 FT
U/S INV EL = 4897.58 FT
SLOPE = 0.2%
COSTS ASSOCIATED WITH IC-C18

CROSSING IMPROVEMENT
IC-C18 CROSSING
Q = 700 CFS
(4) 3'Hx11'W RCBCS
LENGTH = 100 FT
U/S INV EL = 4900.5 FT
SLOPE = 0.3%

CREATE BERM ON
LEFT SIDE OF CHANNEL
ELEVATION = 4904 FT

CROSSING IMPROVEMENT
IC-C17 CROSSING
Q = 230 CFS
(1) 3'Hx9'W RCBC
LENGTH = 70 FT
U/S INV EL = 4937.65
SLOPE = 0.5%

WCR 7

CHANNEL IMPROVEMENT
Q = 457 CFS
LENGTH = 2650 FT
BOTTOM WIDTH = 40 FT
DEPTH = 3 FT
SIDE SLOPES = 4H:1V
U/S INV EL = 4929.15 FT
SLOPE = 0.9%
COSTS ASSOCIATED WITH IC-C20

CHANNEL IMPROVEMENT
Q = 680 CFS
LENGTH = 1310 FT
BOTTOM WIDTH = 65 FT
DEPTH = 3.5 FT
4H:1V SIDE SLOPES
U/S INV EL = 4905.05 FT
SLOPE = 0.35%
COSTS ASSOCIATED WITH IC-C20

WCR 18

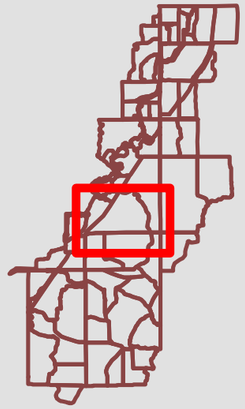
RAISE 510 FT OF ROAD
A MAX OF 2 FT
COSTS ASSOCIATED WITH IC-C17

CROSSING IMPROVEMENT
IC-C16 CROSSING
Q = 134 CFS
(1) 3'Hx7'W RCBC
LENGTH = 65 FT
U/S INV EL = 4939.05 FT
SLOPE = 0.5%
COSTS ASSOCIATED WITH IC-C17

Legend

- Crossing Improvement
- Channel Improvement
- Road Raise
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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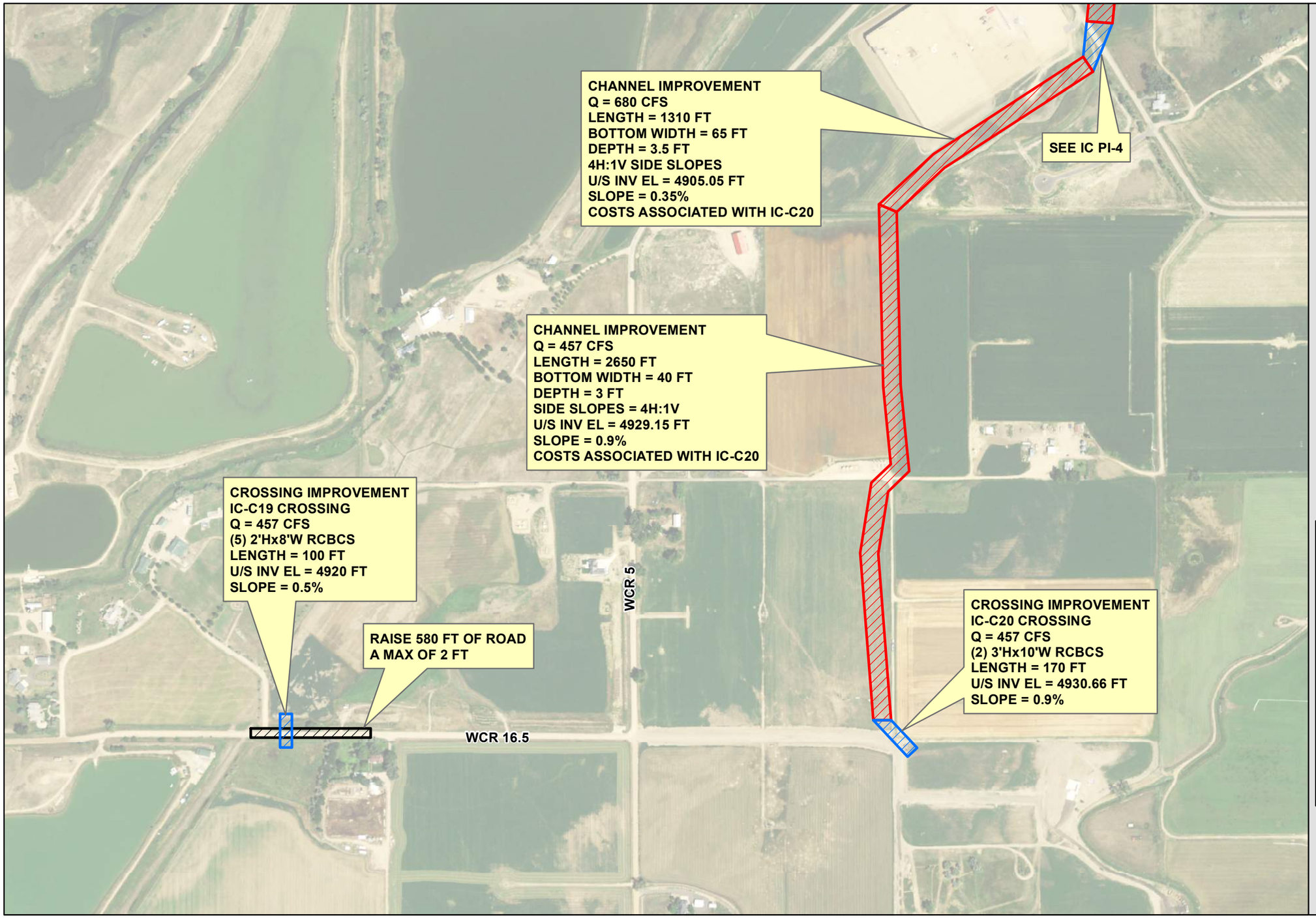
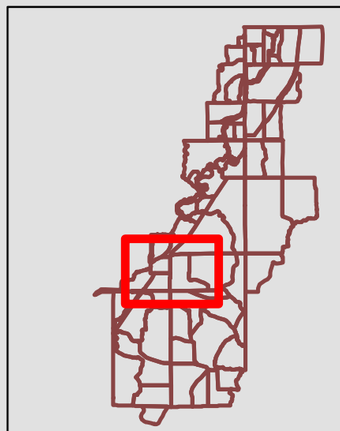


Legend

- Crossing Improvement
- Channel Improvement
- Road Raise
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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PROJECT NUMBER: COTOF.03	
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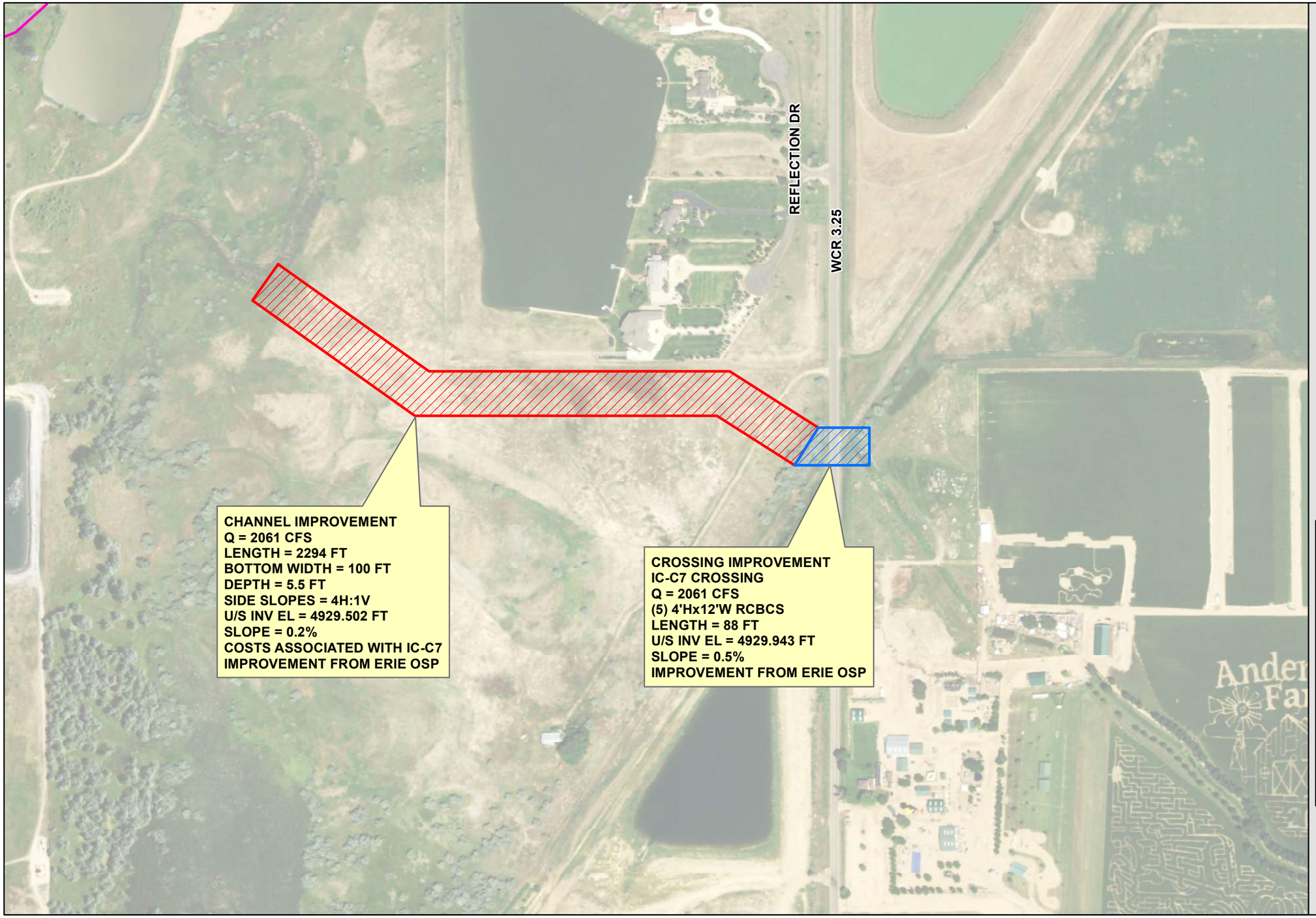
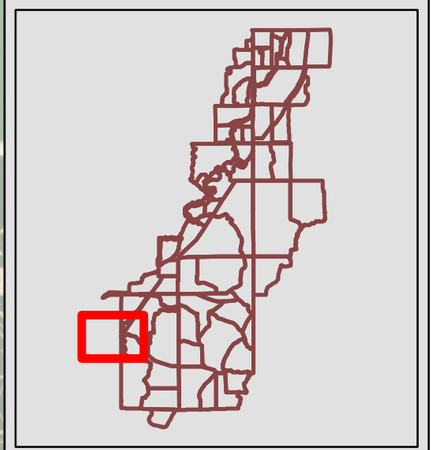
SHEET: IC	INDEX: PI-5



Legend

- Crossing Improvement
- Channel Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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IDAHO CREEK
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DATE: 12/13/2021	
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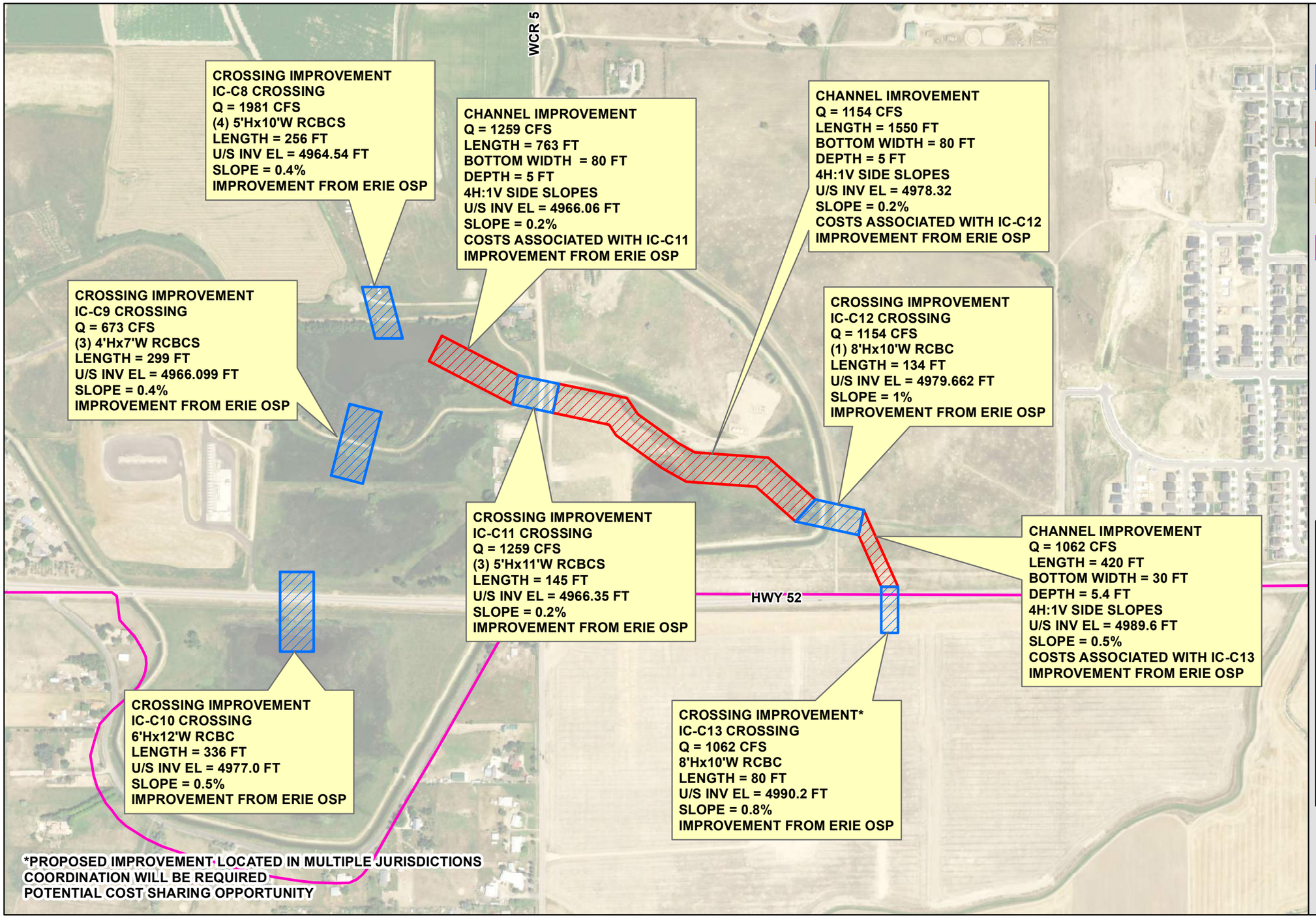
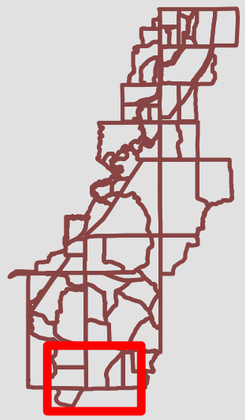


Legend

- Crossing Improvement
- Channel Improvement
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



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OUTFALL SYSTEM PLAN

IDAHO CREEK
PROPOSED
IMPROVEMENTS

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DATE: 12/13/2021	
SHEET: IC	INDEX: PI-7

CONCEPTUAL POND 833 FOR IDAHO CREEK SUBBASIN IC-33 DOWNSTREAM OF DITCH

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4883.70	0	0.00	0.0		0.00	0.00	Bottom
4887.20	13000	0.30	3.50	22126	0.51	8.22	Top of 10-Year Detention Zone
4888.70	45000	1.03	5.00	65294	1.50	96.34	Top of 100-Year Detention Zone

CONCEPTUAL POND 933 FOR IDAHO CREEK SUBBASIN IC-33 UPSTREAM OF DITCH

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4890.00	0	0.00	0.0		0.00	0.00	Bottom
4893.50	12250	0.28	3.50	21294	0.49	8.04	Top of 10-Year Detention Zone
4895.00	42000	0.96	5.00	61563	1.41	94.27	Top of 100-Year Detention Zone

CONCEPTUAL POND 934 FOR IDAHO CREEK SUBBASIN IC-34 East Basin

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4894.00	0	0.00	0.0		0.00	0.00	Bottom
4897.50	19500	0.45	3.50	33928	0.78	12.72	Top of 10-Year Detention Zone
4899.00	65000	1.49	5.00	96752	2.22	151.79	Top of 100-Year Detention Zone

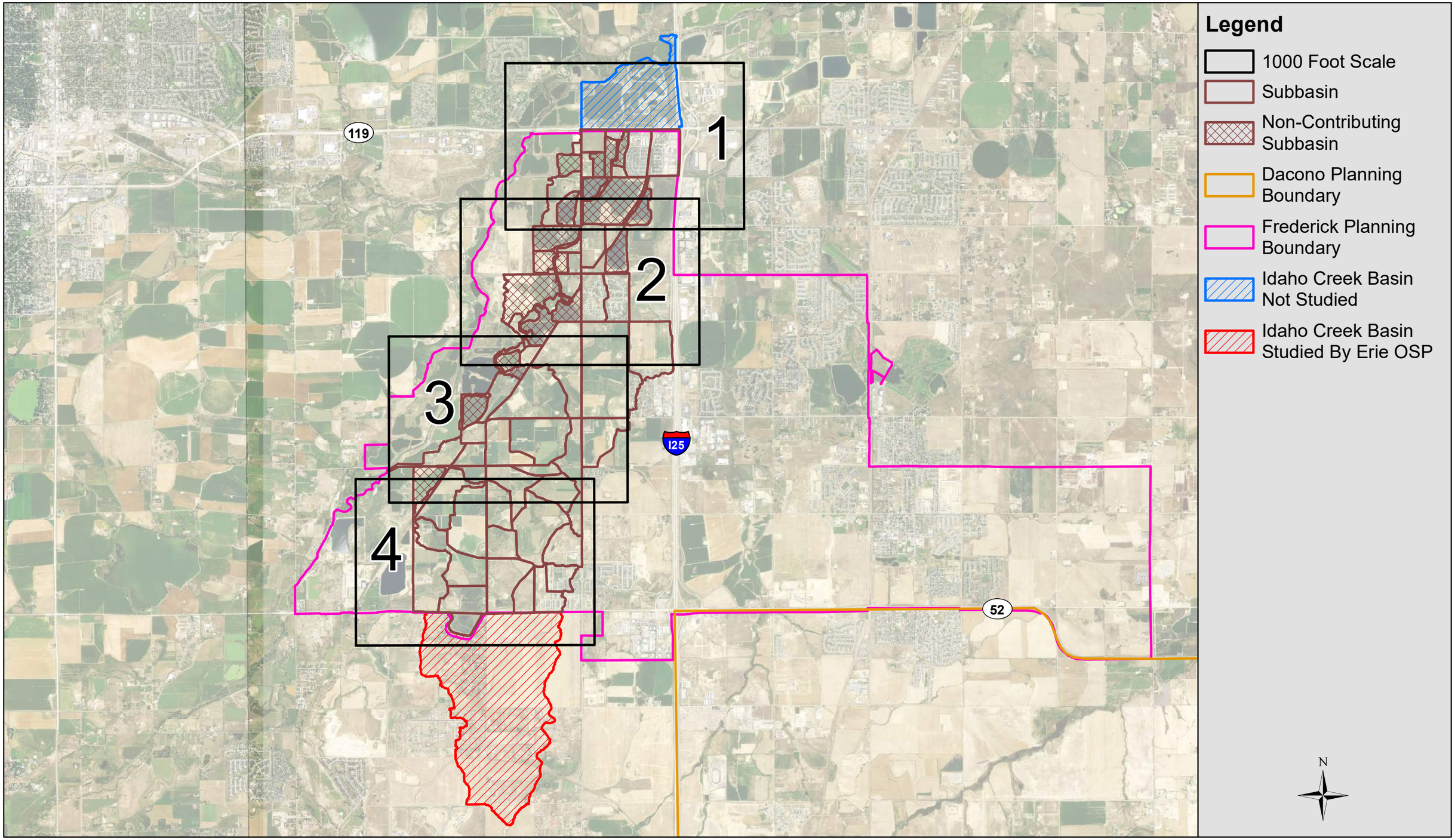
CONCEPTUAL POND 834 FOR IDAHO CREEK SUBBASIN IC-34 Middle Basin

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4905.00	0	0.00	0.0		0.00	0.00	Bottom
4908.50	3250	0.07	3.50	5416	0.12	1.96	Top of 10-Year Detention Zone
4910.00	10000	0.23	5.00	15483	0.36	23.43	Top of 100-Year Detention Zone

CONCEPTUAL POND 864 FOR IDAHO CREEK SUBBASIN IC-34 West Basin

Stage (NAVD 88)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4900.00	0	0.00	0.0		0.00	0.00	Bottom
4903.50	6000	0.14	3.50	10118	0.23	3.70	Top of 10-Year Detention Zone
4905.00	20000	0.46	5.00	29551	0.68	44.17	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run



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IDAHO CREEK
SWMM CONVEYANCE
ELEMENT MAPS

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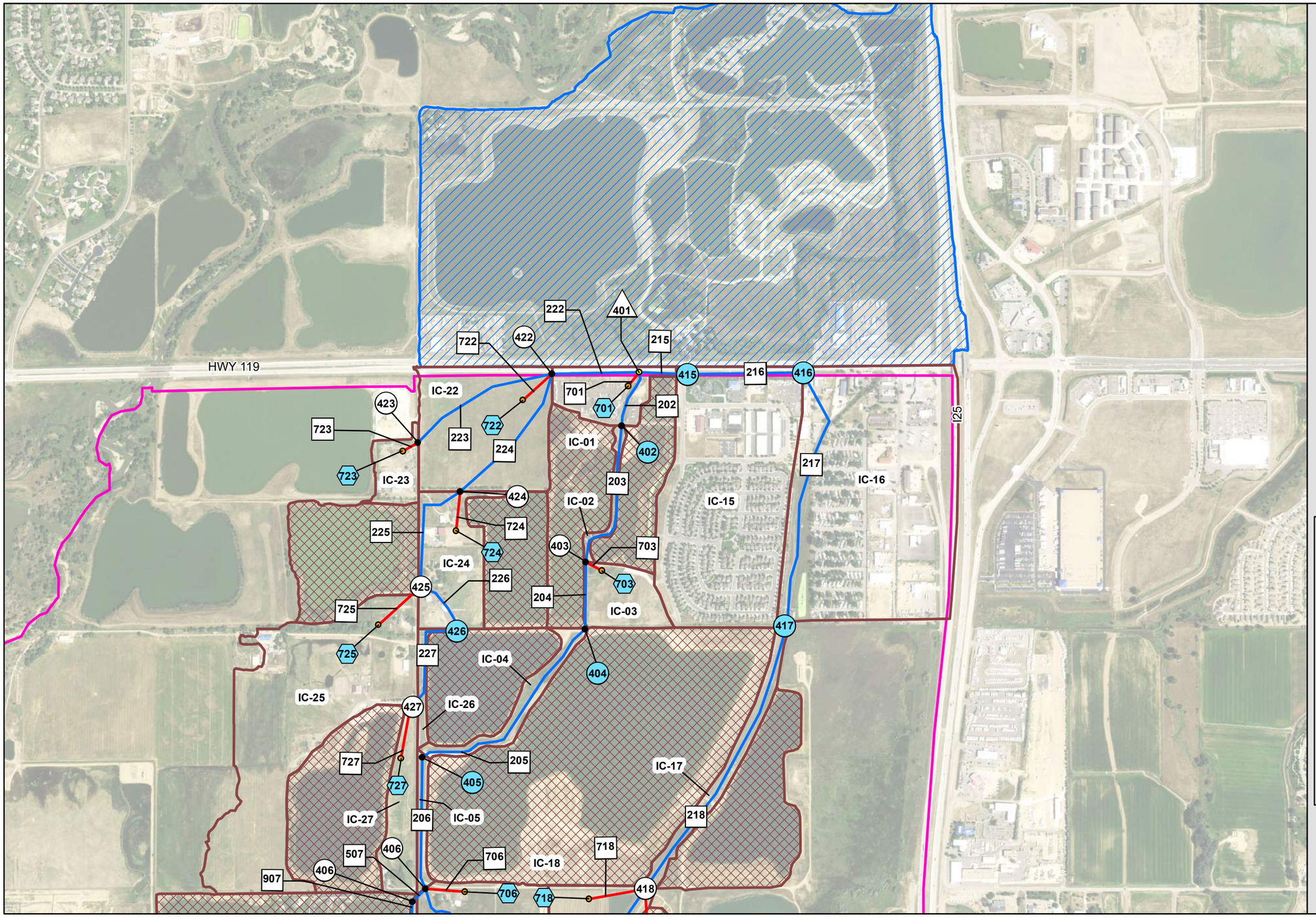
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 3/26/2021	
SHEET: IC	INDEX: C-INDEX



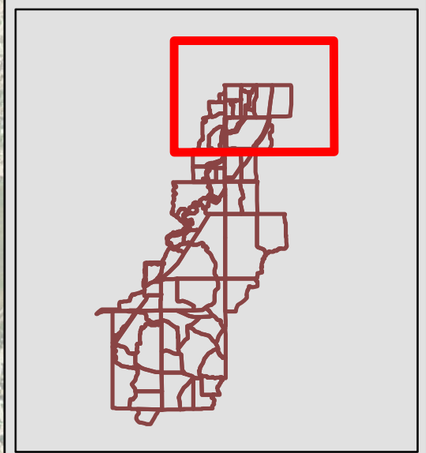
Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning
- Idaho Creek Basin Not
- Idaho Creek Studied By Erie

Key Map



N

0 500 1,000 2,000
Feet

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IDAHO CREEK
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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DATE: 12/20/2021	
SHEET: IC	INDEX: PI-1

IC-33 AND IC-34 SUBBASINS SUBDIVIDED FOR PROPOSED IMPROVEMENT ANALYSIS

WCR 20 1/2

BELLA ROSA PKWY

AGGREGATE BLVD

WCR 5

I25

IC-10 IC-17 IC-18 IC-19 IC-20 IC-21 IC-27 IC-28 IC-29 IC-30 IC-31 IC-32 IC-33 IC-34 IC-39 IC-40 IC-41

Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Proposed Improvement
- Subbasin
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Key Map

N

0 500 1,000 2,000
Feet

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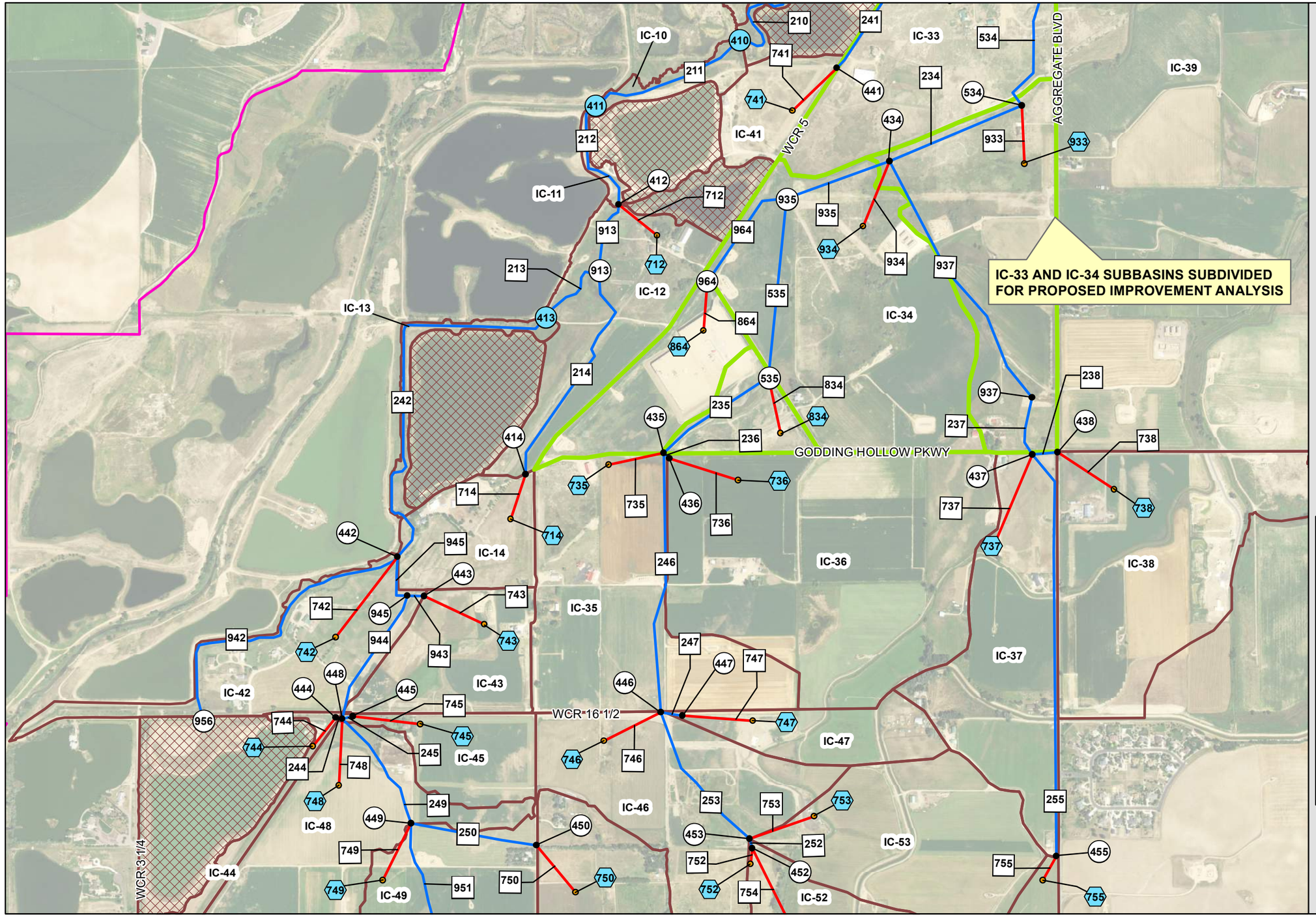

Legend

- Junction
- Flow Diversion Node
- Outfall
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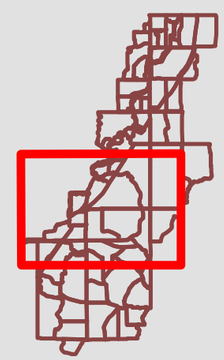

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0 500 1,000 2,000
Feet

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PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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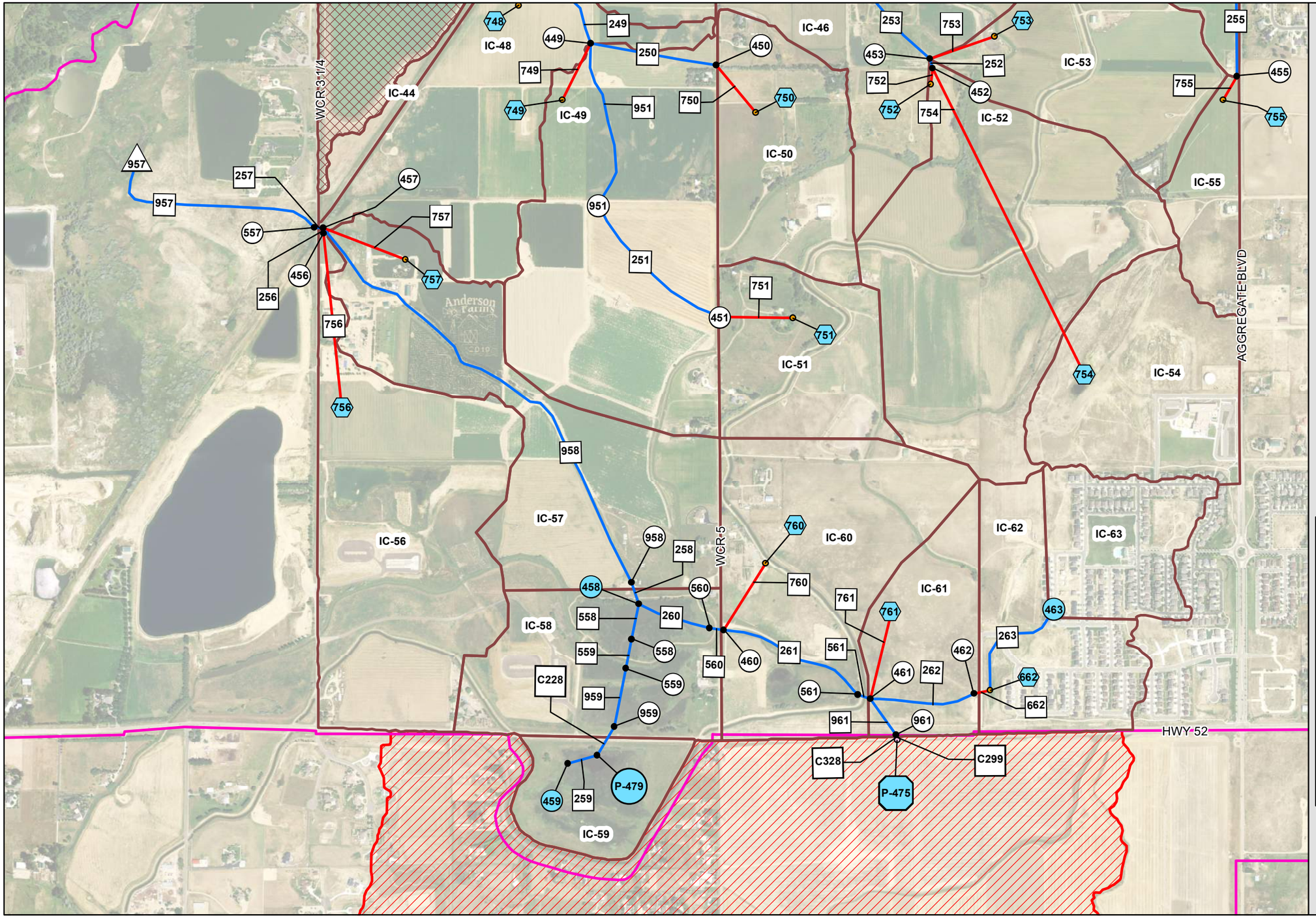
SHEET: IC	INDEX: PI-3



Legend

- Junction
- Flow Diversion Node
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

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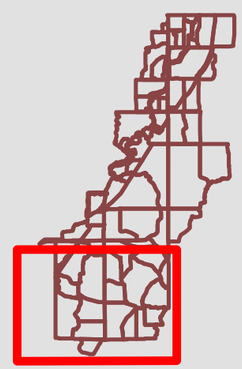

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0 500 1,000 2,000
Feet

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IDAHO CREEK
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/20/2021	
SHEET: IC	INDEX: PI-4

Table E.3.1: Idaho Creek Basin Peak Discharge Comparison: Future Conditions 2022 OSP and Proposed Improvements 2022 OSP

Location	SWMM Node	Drainage Area* (acres)	Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Difference (Proposed Improvements - Future Condition) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path - Lower Idaho Creek																		
Highway 119/ Frederick Planning Boundary	401	5348	53	92	228	1237	1962	53	80	116	1019	1741	0	-12	-112	-219	-220	
County Road 7, South of Highway 119	407	4701	45	89	223	1215	1907	26	52	94	1004	1706	-19	-37	-129	-211	-201	Proposed crossing improvement to eliminate overtopping of County Road 7.
County Road 20.5	409	4656	45	90	225	1221	1913	28	53	96	1034	1730	-17	-37	-129	-187	-183	Proposed crossing improvement to eliminate overtopping of County Road 20.5
Rural Ditch																		
County Road 20.5	420	82	2	3	7	17	39	2	3	7	17	39	0	0	0	0	0	
County Road 20, East of County Road 7	440	162	12	15	19	166	237	12	15	19	166	237	0	0	0	0	0	
Main Flow Path - Upper Idaho Creek																		
Country Road 16.5	956	2064	57	117	263	1220	1837	N/A	N/A	N/A	N/A	N/A	-57	-117	-263	-1220	-1837	Due to proposed improvement that will route flood upstream flows towards Boulder Creek, this crossing will only need to convey local and irrigation flows.
Decommissioned Railroad Embankment	457	2064	60	127	286	1259	1883	83	172	345	1557	2061	23	45	59	297	178	Flows at this location are proposed to be routed to Boulder Creek.
HWY 52, West of County Road 5	P-479	1181	48	111	240	888	1252	40	79	143	662	674	-8	-32	-97	-226	-578	Recommended Plan Condition inflows from Erie OSP.
County Road 5/Boulder and Weld County Ditch	460	506	7	17	59	354	518	46	104	221	864	1259	39	87	162	509	741	Proposed crossing improvement to eliminate overtopping of County Road 5 and Boulder/Weld County Ditch.
HWY 52, East of County Road 5	P-475	214	2	9	46	205	288	44	99	207	745	1062	42	90	161	540	774	Recommended Plan Condition inflows from Erie OSP.
Other Tributary Crossings																		
County Road 7, South of County Road 20	439	345	6	10	14	260	439	6	10	14	262	452	0	0	0	3	13	Proposed crossing improvement to eliminate overtopping of County Road 7.
County Road 20, West of County Road 7	433	1631	18	36	67	698	1253	17	40	76	936	1619	-1	3	9	239	366	Proposed crossing improvement to eliminate overtopping of County Road 20.
County Road 18, East of County Road 5	535	721	10	16	22	304	555	13	19	27	421	700	2	3	5	117	145	Proposed crossing improvement to eliminate overtopping of County Road 18.
County Road 16.5, East of County Road 5	446	460	10	15	20	292	457	10	15	20	292	457	0	0	0	1	0	Proposed crossing improvement at future County Road 16.5 extension.
County Road 16.5 at Decommissioned Railroad Embankment	448	458	8	16	31	298	457	8	16	31	298	457	0	0	0	0	0	Proposed crossing improvement to eliminate overtopping of County Road 16.5.

*Existing reclaimed gravel pit/pond areas were considered non-contributing areas due to surrounding berms isolating them from the watershed. Total non-contributing area ~ 874 acres.

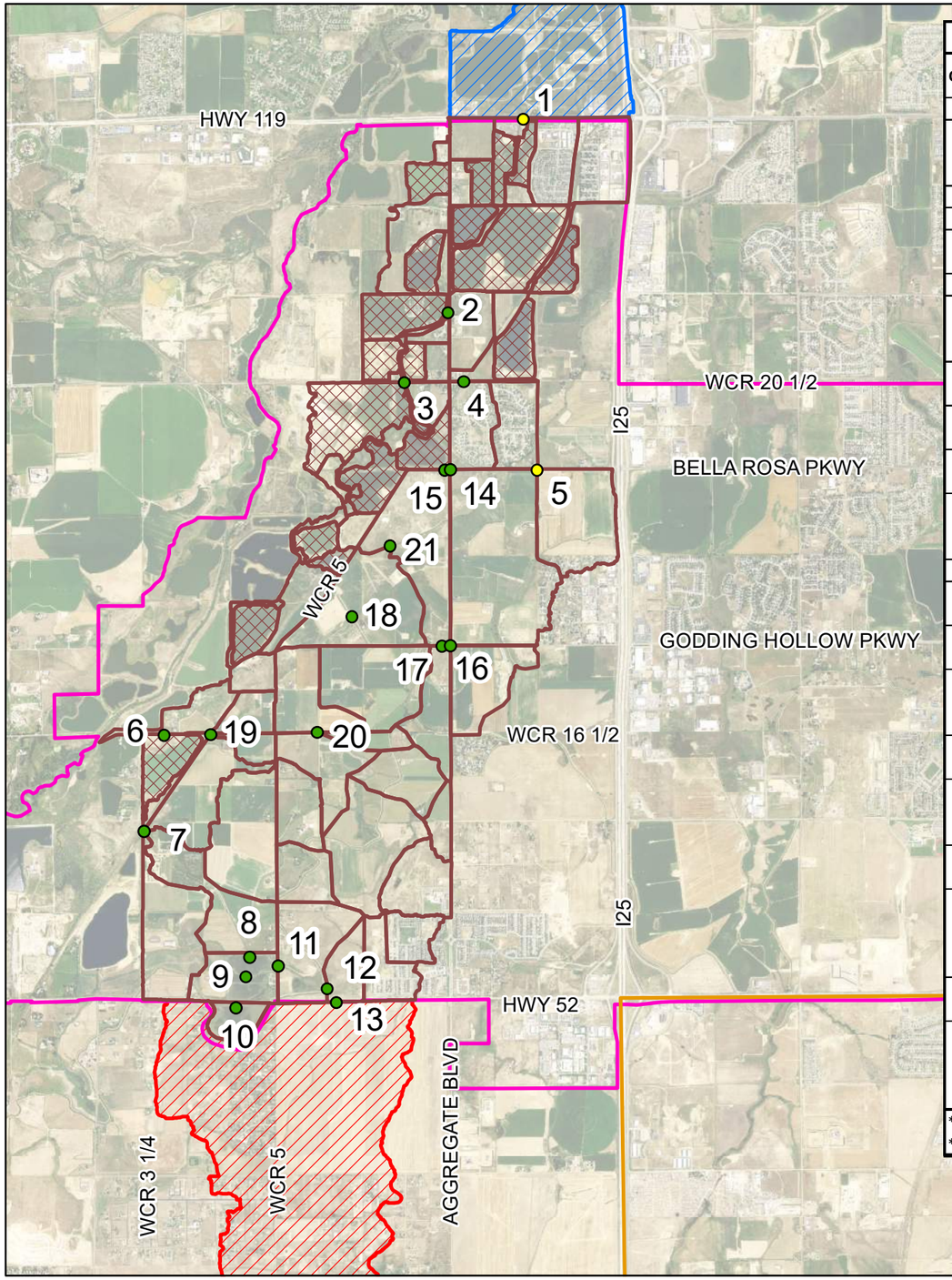
Table E.3.2: Idaho Creek Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvements SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Main Flow Path - Lower Idaho Creek																		
IC-C1	Highway 119	401	(2) 5' H x 9' W RCBC	4843.9	1000	< 50-Year	< 50-Year	53	92	228	1237	1962	53	80	116	1019	1741	Crossing adheres to CDOT criteria. No proposed improvements for this crossing.
IC-C2	County Road 7, South of Highway 119	407	(4) 3'H x 12' W RCBC	4866.1	1160	< 10-Year	> 100-Year	45	89	223	1215	1907	26	52	94	1004	1706	Existing 3' H x 12' W RCBC to remain and be extended upstream. Three additional 3' H x 12'W RCBCs to be added at existing crossing and an additional overflow (2) 3' H x 12' W RCBCs to be added to the north of existing crossing to eliminate overtopping of County Road 7.
		507	(2) 3'H x 12'W RCBC	4865.0	570								0	0	0	0	545	
IC-C3	County Road 20.5	409	(5) 4'H x 12' W RCBC	4871.1	1810	< 10-Year	> 100-Year	45	90	225	1221	1913	28	53	96	1034	1730	Proposed crossing improvements to eliminate overtopping of Country Road 20.5. Water surface elevation on upstream side of crossing designed for a maximum elevation of 4876.0 to protect existing adjacent structures from flooding and to eliminate spilling of water to northeast.
Rural Ditch																		
IC-C4	County Road 20.5	420	3.7' H x 10' W Arch CMP	4871.1	170	> 100-Year	> 100-Year	2	3	7	17	39	2	3	7	17	39	
IC-C5	County Road 20, East of County Road 7	440	42" CMP	4891.1	100	< 50-Year	< 50-Year	12	15	19	166	237	12	15	19	166	237	Road does not overtop as excess flow spills to west and is conveyed along roadside ditch to County Road 7 (IC Crossing 14) . No proposed improvements for this crossing.
Main Flow Path - Upper Idaho Creek																		
IC-C6	County Road 16.5	956	18" CMP	4915.1***	5**	< 2-Year	> 100-Year	57	117	263	1220	1837	N/A	N/A	N/A	N/A	N/A	Due to proposed improvement that will route flood flows at Crossing IC-C7 towards Boulder Creek, this crossing will only need to convey local and irrigation flows.
IC-C7	Decommissioned Railroad Embankment	457	(5) 4'H X 12'W RCBC***	4929.9***	2070	< 2-Year	> 100-Year	60	127	286	1259	1883	83	172	345	1557	2061	Proposed crossing improvements and channel improvements to eliminate overtopping of Country Road 3.25 and direct flow towards Boulder Creek per Eire OSP.
IC-C8	Wetland Pond Embankment	458	(4) 5'H X 10'W RCBC***	4964.5***	2010	< 2-Year	> 100-Year	54	128	296	1228	1787	82	181	362	1548	1981	Proposed culvert crossing of Wetland Pond Embankment per Erie OSP.
IC-C9	Boulder and Weld County Ditch	559	(3) 4'H X 7'W RCBC***	4966.1***	790	< 2-Year	> 100-Year	47	108	237	878	1242	40	79	143	658	673	Proposed culvert crossing of Boulder and Weld County Ditch per Erie OSP.
IC-C10	HWY 52, West of County Road 5	P-479	6'H X 12'W RCBC***	4977.0	690	< 5-Year	> 100-Year	48	111	240	888	1252	40	79	143	662	674	Proposed culvert crossing of HWY 52 per Erie OSP.
IC-C11	County Road 5/Boulder and Weld County Ditch	460	(3) 5'H X 11'W RCBC***	4966.4***	1470	< 2-Year	> 100-Year	7	17	59	354	518	46	104	221	864	1259	Proposed culvert crossing of CR 5/ Boulder and Weld County Ditch per Eire OSP.
IC-C12	Lower Boulder Ditch	461	8'H X 10'W RCBC***	4979.7***	1220	< 2-Year	> 100-Year	4	13	53	261	369	45	101	214	799	1154	Proposed culvert crossing of Lower Boulder Ditch per Erie OSP.
IC-C13	HWY 52, East of County Road 5	P-475	8'H X 10'W RCBC***	4990.2	1070	< 5-Year	> 100-Year	2	9	46	205	288	44	99	207	745	1062	Proposed culvert crossing of HWY 52 per Erie OSP.

Table E.3.2: Idaho Creek Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvements SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Other Tributary Crossings																		
IC-C14	County Road 7, South of County Road 20	439	(2) 3'H X 12'W RCBC	4881.3	510	< 2-Year	> 100-Year	6	10	14	260	439	6	10	14	262	452	Proposed crossing and road raising improvements to eliminate overtopping of Weld County Road 7.
IC-C15	County Road 20, West of County Road 7	433	(5) 4'H X 12'W RCBC	4881.0	1740	< 2-Year	> 100-Year	18	36	67	698	1253	17	40	76	936	1619	Proposed crossing and road raising improvements to eliminate overtopping of Weld County Road 20.
IC-C16	County Road 18, East of County Road 7	438	3'H X 7'W RCBC	4938.1	140	< 2-Year	> 100-Year	3	6	9	93	134	3	6	9	93	134	Proposed crossing improvements to eliminate overtopping of Weld County Road 7.
IC-C17	County Road 18, West of County Road 7	437	3'H X 9'W RCBC	4937.7	250	< 2-Year	> 100-Year	3	5	8	68	105	6	10	17	152	230	Proposed crossing and road raising improvements to eliminate overtopping of Weld County Road 18.
IC-C18	County Road 18, East of County Road 5	535 964	(4) 3'H X 11'W RCBC 2'H X 5'W RCBC	4900.5 4897.6	750 50	< 2-Year	> 100-Year	10	16	22	304	555	13 1	19 2	27 4	421 31	700 44	Proposed dual crossings and road raising improvements to eliminate overtopping of Weld County Road 18.
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	448	(5) 2'H X 8'W RCBC	4920.0	520	< 2-Year	> 100-Year	8	16	31	298	457	8	16	31	298	457	Proposed crossing and road raising improvements to eliminate overtopping of Weld County Road 16.5.
IC-C20	County Road 16.5, East of County Road 5	446	(2) 3'H X 10'W RCBC	4930.7	460	< 2-Year	> 100-Year	10	15	20	292	457	10	15	20	292	457	Proposed crossing and road raising improvements to eliminate overtopping of Weld County Road 16.5.
IC-C21	Godding Ditch Crossing	534	Proposed Channel Improvements 6' RCP Siphon for Ditch Crossing	4891.1 4887.8	1190 200	< 2-Year	> 100-Year	12	24	42	481	874	16	31	57	688	1152	Proposed channel improvements and siphon of ditch to convey stormwater flow over ditch. Siphon designed to convey 200 cfs based on ditch capacity calculations.

*HY-8 Program used to evaluate capacities unless otherwise noted
**Capacities evaluated in EPA-SWMM or StormCAD
***Obtained from Erie OSP



Idaho Creek Basin Crossings

Crossing	Street Name	Proposed Crossing Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
IC-C1	Highway 119	(2) 5' H x 9' W RCBC	< 50-Year	4843.9	401
IC-C2	County Road 7, South of Highway 119	(4) 3'H x 12' W RCBC*	> 100-Year	4866.1*	407
		(2) 3'H x 12'W RCBC*		4865*	507
IC-C3	County Road 20.5	(5) 4'H x 12' W RCBC*	> 100-Year	4871.1	409
IC-C4	County Road 20.5	3.7' H x 10' W Arch CMP	> 100-Year	4871.1	420
IC-C5	County Road 20, East of County Road 7	42" CMP	< 50-Year	4891.1	440
IC-C6	County Road 16.5	18" CMP	> 100-Year	4915.1**	956
IC-C7	Decommissioned Railroad Embankment	(5) 4'H X 12'W RCBC**	> 100-Year	4929.9**	457
IC-C8	Wetland Pond Embankment	(4) 5'H X 10'W RCBC**	> 100-Year	4964.5**	458
IC-C9	Boulder and Weld County Ditch	(3) 4'H X 7'W RCBC**	> 100-Year	4966.1**	559
IC-C10	HWY 52, West of County Road 5	6'H X 12'W RCBC**	> 100-Year	4977*	P-479
IC-C11	County Road 5/Boulder and Weld County Ditch	(3) 5'H X 11'W RCBC**	> 100-Year	4966.4**	460
IC-C12	Lower Boulder Ditch	8'H X 10'W RCBC**	> 100-Year	4979.7**	461
IC-C13	HWY 52, East of County Road 5	8'H X 10'W RCBC**	> 100-Year	4990.2*	P-475
IC-C14	County Road 7, South of County Road 20	(2) 3'H X 12'W RCBC*	> 100-Year	4881.3*	439
IC-C15	County Road 20, West of County Road 7	(5) 4'H X 12'W RCBC*	> 100-Year	4881*	433
IC-C16	County Road 18, East of County Road 7	3'H X 7'W RCBC*	> 100-Year	4938.1*	438
IC-C17	County Road 18, West of County Road 7	3'H X 9'W RCBC*	> 100-Year	4937.7*	437
IC-C18	County Road 18, East of County Road 5	(4) 3'H X 11'W RCBC*	> 100-Year	4900.5*	4900.5
		2'H X 5'W RCBC*		4897.6*	4897.6
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	(5) 2'H X 8'W RCBC*	> 100-Year	4920*	448
IC-C20	County Road 16.5, East of County Road 5	(2) 3'H X 10'W RCBC*	> 100-Year	4930.7*	446
IC-C21	Godding Ditch Crossing	Proposed Channel Improvements 6' RCP Siphon for Ditch Crossing*	> 100-Year	4891.1* 4887.8*	534

*Indicates revised information for proposed improvements
**Obtained from Erie OSP

Legend

- Crossing with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Non-Contributing Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Idaho Creek Basin Not Studied
- Idaho Creek Studied By Erie OSP

N

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

IDAHO CREEK
PROPOSED CONDITION
CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 1/6/2022	
SHEET: IC	INDEX: PI-CROSS

Appendix E.4. Idaho Creek Cost Estimate Documentation

Table E.4.1: Idaho Creek Basin Proposed Improvement Cost Summary

Crossing	Street Name	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
Town of Frederick								
IC-C2	County Road 7, South of Highway 119	$1,053,000	$5,000	$158,000	$53,000	$105,000	$263,000	$1,638,000
IC-C3	County Road 20.5	$465,000	$41,000	$70,000	$23,000	$47,000	$116,000	$762,000
IC-C7	Decommissioned Railroad Embankment	$1,819,000	$1,000	$273,000	$91,000	$182,000	$455,000	$2,820,000
IC-C8	Wetland Pond Embankment	$1,361,000	$1,000	$204,000	$68,000	$136,000	$340,000	$2,110,000
IC-C9	Boulder and Weld County Ditch	$873,000	$0	$131,000	$44,000	$87,000	$218,000	$1,354,000
IC-C10	Hwy 52, West of County Road 5	$680,000	$0	$102,000	$34,000	$68,000	$170,000	$1,054,000
IC-C11	County Road 5/Boulder and Weld County Ditch	$1,038,000	$0	$156,000	$52,000	$104,000	$259,000	$1,609,000
IC-C12	Lower Boulder Ditch	$1,626,000	$3,000	$244,000	$81,000	$163,000	$406,000	$2,522,000
IC-C13	Hwy 52, East of County Road 5 (Frederick Portion)	$390,000	$1,000	$59,000	$20,000	$39,000	$98,000	$606,000
IC-C14 & IC-C15	County Road 7, South of County Road 20	$5,537,000	$0	$830,000	$277,000	$554,000	$1,384,000	$8,582,000
IC-C16 & IC-C17	County Road 18, East of County Road 7	$414,000	$0	$62,000	$21,000	$41,000	$104,000	$642,000
IC-C18	County Road 18, East of County Road 5	$1,160,000	$1,000	$174,000	$58,000	$116,000	$290,000	$1,799,000
IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	$737,000	$1,000	$111,000	$37,000	$74,000	$184,000	$1,143,000
IC-C20	County Road 16.5, East of County Road 5	$729,000	$10,000	$109,000	$36,000	$73,000	$182,000	$1,140,000
IC-C21	Godding Ditch Crossing	$473,000	$1,000	$71,000	$24,000	$47,000	$118,000	$734,000
Total Cost		**$18,355,000**	**$65,000**	**$2,754,000**	**$919,000**	**$1,836,000**	**$4,587,000**	**$28,515,000**
Town of Erie								
IC-C13	Hwy 52, East of County Road 5 (Erie Portion)	$141,000	$0	$21,000	$7,000	$14,000	$35,000	$218,000
Total Cost		**$141,000**	**$0**	**$21,000**	**$7,000**	**$14,000**	**$35,000**	**$218,000**

IC-C2 County Road 7, South of Highway 119

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	3	1	51	L.F.	$979.17	$49,938.00	3'Hx12'W RCBC extension. Assumed costs are equal to 3'Hx11' RCBC
11	3	3	111	L.F.	$2,937.51	$326,064.00	(3) 3'Hx12'W RCBCs. Assumed costs are equal to 3'Hx11'W RCBC.
11	3	2	100	L.F.	$1,958.34	$195,834.00	(2) 3'Hx11'W RCBCs for new downstream crossing.
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	1	13.00	1	EA	$1,264.97	$1,265.00	Extended existing culvert upstream
11	3	36.00	2	EA	$3,502.98	$7,006.00	New culverts at main crossing
11	2	25.00	2	EA	$2,432.63	$4,865.00	New culverts at new crossing
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	3	1	1	EA	$7,790.51	$7,790.50	
11	3	3	2	EA	$13,136.69	$26,273.40	
11	3	2	2	EA	$10,463.60	$20,927.20	
Channel Improvements							
18-inch Riprap, Type H			90	C.Y.	$108.00	$9,720.00	Riprap for new culverts at existing crossing
18-inch Riprap, Type H			50	C.Y.	$108.00	$5,400.00	Riprap for culverts at new crossing
Excavation, Mid Range			2310	C.Y.	$33.00	$76,230.00	Cut to be hauled offsite for both channels
Excavation, Low Range			1485	C.Y.	$15.00	$22,275.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			3	ACRE	$1,355.00	$4,065.00	Reseeding of channels
Special Items (User Defined)							
Irrigation Turnout and Weir	<----User Defined Items		1	EA	$50,000.00	$50,000.00	Estimated cost for irrigation structures and weir
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$5,000.00	$5,000.00	No land evaluation, assumed values for easements

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$0.00
Concrete Box Culverts			$639,963.00
Hydraulic Structures			$0.00
Channel Improvements			$113,625.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$4,065.00
Special Items (User Defined)			$50,000.00
Subtotal Capital Improvement Costs			**$807,653.00**
Additional Capital Improvement Costs			
Dewatering	$55,000.00	L.S.	$55,000.00
Mobilization	5%		$40,383.00
Traffic Control	$55,000.00	L.S.	$55,000.00
Utility Coordination/Relocation	$55,000.00	L.S.	$55,000.00
Stormwater Management/Erosion Control	5%		$40,383.00
Subtotal Additional Capital Improvement Costs			**$245,766.00**
Land Acquisition Costs			
ROW/Easements			$5,000.00
Subtotal Land Acquisition Costs			**$5,000.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$158,013.00
Legal/Administrative	5%		$52,671.00
Contract Admin/Construction Management	10%		$105,342.00
Contingency	25%		$263,355.00
Subtotal Other Costs			**$579,381.00**
Total Capital Improvement Costs			**$1,637,800.00**

IC-C3 County Road 20.5

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	5	55	L.F.	$5,524.92	$303,870.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	5	65.00	2	EA	$6,285.83	$12,572.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	5	2	EA	$21,903.16	$43,806.30	
Channel Improvements							
18-inch Riprap, Type H			150	C.Y.	$108.00	$16,200.00	
Removals							
Removal of culvert pipe (48"<D<84")			55	L.F.	$68.00	$3,740.00	38"H x 60"W HERCP is a 48" equivalent
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$40,600.00	$40,600.00	Lump sum for proposed ROW acquisition

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$0.00
Concrete Box Culverts			$360,248.00
Hydraulic Structures			$0.00
Channel Improvements			$16,200.00
Detention/Water Quality Facilities			$0.00
Removals			$3,740.00
Landscaping and Maintenance Improvements			$2,710.00
Special Items (User Defined)			$0.00
Subtotal Capital Improvement Costs			**$382,898.00**
Additional Capital Improvement Costs			
Dewatering	$25,000.00	L.S.	$25,000.00
Mobilization	5%		$19,145.00
Traffic Control	$9,500.00	L.S.	$9,500.00
Utility Coordination/Relocation	$9,500.00	L.S.	$9,500.00
Stormwater Management/Erosion Control	5%		$19,145.00
Subtotal Additional Capital Improvement Costs			**$82,290.00**
Land Acquisition Costs			
ROW/Easements			$40,600.00
Subtotal Land Acquisition Costs			**$40,600.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$69,778.00
Legal/Administrative	5%		$23,259.00
Contract Admin/Construction Management	10%		$46,519.00
Contingency	25%		$116,297.00
Subtotal Other Costs			**$255,853.00**
Total Capital Improvement Costs			**$761,641.00**

IC-C7 Decommissioned Railroad Embankment

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	5	88	L.F.	$5,524.92	$486,193.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	5	65.00	2	EA	$6,285.83	$12,572.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	5	2	EA	$21,903.16	$43,806.30	
Channel Improvements							
18-inch Riprap, Type H			140	C.Y.	$108.00	$15,120.00	
Excavation, Mid Range			28785	C.Y.	$33.00	$949,905.00	Cut to be hauled offsite for channel
Excavation, Low Range			3175	C.Y.	$15.00	$47,625.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			12	ACRE	$1,355.00	$16,260.00	Reseeding for channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for land acquisition

Master Plan Capital Improvement Cost Summary			
Capital Improvement Costs			
Pipe Culverts and Storm Drains			$0.00
Concrete Box Culverts			$542,571.00
Hydraulic Structures			$0.00
Channel Improvements			$1,012,650.00
Detention/Water Quality Facilities			$0.00
Removals			$0.00
Landscaping and Maintenance Improvements			$16,260.00
Special Items (User Defined)			$0.00
Subtotal Capital Improvement Costs			**$1,571,481.00**
Additional Capital Improvement Costs			
Dewatering	$50,000.00	L.S.	$50,000.00
Mobilization	5%		$78,574.00
Traffic Control	$20,000.00	L.S.	$20,000.00
Utility Coordination/Relocation	$20,000.00	L.S.	$20,000.00
Stormwater Management/Erosion Control	5%		$78,574.00
Subtotal Additional Capital Improvement Costs			**$247,148.00**
Land Acquisition Costs			
ROW/Easements			$1,000.00
Subtotal Land Acquisition Costs			**$1,000.00**
Other Costs (percentage of Capital Improvement Costs)			
Engineering	15%		$272,794.00
Legal/Administrative	5%		$90,931.00
Contract Admin/Construction Management	10%		$181,863.00
Contingency	25%		$454,657.00
Subtotal Other Costs			**$1,000,245.00**
Total Capital Improvement Costs			**$2,819,874.00**

IC-C8 Wetland Pond Embankment

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	5	4	256	L.F.	$4,364.65	$1,117,350.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	4	44.00	2	EA	$4,281.42	$8,563.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	5	4	2	EA	$20,899.88	$41,799.80	
Channel Improvements							
18-inch Riprap, Type H			140	C.Y.	$108.00	$15,120.00	
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$500.00	$500.00	Lump sum for crossing acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$1,167,713.00	
Hydraulic Structures						$0.00	
Channel Improvements						$15,120.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$1,182,833.00**	
Additional Capital Improvement Costs							
Dewatering			$40,000.00	L.S.		$40,000.00	
Mobilization			5%			$59,142.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$10,000.00	L.S.		$10,000.00	
Stormwater Management/Erosion Control			5%			$59,142.00	
Subtotal Additional Capital Improvement Costs						**$178,284.00**	
Land Acquisition Costs							
ROW/Easements						$500.00	
Subtotal Land Acquisition Costs						**$500.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$204,168.00	
Legal/Administrative			5%			$68,056.00	
Contract Admin/Construction Management			10%			$136,112.00	
Contingency			25%			$340,279.00	
Subtotal Other Costs						**$748,615.00**	
Total Capital Improvement Costs						**$2,110,232.00**	

IC-C9 Boulder and Weld County Ditch

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
7	4	3	299	L.F.	$2,375.30	$710,214.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
7	3	24.00	2	EA	$2,188.92	$4,378.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
7	4	3	2	EA	$12,440.50	$24,881.00	
Channel Improvements							
18-inch Riprap, Type H			70	C.Y.	$108.00	$7,560.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$739,473.00	
Hydraulic Structures						$0.00	
Channel Improvements						$7,560.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$1,355.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$748,388.00**	
Additional Capital Improvement Costs							
Dewatering			$30,000.00	L.S.		$30,000.00	
Mobilization			5%			$37,419.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$10,000.00	L.S.		$10,000.00	
Stormwater Management/Erosion Control			5%			$37,419.00	
Subtotal Additional Capital Improvement Costs						**$124,838.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$130,984.00	
Legal/Administrative			5%			$43,661.00	
Contract Admin/Construction Management			10%			$87,323.00	
Contingency			25%			$218,307.00	
Subtotal Other Costs						**$480,275.00**	
Total Capital Improvement Costs						**$1,353,501.00**	

IC-C10 Hwy 52, West of County Road 5

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	6	1	336	L.F.	$1,396.23	$469,134.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	1	14.00	2	EA	$1,353.87	$2,708.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	6	1	2	EA	$15,967.15	$31,934.30	
Channel Improvements							
18-inch Riprap, Type H			110	C.Y.	$108.00	$11,880.00	
Removals							
Removal of culvert pipe (D<48")			336	L.F.	$27.00	$9,072.00	36" RCP
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$503,776.00	
Hydraulic Structures						$0.00	
Channel Improvements						$11,880.00	
Detention/Water Quality Facilities						$0.00	
Removals						$9,072.00	
Landscaping and Maintenance Improvements						$2,710.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$527,438.00**	
Additional Capital Improvement Costs							
Dewatering			$20,000.00	L.S.		$20,000.00	
Mobilization			5%			$26,372.00	
Traffic Control			$30,000.00	L.S.		$30,000.00	
Utility Coordination/Relocation			$50,000.00	L.S.		$50,000.00	
Stormwater Management/Erosion Control			5%			$26,372.00	
Subtotal Additional Capital Improvement Costs						**$152,744.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$102,027.00	
Legal/Administrative			5%			$34,009.00	
Contract Admin/Construction Management			10%			$68,018.00	
Contingency			25%			$170,046.00	
Subtotal Other Costs						**$374,100.00**	
Total Capital Improvement Costs						**$1,054,282.00**	

IC-C11 County Road 5/Boulder and Weld County Ditch

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
11	5	3	145	L.F.	$3,513.41	$509,444.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
11	3	36.00	2	EA	$3,502.98	$7,006.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
11	5	3	2	EA	$18,786.40	$37,572.80	
Channel Improvements							
18-inch Riprap, Type H			120	C.Y.	$108.00	$12,960.00	
Excavation, Mid Range			8830	C.Y.	$33.00	$291,390.00	Cut to be hauled offsite for downstream channel
Excavation, Low Range			35	C.Y.	$15.00	$525.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	Reseeding for channel

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$554,023.00	
Hydraulic Structures						$0.00	
Channel Improvements						$304,875.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$2,710.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$861,608.00**	
Additional Capital Improvement Costs							
Dewatering			$40,000.00	L.S.		$40,000.00	
Mobilization			5%			$43,080.00	
Traffic Control			$20,000.00	L.S.		$20,000.00	
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00	
Stormwater Management/Erosion Control			5%			$43,080.00	
Subtotal Additional Capital Improvement Costs						**$176,160.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$155,665.00	
Legal/Administrative			5%			$51,888.00	
Contract Admin/Construction Management			10%			$103,777.00	
Contingency			25%			$259,442.00	
Subtotal Other Costs						**$570,772.00**	
Total Capital Improvement Costs						**$1,608,540.00**	

IC-C12 Lower Boulder Ditch

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	8	1	134	L.F.	$1,326.15	$177,704.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	1	12.00	2	EA	$1,167.66	$2,335.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	8	1	2	EA	$21,199.04	$42,398.10	
Channel Improvements							
18-inch Riprap, Type H			110	C.Y.	$108.00	$11,880.00	
Excavation, Mid Range			34010	C.Y.	$33.00	$1,122,330.00	Cut to be hauled offsite for downstream channel
Excavation, Low Range			3200	C.Y.	$15.00	$48,000.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			7	ACRE	$1,355.00	$9,485.00	Reseeding for channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$2,600.00	$2,600.00	Lump sum for channel acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$222,437.00	
Hydraulic Structures						$0.00	
Channel Improvements						$1,182,210.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$9,485.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$1,414,132.00**	
Additional Capital Improvement Costs							
Dewatering			$40,000.00	L.S.		$40,000.00	
Mobilization			5%			$70,707.00	
Traffic Control			$10,000.00	L.S.		$10,000.00	
Utility Coordination/Relocation			$20,000.00	L.S.		$20,000.00	
Stormwater Management/Erosion Control			5%			$70,707.00	
Subtotal Additional Capital Improvement Costs						**$211,414.00**	
Land Acquisition Costs							
ROW/Easements						$2,600.00	
Subtotal Land Acquisition Costs						**$2,600.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$243,832.00	
Legal/Administrative			5%			$81,277.00	
Contract Admin/Construction Management			10%			$162,555.00	
Contingency			25%			$406,387.00	
Subtotal Other Costs						**$894,051.00**	
Total Capital Improvement Costs						**$2,522,197.00**	

IC-C13 Hwy 52, East of County Road 5 (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	8	1	40	L.F.	$1,326.15	$53,046.00	Portion of crossing located in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	1	12.00	1	EA	$1,167.66	$1,168.00	Outlet located in Frederick
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	8	1	1	EA	$21,199.04	$21,199.00	Outlet located in Frederick
Channel Improvements							
18-inch Riprap, Type H			55	C.Y.	$108.00	$5,940.00	Riprap for Outlet in Frederick
Excavation, Mid Range			6465	C.Y.	$33.00	$213,345.00	Cut to be hauled offsite for downstream channel
Excavation, Low Range			30	C.Y.	$15.00	$450.00	Cut to be used on site for fill
Removals							
Removal of culvert pipe (D<48")			40	L.F.	$27.00	$1,080.00	Removal of existing RCP in Frederick
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			3	ACRE	$1,355.00	$4,065.00	Reseeding of channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for channel acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$75,413.00	
Hydraulic Structures						$0.00	
Channel Improvements						$219,735.00	
Detention/Water Quality Facilities						$0.00	
Removals						$1,080.00	
Landscaping and Maintenance Improvements						$4,065.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$300,293.00**	
Additional Capital Improvement Costs							
Dewatering			$20,000.00	L.S.		$20,000.00	
Mobilization			5%			$15,015.00	
Traffic Control			$15,000.00	L.S.		$15,000.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$15,015.00	
Subtotal Additional Capital Improvement Costs						**$90,030.00**	
Land Acquisition Costs							
ROW/Easements						$1,000.00	
Subtotal Land Acquisition Costs						**$1,000.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$58,548.00	
Legal/Administrative			5%			$19,516.00	
Contract Admin/Construction Management			10%			$39,032.00	
Contingency			25%			$97,581.00	
Subtotal Other Costs						**$214,677.00**	
Total Capital Improvement Costs						**$606,000.00**	

IC-C13 Hwy 52, East of County Road 5 (Erie Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	8	1	40	L.F.	$1,326.15	$53,046.00	Portion of crossing located in Erie
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	1	12.00	1	EA	$1,167.66	$1,168.00	Inlet located in Erie
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	8	1	1	EA	$21,199.04	$21,199.00	Inlet located in Erie
Channel Improvements							
18-inch Riprap, Type H			55	C.Y.	$108.00	$5,940.00	Riprap for Inlet in Erie
Removals							
Removal of culvert pipe (D<48")			40	L.F.	$27.00	$1,080.00	Removal of existing RCP in Erie

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$75,413.00
Hydraulic Structures					$0.00
Channel Improvements					$5,940.00
Detention/Water Quality Facilities					$0.00
Removals					$1,080.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$0.00
Subtotal Capital Improvement Costs					**$82,433.00**
Additional Capital Improvement Costs					
Dewatering		$10,000.00	L.S.		$10,000.00
Mobilization		5%			$4,122.00
Traffic Control		$15,000.00	L.S.		$15,000.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$4,122.00
Subtotal Additional Capital Improvement Costs					**$58,244.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$21,102.00
Legal/Administrative		5%			$7,034.00
Contract Admin/Construction Management		10%			$14,068.00
Contingency		25%			$35,169.00
Subtotal Other Costs					**$77,373.00**
Total Capital Improvement Costs					**$218,050.00**

IC-C14 & IC-C15 County Road 20/County Road 7

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	5	675	L.F.	$5,524.92	$3,729,318.00	WCR 20 Crossing
11	3	2	100	L.F.	$1,958.34	$195,834.00	WCR 7 Crossing 3x12. Assumed costs are equal to 3'Hx11'W RCBC.
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	5	65.00	2	EA	$6,285.83	$12,572.00	
11	2	25.00	2	EA	$2,432.63	$4,865.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	5	2	EA	$21,903.16	$43,806.30	
11	3	2	2	EA	$10,463.60	$20,927.20	
Channel Improvements							
18-inch Riprap, Type H			150	C.Y.	$108.00	$16,200.00	Riprap for WCR 20 Crossing
18-inch Riprap, Type H			50	C.Y.	$108.00	$5,400.00	Riprap WCR 7 Crossing
Excavation, Mid Range			9645	C.Y.	$33.00	$318,285.00	Cut to be hauled offsite for channel
Excavation, Low Range			1305	C.Y.	$15.00	$19,575.00	Cut to be used on site for fill
Special Items (User Defined)							
Asphalt	<----User Defined Items		5000	S.Y.	$100.00	$500,000.00	1490'Lx30'W. Assumed asphalt + base course is equal to road raise height
Road Base Fill	<----User Defined Items		830	C.Y.	$80.00	$66,400.00	1490'Lx30'Wx0.5'D

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$4,007,323.00
Hydraulic Structures					$0.00
Channel Improvements					$359,460.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$566,400.00
Subtotal Capital Improvement Costs					**$4,933,183.00**
Additional Capital Improvement Costs					
Dewatering		$50,000.00	L.S.		$50,000.00
Mobilization		5%			$246,659.00
Traffic Control		$30,000.00	L.S.		$30,000.00
Utility Coordination/Relocation		$30,000.00	L.S.		$30,000.00
Stormwater Management/Erosion Control		5%			$246,659.00
Subtotal Additional Capital Improvement Costs					**$603,318.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$830,475.00
Legal/Administrative		5%			$276,825.00
Contract Admin/Construction Management		10%			$553,650.00
Contingency		25%			$1,384,125.00
Subtotal Other Costs					**$3,045,075.00**
Total Capital Improvement Costs					**$8,581,576.00**

IC-C16 & IC-C17 County Road 18/County Road 7

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	3	1	70	L.F.	$855.17	$59,862.00	WCR 18 Crossing
7	3	1	65	L.F.	$729.36	$47,408.00	WCR 7 Crossing
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9	1	11.00	2	EA	$1,007.66	$2,015.00	
7	1	9.00	2	EA	$820.85	$1,642.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	3	1	2	EA	$7,345.00	$14,690.00	
7	3	1	2	EA	$6,899.48	$13,799.00	
Channel Improvements							
18-inch Riprap, Type H			26	C.Y.	$108.00	$2,808.00	WCR 18 Crossing
18-inch Riprap, Type H			22	C.Y.	$108.00	$2,376.00	WCR 7 Crossing
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			2	ACRE	$1,355.00	$2,710.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		1420	S.Y.	$100.00	$142,000.00	510'Lx25'W. Assumed asphalt + base course is equal to road raise height
Road Base Fill	<----User Defined Items		237	C.Y.	$80.00	$18,960.00	510'Lx25'Wx0.5'D

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$139,416.00
Hydraulic Structures					$0.00
Channel Improvements					$5,184.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$2,710.00
Special Items (User Defined)					$160,960.00
Subtotal Capital Improvement Costs					**$308,270.00**
Additional Capital Improvement Costs					
Dewatering		$15,000.00	L.S.		$15,000.00
Mobilization		5%			$15,414.00
Traffic Control		$30,000.00	L.S.		$30,000.00
Utility Coordination/Relocation		$30,000.00	L.S.		$30,000.00
Stormwater Management/Erosion Control		5%			$15,414.00
Subtotal Additional Capital Improvement Costs					**$105,828.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$62,115.00
Legal/Administrative		5%			$20,705.00
Contract Admin/Construction Management		10%			$41,410.00
Contingency		25%			$103,525.00
Subtotal Other Costs					**$227,755.00**
Total Capital Improvement Costs					**$641,853.00**

IC-C18 County Road 18/County Road 5

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	3	4	100	L.F.	$3,916.68	$391,668.00	Main Crossing
5	2	1	75	L.F.	$541.96	$40,647.00	Secondary Crossing
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	4	48.00	2	EA	$4,670.64	$9,341.00	
5	1	7.00	2	EA	$616.04	$1,232.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	3	4	2	EA	$15,809.78	$31,619.60	
5	2	1	2	EA	$5,891.28	$11,782.60	
Channel Improvements							
18-inch Riprap, Type H			85	C.Y.	$108.00	$9,180.00	Riprap for Main Crossing
18-inch Riprap, Type H			15	C.Y.	$108.00	$1,620.00	Riprap for Secondary Crossing
Excavation, Mid Range			2325	C.Y.	$33.00	$76,725.00	Fill hauled from offsite for main channel with freeboard
Excavation, Low Range			13885	C.Y.	$15.00	$208,275.00	Cut to be used on site for fill for main channel
Excavation, Mid Range			3350	C.Y.	$33.00	$110,550.00	Fill hauled from offsite for secondary channel with freeboard
Excavation, Low Range			100	C.Y.	$15.00	$1,500.00	Cut to be used on site for fill for secondary channel
Excavation, Mid Range			545	C.Y.	$33.00	$17,985.00	Fill hauled from offsite for berm
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			26	ACRE	$1,355.00	$35,230.00	Reseeding for channels
Special Items (User Defined)							
Asphalt	<----User Defined Items		140	S.Y.	$100.00	$14,000.00	50'Lx25'W. Assumed asphalt + base course is equal to road raise height
Road Base Fill	<----User Defined Items		25	C.Y.	$80.00	$2,000.00	50'Lx25'Wx0.5'D
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for land acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$486,290.00	
Hydraulic Structures						$0.00	
Channel Improvements						$425,835.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$35,230.00	
Special Items (User Defined)						$16,000.00	
Subtotal Capital Improvement Costs						**$963,355.00**	
Additional Capital Improvement Costs							
Dewatering			$50,000.00	L.S.		$50,000.00	
Mobilization			5%			$48,168.00	
Traffic Control			$20,000.00	L.S.		$20,000.00	
Utility Coordination/Relocation			$30,000.00	L.S.		$30,000.00	
Stormwater Management/Erosion Control			5%			$48,168.00	
Subtotal Additional Capital Improvement Costs						**$196,336.00**	
Land Acquisition Costs							
ROW/Easements						$1,000.00	
Subtotal Land Acquisition Costs						**$1,000.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$173,954.00	
Legal/Administrative			5%			$57,985.00	
Contract Admin/Construction Management			10%			$115,969.00	
Contingency			25%			$289,923.00	
Subtotal Other Costs						**$637,831.00**	
Total Capital Improvement Costs						**$1,798,522.00**	

IC-C19 County Road 16.5 at Decommissioned Railroad Embankment

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	2	5	100	L.F.	$3,646.80	$364,680.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	5	45.00	2	EA	$4,122.23	$8,244.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	2	5	2	EA	$13,831.31	$27,662.60	
Channel Improvements							
18-inch Riprap, Type H			50	C.Y.	$108.00	$5,400.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		1833	S.Y.	$100.00	$183,300.00	550'Lx30'W
Road Base Fill	<----User Defined Items		305	C.Y.	$80.00	$24,400.00	550'Lx30'Wx0.5'D
Fill	<----User Defined Items		165	C.Y.	$33.00	$5,445.00	775 C.Y. - 550'Lx30'Wx1'D. Fill from offsite
Cut	<----User Defined Items		15	C.Y.	$15.00	$225.00	Cut to be placed onsite
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$500.00	$500.00	Lump sum acquisition for ROW

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$400,587.00	
Hydraulic Structures						$0.00	
Channel Improvements						$5,400.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$213,370.00	
Subtotal Capital Improvement Costs						**$619,357.00**	
Additional Capital Improvement Costs							
Dewatering			$18,500.00	L.S.		$18,500.00	
Mobilization			5%			$30,968.00	
Traffic Control			$18,500.00	L.S.		$18,500.00	
Utility Coordination/Relocation			$18,500.00	L.S.		$18,500.00	
Stormwater Management/Erosion Control			5%			$30,968.00	
Subtotal Additional Capital Improvement Costs						**$117,436.00**	
Land Acquisition Costs							
ROW/Easements						$500.00	
Subtotal Land Acquisition Costs						**$500.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$110,519.00	
Legal/Administrative			5%			$36,840.00	
Contract Admin/Construction Management			10%			$73,679.00	
Contingency			25%			$184,198.00	
Subtotal Other Costs						**$405,236.00**	
Total Capital Improvement Costs						**$1,142,529.00**	

IC-C20 County Road 16.5, East of County Road 5

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	3	2	170	L.F.	$1,833.53	$311,700.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	2	23.00	2	EA	$2,238.02	$4,476.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	3	2	2	EA	$10,018.09	$20,036.20	
Channel Improvements							
18-inch Riprap, Type H			45	C.Y.	$108.00	$4,860.00	Riprap for Crossing
Excavation, Mid Range			3300	C.Y.	$33.00	$108,900.00	Fill hauled from offsite for channel with freeboard
Excavation, Low Range			7015	C.Y.	$15.00	$105,225.00	Cut to be used on site for fill for channel
Excavation, Mid Range			255	C.Y.	$33.00	$8,415.00	Cut for upstream of crossing
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			16	ACRE	$1,355.00	$21,680.00	Reseeding for channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$10,000.00	$10,000.00	Lump sum for land acquisition

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$336,212.00	
Hydraulic Structures						$0.00	
Channel Improvements						$227,400.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$21,680.00	
Special Items (User Defined)						$0.00	
Subtotal Capital Improvement Costs						**$585,292.00**	
Additional Capital Improvement Costs							
Dewatering			$50,000.00	L.S.		$50,000.00	
Mobilization			5%			$29,265.00	
Traffic Control			$15,000.00	L.S.		$15,000.00	
Utility Coordination/Relocation			$20,000.00	L.S.		$20,000.00	
Stormwater Management/Erosion Control			5%			$29,265.00	
Subtotal Additional Capital Improvement Costs						**$143,530.00**	
Land Acquisition Costs							
ROW/Easements						$10,000.00	
Subtotal Land Acquisition Costs						**$10,000.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$109,323.00	
Legal/Administrative			5%			$36,441.00	
Contract Admin/Construction Management			10%			$72,882.00	
Contingency			25%			$182,206.00	
Subtotal Other Costs						**$400,852.00**	
Total Capital Improvement Costs						**$1,139,674.00**	

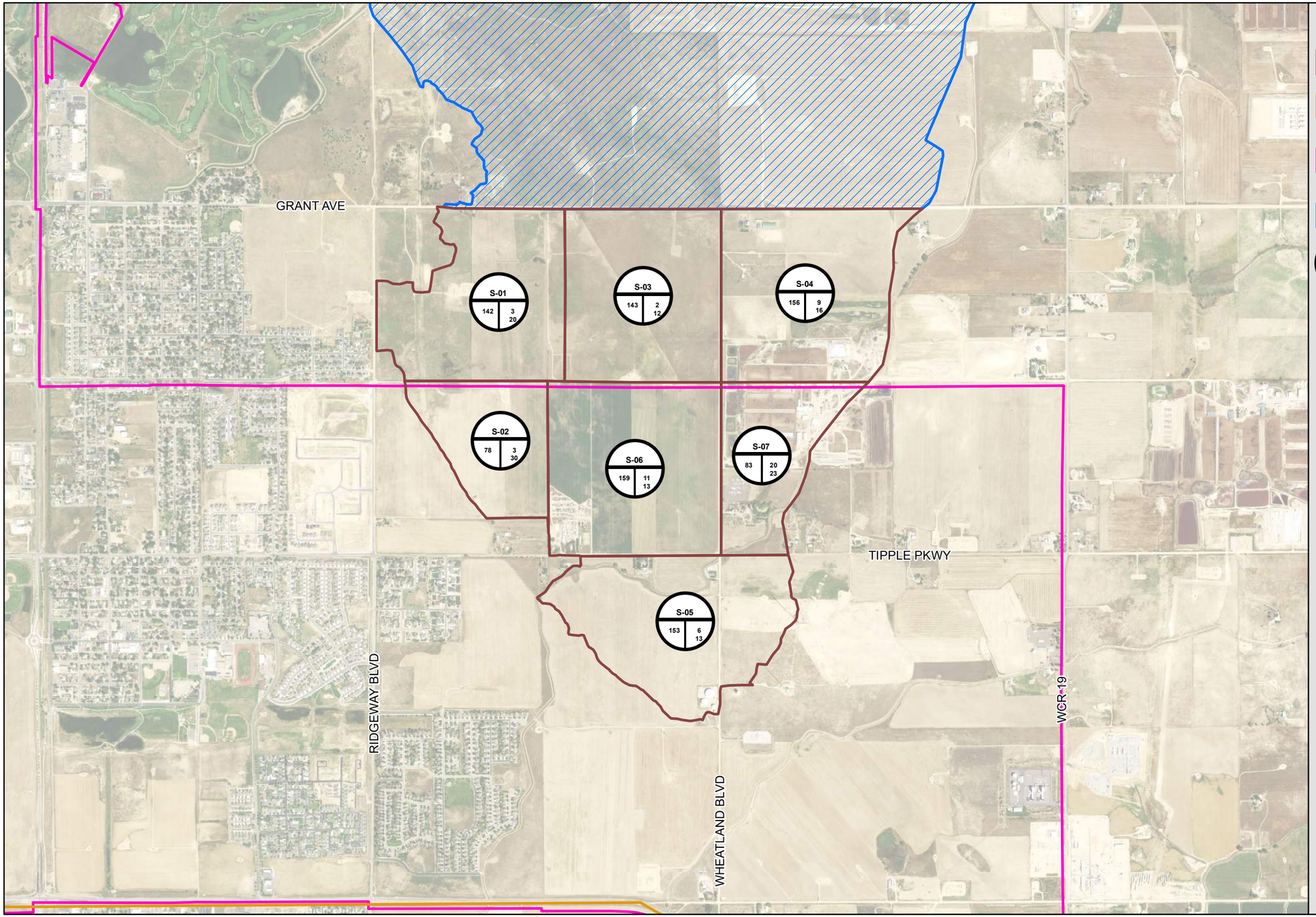
IC-C21 Godding Ditch Crossing

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
72-inch	300	1	300	L.F.	$488.00	$146,400.00	Assumed to be a siphon.
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
72-inch	Yes	1	2	EA	$2,587.05	$5,174.00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
72-inch		1	2	EA	$15,675.35	$31,351.00	
Manholes and Inlets							
Manhole, 5' Dia. (Pipe Dia. 36" - 42")			1	EA	$5,285.00	$5,285.00	Manhole access for siphon
Channel Improvements							
18-inch Riprap, Type H			60	C.Y.	$108.00	$6,480.00	Riprap for siphon
Excavation, Mid Range			2110	C.Y.	$33.00	$69,630.00	Cut to be hauled offsite
Excavation, Low Range			6050	C.Y.	$15.00	$90,750.00	Cut to be used on site for fill
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			15	ACRE	$1,355.00	$20,325.00	Reseeding of channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$1,000.00	$1,000.00	Lump sum for land acquisition

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$188,210.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$166,860.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$20,325.00	
Special Items (User Defined)			$0.00	
Subtotal Capital Improvement Costs			**$375,395.00**	
Additional Capital Improvement Costs				
Dewatering	$40,000.00	L.S.	$40,000.00	
Mobilization	5%		$18,770.00	
Traffic Control	$10,000.00	L.S.	$10,000.00	
Utility Coordination/Relocation	$10,000.00	L.S.	$10,000.00	
Stormwater Management/Erosion Control	5%		$18,770.00	
Subtotal Additional Capital Improvement Costs			**$97,540.00**	
Land Acquisition Costs				
ROW/Easements			$1,000.00	
Subtotal Land Acquisition Costs			**$1,000.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$70,940.00	
Legal/Administrative	5%		$23,647.00	
Contract Admin/Construction Management	10%		$47,294.00	
Contingency	25%		$118,234.00	
Subtotal Other Costs			**$260,115.00**	
Total Capital Improvement Costs			**$734,050.00**	

Appendix F. Sump Basin Documentation

Appendix F.1. Sump Basin Existing Condition Documentation



Legend

- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Sump Basin Not Studied

XX — Subcatchment ID
XX | X — % Impervousness (Existing Condition) / % Impervousness (Future Condition)
Acreage

N

0 750 1,500 3,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
SUBBASIN MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/18/21	
SHEET: SB	INDEX: SB

TABLE F.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

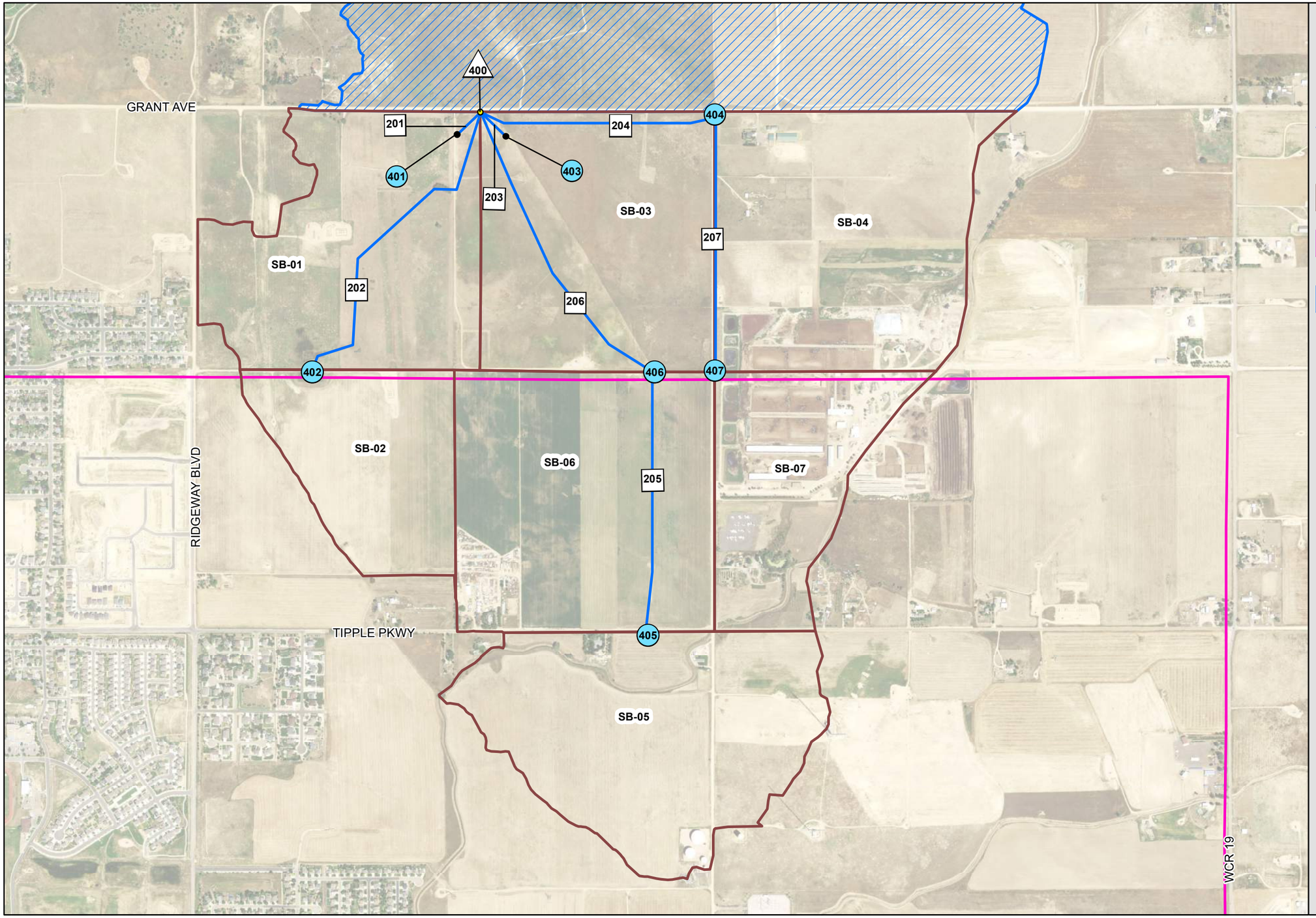
Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
SUMP BASIN																				
SB-01	401	0.22171	141.9	0.37759	1994	0.71900	3796	0.0112	3	0.40	0.05	4.58	0.0015	0.72	146.62	1.03	94.30	3.30	1.96	0.78
SB-02	402	0.12181	78.0	0.22593	1193	0.42600	2249	0.0159	3	0.40	0.05	4.50	0.0018	0.61	114.04	1.46	78.32	11.16	1.80	0.86
SB-03	403	0.22306	142.8	0.33539	1771	0.59243	3128	0.0118	2	0.40	0.05	4.26	0.0018	0.58	186.52	1.31	128.45	19.19	1.98	0.95
SB-04	404	0.24415	156.3	0.34480	1821	0.61106	3226	0.0127	9	0.40	0.05	4.64	0.0015	0.72	193.90	1.24	128.68	12.68	7.72	3.33
SB-05	405	0.23875	152.8	0.19805	1046	0.49200	2598	0.0196	6	0.40	0.05	4.68	0.0014	0.74	251.98	1.65	166.69	11.75	6.97	2.74
SB-06	406	0.24797	158.7	0.22690	1198	0.50628	2673	0.0138	11	0.40	0.05	4.64	0.0015	0.71	253.42	1.60	171.07	21.36	13.18	6.23
SB-07	407	0.12975	83.0	0.22896	1209	0.46208	2440	0.0129	20	0.40	0.05	4.55	0.0017	0.64	131.45	1.58	93.10	22.74	12.97	7.81
Totals/Averages			**913.4**						**8**						**182.56**	**1.40**	**122.94**	**14.60**	**6.66**	**3.24**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Table F.1.2: Existing Sump Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Condition SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)	Existing Condition	Future Condition	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
SB-C1	County Road 16/Tipple Parkway	405	N/A	5060.9	N/A	< 2-Year	< 2-Year	3	7	12	167	252	5	8	12	170	249	Existing crossing culvert could not be located. Overtopping of Tipple Parkway will occur to north.
SB-C2	Future McClure Avenue Crossing	406	N/A	5022.0	N/A	< 2-Year	< 2-Year	7	15	26	308	473	9	18	28	312	470	No existing road/crossing exists.



Legend

- Junction
- Outfall
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Frederick Planning Boundary
- Sump Basin Not Studied

N

0 500 1,000 2,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/18/2021	
SHEET: SB	INDEX: EC

Table F.1.3: Sump Basin Peak Discharge Comparison: Existing Conditions 2010 CCG Study and 2022 OSP

Location	SWMM Node	Drainage Area (acres)	2010 CCG Study Existing Condition SWMM Model Peak Discharge (cfs)					2022 OSP Study Existing Condition SWMM Model Peak Discharge (cfs)					Difference (2022 OSP - 2010 CCG Study) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
County Road 16/Grant Avenue	400	913	1	39	152	N/A	835	14	29	66	706	1097	13	-10	-86	N/A	262	
Future McClure Avenue Crossing/ Frederick Planning Boundary	406	312	N/A	N/A	N/A	N/A	N/A	7	15	26	308	473	N/A	N/A	N/A	N/A	N/A	
County Road 18/Tipple Parkway	405	153	0	10	37	N/A	178	3	7	12	167	252	3	-3	-25	N/A	74	

Appendix F.2. Sump Basin Future Condition Documentation

TABLE F.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
SUMP BASIN																				
SB-01	701	0.22171	141.9	0.37759	1994	0.71900	3796	0.0112	20	0.35	0.05	4.58	0.0015	0.72	179.50	1.27	125.66	29.07	17.17	10.37
SB-02	702	0.12181	78.0	0.22593	1193	0.42600	2249	0.0159	30	0.35	0.05	4.50	0.0018	0.61	160.58	2.06	119.94	40.96	22.95	14.65
SB-03	703	0.22306	142.8	0.33539	1771	0.59243	3128	0.0118	12	0.40	0.05	4.26	0.0018	0.58	199.30	1.40	140.39	31.15	12.22	6.59
SB-04	704	0.24415	156.3	0.34480	1821	0.61106	3226	0.0127	16	0.40	0.05	4.64	0.0015	0.72	207.61	1.33	141.72	23.53	15.87	8.74
SB-05	705	0.23875	152.8	0.19805	1046	0.49200	2598	0.0196	13	0.40	0.05	4.68	0.0014	0.74	269.82	1.77	183.63	25.96	16.73	8.34
SB-06	706	0.24797	158.7	0.22690	1198	0.50628	2673	0.0138	13	0.40	0.05	4.64	0.0015	0.71	257.69	1.62	175.69	25.40	16.30	8.27
SB-07	707	0.12975	83.0	0.22896	1209	0.46208	2440	0.0129	23	0.40	0.05	4.55	0.0017	0.64	136.08	1.64	97.02	25.75	15.34	9.41
Totals/Averages			**913.4**						**18**						**201.51**	**1.54**	**140.58**	**28.83**	**16.65**	**9.48**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

CONCEPTUAL POND 701 FOR SUMP BASIN SUBBASIN SB-01

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4993.00	0	0.00	0.0	0	0.00	0.00	Bottom
4996.50	68000	1.56	3.50	118513	2.72	3.30	Top of 10-Year Detention Zone
4998.00	85000	1.95	5.00	231239	5.31	146.62	Top of 100-Year Detention Zone

CONCEPTUAL POND 702 FOR SUMP BASIN SUBBASIN SB-02*

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5012.00	54508	1.25	0.0	0	0.00	0.00	Bottom
5013.00	65223	1.50	1	59785	1.37	3.92	
5014.00	67841	1.56	2	126313	2.90	7.50	
5015.00	75213	1.73	3	197808	4.54	9.86	
5016.00	84102	1.93	4	277425	6.37	11.75	
5016.77	92027	2.11	4.77	346124	7.95	13.00	Linearly Interpolated
5017.00	94436	2.17	5	366644	8.42	13.00	
5018.00	107118	2.46	6	467354	10.73	13.00	
5019.00	121265	2.78	7	581473	13.35	13.00	

*Pond curve reported from Hidden Creek Drainage Report

CONCEPTUAL POND 703 FOR SUMP BASIN SUBBASIN SB-03

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
4993.00	0	0.00	0.0	0	0.00	0.00	Bottom
4996.50	18500	0.42	3.50	31978	0.73	19.19	Top of 10-Year Detention Zone
4998.00	65000	1.49	5.00	93681	2.15	186.52	Top of 100-Year Detention Zone

CONCEPTUAL POND 704 FOR SUMP BASIN SUBBASIN SB-04

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5010.80	0	0.00	0.0	0	0.00	0.00	Bottom
5014.30	20500	0.47	3.50	35523	0.82	12.68	Top of 10-Year Detention Zone
5015.80	70000	1.61	5.00	102251	2.35	193.90	Top of 100-Year Detention Zone

CONCEPTUAL POND 705 FOR SUMP BASIN SUBBASIN SB-05

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5061.90	0	0.00	0.0	0	0.00	0.00	Bottom
5065.40	17000	0.39	3.50	29476	0.68	11.75	Top of 10-Year Detention Zone
5066.90	64000	1.47	5.00	89190	2.05	251.98	Top of 100-Year Detention Zone

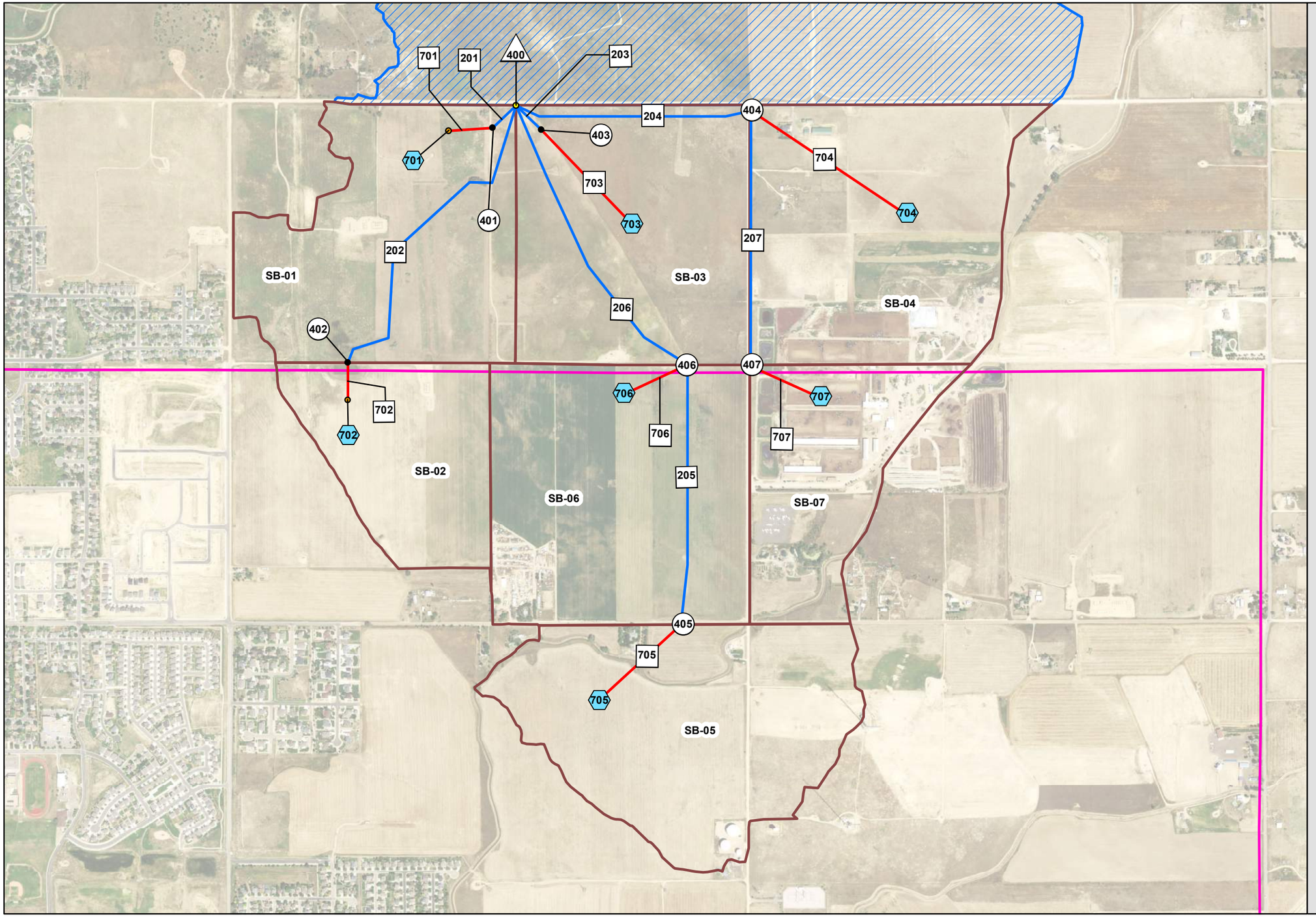
CONCEPTUAL POND 706 FOR SUMP BASIN SUBBASIN SB-06

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5023.00	0	0.00	0.0	0	0.00	0.00	Bottom
5026.50	5000	0.11	3.50	8588	0.20	21.36	Top of 10-Year Detention Zone
5028.00	35000	0.80	5.00	38442	0.88	253.42	Top of 100-Year Detention Zone

CONCEPTUAL POND 707 FOR SUMP BASIN SUBBASIN SB-07

Stage (NAVD 88) (ft)	Area (ft^2)	Area (acre)	Unit Depth (ft)	Total Volume (ft^3)	Total Volume (acre-ft)	Total Discharge (cfs)	Notes:
5032.00	0	0.00	0.0	0	0.00	0.00	Bottom
5035.50	4500	0.10	3.50	7816	0.18	22.74	Top of 10-Year Detention Zone
5037.00	25000	0.57	5.00	29764	0.68	131.45	Top of 100-Year Detention Zone

Assumed Based on Site Conditions
Area Iterated on with SWMM Model
Discharge Found from Existing Condition CUHP Run



Legend

- Junction
- Outfall
- Detention Pond
- Link
- Outlet

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Frederick Planning Boundary
- Sump Basin Not Studied

N

0 500 1,000 2,000
Feet

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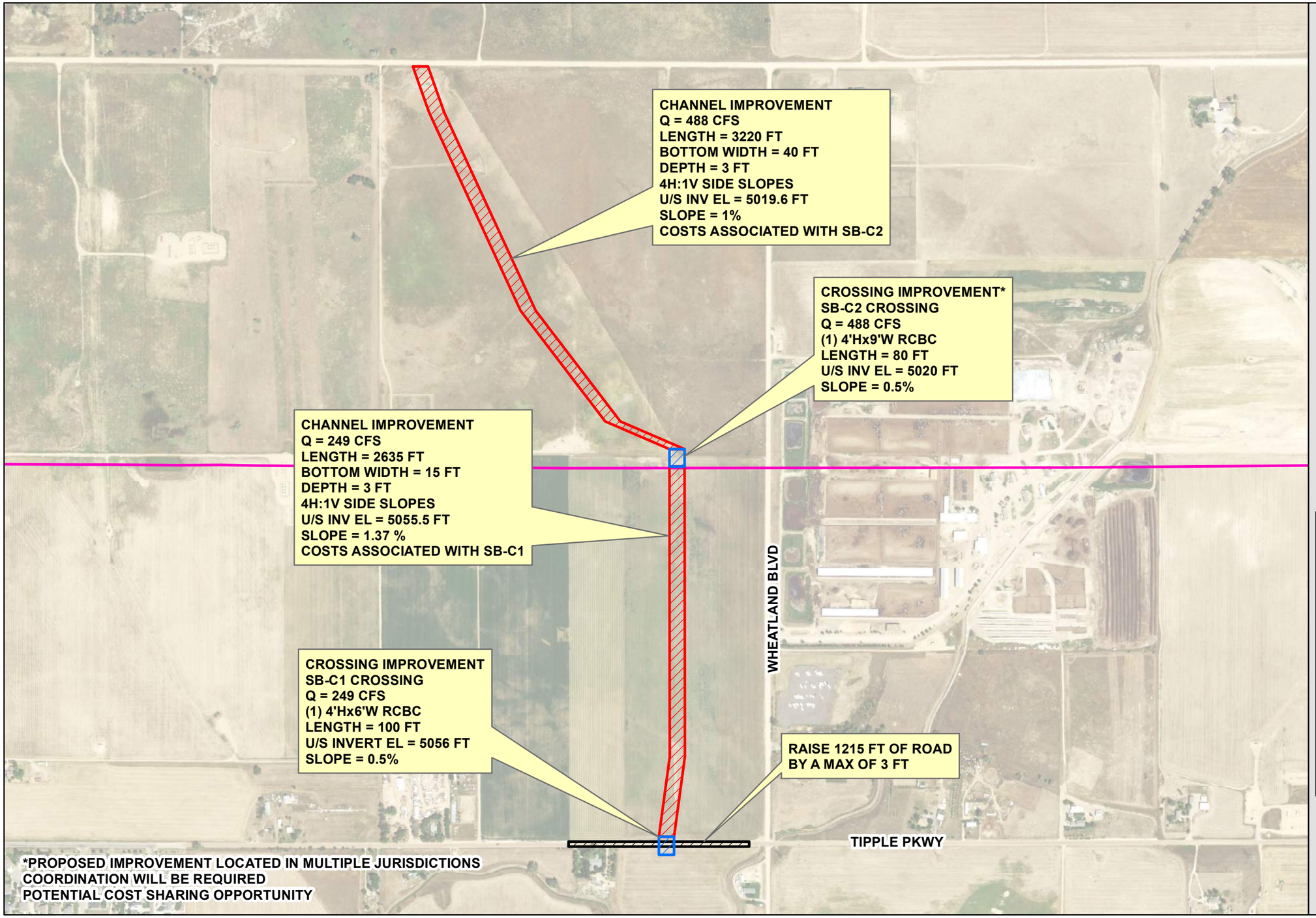
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/18/2021	
SHEET: SB	INDEX: FC

Table F.2.2: Sump Basin Peak Discharge Comparison: Existing Conditions 2022 OSP and Future Conditions 2022 OSP																		
Location	**SWMM Node**	**Drainage Area (acres)**	**Existing Condition SWMM Model Peak Discharge (cfs)**					**Future Condition SWMM Model Peak Discharge (cfs)**					**Difference (Future Condition - Existing Condition) Peak Discharge (cfs)**					**Notes:**
			2	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	
Main Flow Path																		
County Road 16/Grant Avenue	400	913	14	29	66	706	1097	25	46	79	686	1050	11	18	13	-20	-47	
Future McClure Avenue Crossing/ Frederick Planning Boundary	406	312	7	15	26	308	473	9	18	28	312	470	2	3	2	3	-4	
County Road 18/Tipple Parkway	405	153	3	7	12	167	252	5	8	12	170	249	2	1	0	4	-3	

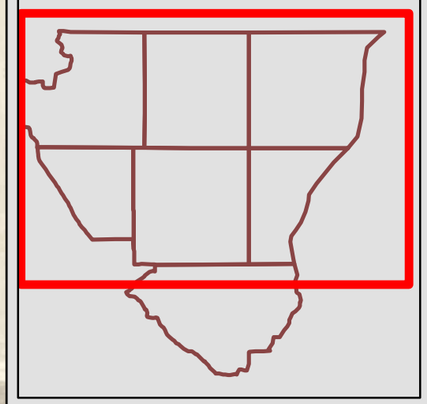
Appendix F.3. Sump Basin Proposed Improvement Documentation



Legend

- Crossing Improvement
- Channel Improvements
- Road Raise
- Dacono Planning Boundary
- Frederick Planning Boundary

Key Map



N

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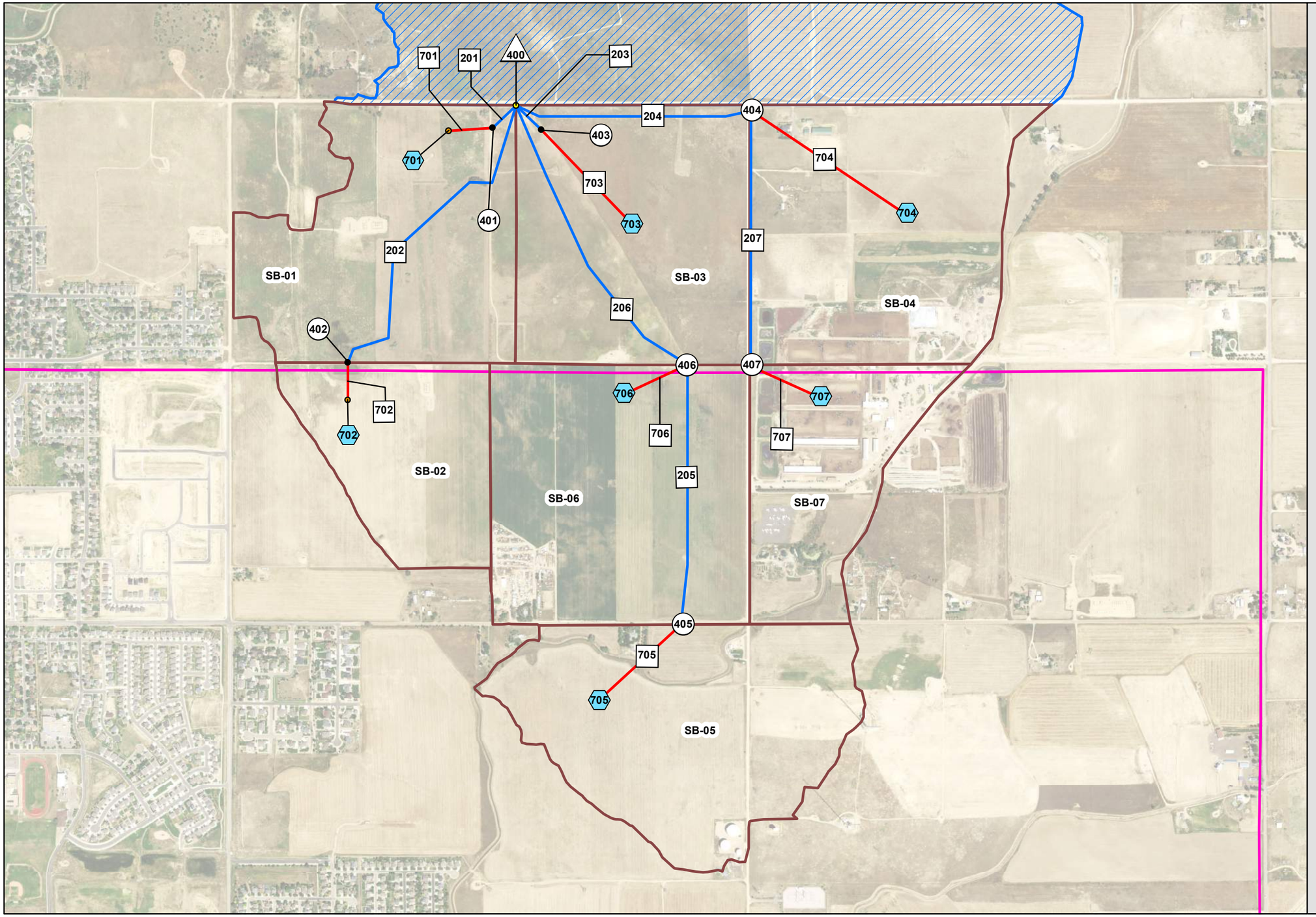
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
PROPOSED
IMPROVEMENTS

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/20/2021	
SHEET: SB	INDEX: PI



Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Note: A blue symbol designates a CUHP Inflow Node

- Subbasin
- Frederick Planning Boundary
- Sump Basin Not Studied

N

0 500 1,000 2,000
Feet

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
PROPOSED CONDITION
SWMM CONVEYANCE
ELEMENT MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/20/2021	
SHEET: SB	INDEX: PI

Table F.3.1: Sump Basin Peak Discharge Comparison: Future Conditions 2022 OSP and Proposed Improvements 2022 OSP																		
Location	**SWMM Node**	**Drainage Area (acres)**	**Future Condition SWMM Model Peak Discharge (cfs)**					**Proposed Improvement SWMM Model Peak Discharge (cfs)**					**Difference (Proposed Improvements - Future Condition) Peak Discharge (cfs)**					**Notes:**
			2	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	
Main Flow Path																		
County Road 16/Grant Avenue	400	913	25	46	79	686	1050	25	47	80	700	1056	1	1	1	14	5	
Future McClure Avenue Crossing/ Frederick Planning Boundary	406	312	9	18	28	312	470	9	19	29	329	488	0	1	1	17	18	
County Road 18/Tipple Parkway	405	153	5	8	12	170	249	5	8	12	170	249	0	0	0	0	0	

Table F.3.2: Sump Basin Crossings With Proposed Improvements

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity		Future Condition SWMM Model Peak Discharge (cfs)					Proposed Improvement SWMM Model Peak Discharge (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Condition	Proposed Improvements	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
SB-C1	County Road 16/Tipple Parkway	405	4' H x 6' W RCBC	5056.0	250	< 2-Year	> 100-Year	5	8	12	170	249	5	8	12	170	249	Proposed crossing and road raising improvements to eliminate overtopping of Tipple Parkway.
SB-C2	Future McClure Avenue Crossing	406	4' H x 9' W RCBC	5020.0	490	< 2-Year	> 100-Year	9	18	28	312	470	9	19	29	329	488	Proposed improvements for assumed future crossing of McClure Avenue.

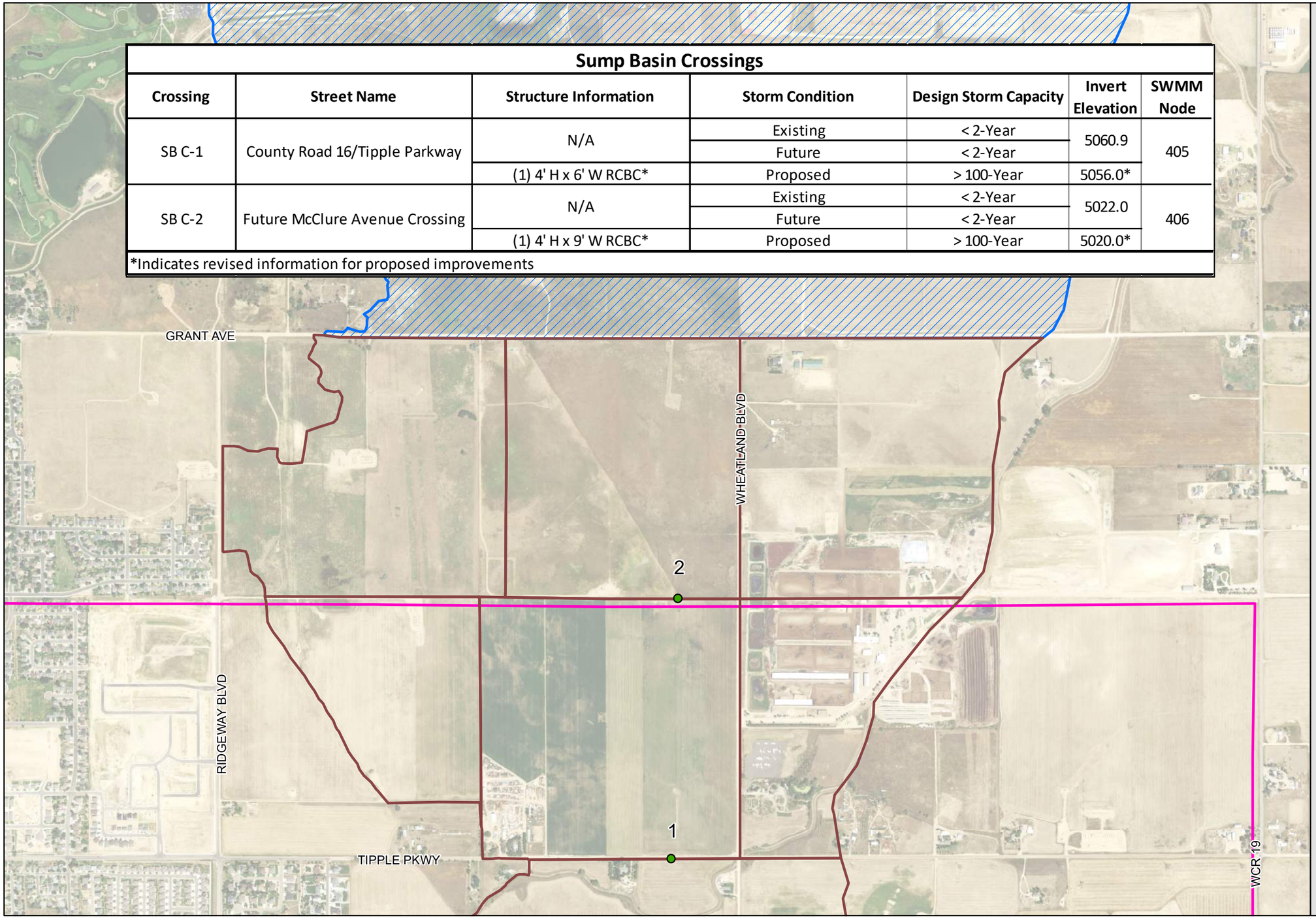
*HY-8 Program used to evaluate capacities unless otherwise noted

Indicates revised information for proposed improvements

Sump Basin Crossings

Crossing	Street Name	Structure Information	Storm Condition	Design Storm Capacity	Invert Elevation	SWMM Node
SB C-1	County Road 16/Tipple Parkway	N/A	Existing	< 2-Year	5060.9	405
			Future	< 2-Year		
		(1) 4' H x 6' W RCBC*	Proposed	> 100-Year	5056.0*	
SB C-2	Future McClure Avenue Crossing	N/A	Existing	< 2-Year	5022.0	406
			Future	< 2-Year		
		(1) 4' H x 9' W RCBC*	Proposed	> 100-Year	5020.0*	

*Indicates revised information for proposed improvements



Legend

- Crossing with > 100-Year Capacity
- Subbasin
- Frederick Planning Boundary
- Sump Basin Not Studied

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

SUMP BASIN
CROSSING MAP

DRAWN BY:	EK
DESIGNED BY:	BS & EK
CHECKED BY:	BS
PROJECT NUMBER: COTOF.03	
DATE: 12/21/2021	
SHEET: SB	INDEX: CROSS

Appendix F.4. Sump Basin Cost Estimate Documentation

Table F.4.1: Sump Basin Proposed Improvement Cost Summary

Crossing	Street Name	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
Town of Frederick								
SB-C1	County Road 16/Tipple Parkway	$790,000	$3,000	$119,000	$40,000	$79,000	$198,000	$1,228,000
SB-C2	Future McClure Avenue Crossing (Frederick Portion)	$69,000	$0	$10,000	$3,000	$7,000	$17,000	$107,000
Total Cost		**$859,000**	**$3,000**	**$129,000**	**$43,000**	**$86,000**	**$215,000**	**$1,335,000**
Town of Firestone								
SB-C2	Future McClure Avenue Crossing (Firestone Portion)	$283,000	$3,000	$42,000	$14,000	$28,000	$71,000	$442,000
Total Cost		**$283,000**	**$3,000**	**$42,000**	**$14,000**	**$28,000**	**$71,000**	**$442,000**

SB-C1 WCR 16/Tipple Parkway

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
6	4	1	100	L.F.	$729.36	$72,936.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
6	1	8.00	2	EA	$729.64	$1,459.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
6	4	1	2	EA	$8,418.86	$16,837.70	
Channel Improvements							
18-inch Riprap, Type H			32	C.Y.	$108.00	$3,456.00	Riprap for inlet/outlet
Excavation, Mid Range			4925	C.Y.	$33.00	$162,525.00	Cut from channel excavation to be hauled off site
Excavation, Low Range			1485	C.Y.	$15.00	$22,275.00	Cut from channel excavation to be placed on site
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			11	ACRE	$1,355.00	$14,905.00	Reseeding of channel
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		2970	S.Y.	$100.00	$297,000.00	1215'Lx22'W
Road Base Fill	**<----User Defined Items**		495	C.Y.	$80.00	$39,600.00	1215'Lx22'Wx0.5'D
Other Embankment Fill	**<----User Defined Items**		990	C.Y.	$33.00	$32,670.00	1160 C.Y. Total including base - 1215'Lx22'Wx1'D
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$3,100.00	$3,100.00	Lump sum for channel acquisition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$91,233.00	
Hydraulic Structures					$0.00	
Channel Improvements					$188,256.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$14,905.00	
Special Items (User Defined)					$369,270.00	
Subtotal Capital Improvement Costs					**$663,664.00**	
Additional Capital Improvement Costs						
Dewatering	$20,000.00	L.S.			$20,000.00	
Mobilization	5%				$33,183.00	
Traffic Control	$15,000.00	L.S.			$15,000.00	
Utility Coordination/Relocation	$25,000.00	L.S.			$25,000.00	
Stormwater Management/Erosion Control	5%				$33,183.00	
Subtotal Additional Capital Improvement Costs					**$126,366.00**	
Land Acquisition Costs						
ROW/Easements					$3,100.00	
Subtotal Land Acquisition Costs					**$3,100.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering	15%				$118,505.00	
Legal/Administrative	5%				$39,502.00	
Contract Admin/Construction Management	10%				$79,003.00	
Contingency	25%				$197,508.00	
Subtotal Other Costs					**$434,518.00**	
Total Capital Improvement Costs					**$1,227,648.00**	

SB-C2 Future McClure Avenue Crossing (Frederick Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	4	1	40	L.F.	$916.77	$36,671.00	Portion of Proposed Crossing in Frederick
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
9	1	11.00	1	EA	$1,007.66	$1,008.00	Inlet located in Frederick
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
9	4	1	1	EA	$9,128.56	$9,128.60	
Channel Improvements							
18-inch Riprap, Type H			20	C.Y.	$108.00	$2,160.00	Riprap for Inlet in Frederick

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$46,808.00	
Hydraulic Structures					$0.00	
Channel Improvements					$2,160.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$0.00	
Subtotal Capital Improvement Costs					**$48,968.00**	
Additional Capital Improvement Costs						
Dewatering	$5,000.00	L.S.			$5,000.00	
Mobilization	5%				$2,448.00	
Traffic Control	$5,000.00	L.S.			$5,000.00	
Utility Coordination/Relocation	$5,000.00	L.S.			$5,000.00	
Stormwater Management/Erosion Control	5%				$2,448.00	
Subtotal Additional Capital Improvement Costs					**$19,896.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering	15%				$10,330.00	
Legal/Administrative	5%				$3,443.00	
Contract Admin/Construction Management	10%				$6,886.00	
Contingency	25%				$17,216.00	
Subtotal Other Costs					**$37,875.00**	
Total Capital Improvement Costs					**$106,739.00**	

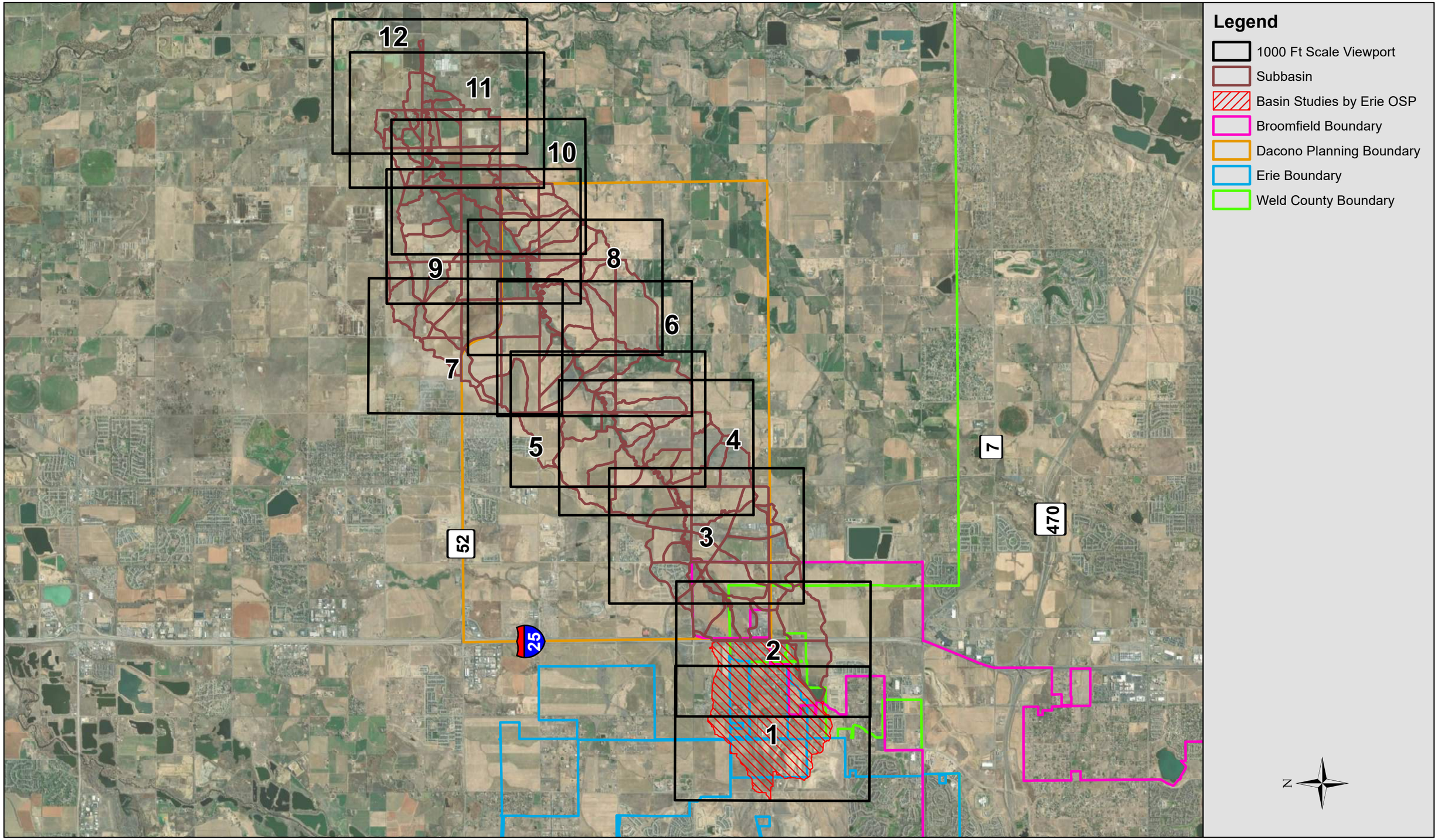
SB-C2 Future McClure Avenue Crossing (Firestone Portion)

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	4	1	40	L.F.	$916.77	$36,671.00	Portion of Proposed Crossing in Firestone
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
9	1	11.00	1	EA	$1,007.66	$1,008.00	Outlet located in Firestone
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
9	4	1	1	EA	$9,128.56	$9,128.60	Outlet located in Firestone
Channel Improvements							
18-inch Riprap, Type H			20	C.Y.	$108.00	$2,160.00	Riprap for Outlet in Firestone
Excavation, Mid Range			2385	C.Y.	$33.00	$78,705.00	Off site fill for channel construction with freeboard
Excavation, Low Range			5955	C.Y.	$15.00	$89,325.00	Excavation and placement of fill on site
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			13	ACRE	$1,355.00	$17,615.00	Reseeding of channel
Land Acquisition							
Easement/ROW Acquisition			1.00	ACRE	$3,000.00	$3,000.00	Lump sum for channel land acquisition

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$46,808.00	
Hydraulic Structures					$0.00	
Channel Improvements					$170,190.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$17,615.00	
Special Items (User Defined)					$0.00	
Subtotal Capital Improvement Costs					**$234,613.00**	
Additional Capital Improvement Costs						
Dewatering	$15,000.00	L.S.			$15,000.00	
Mobilization	5%				$11,731.00	
Traffic Control	$5,000.00	L.S.			$5,000.00	
Utility Coordination/Relocation	$5,000.00	L.S.			$5,000.00	
Stormwater Management/Erosion Control	5%				$11,731.00	
Subtotal Additional Capital Improvement Costs					**$48,462.00**	
Land Acquisition Costs						
ROW/Easements					$3,000.00	
Subtotal Land Acquisition Costs					**$3,000.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering	15%				$42,461.00	
Legal/Administrative	5%				$14,154.00	
Contract Admin/Construction Management	10%				$28,308.00	
Contingency	25%				$70,769.00	
Subtotal Other Costs					**$155,692.00**	
Total Capital Improvement Costs					**$441,767.00**	

Appendix G. Little Dry Creek Documentation

Appendix G.1. Little Dry Creek Existing Condition Documentation



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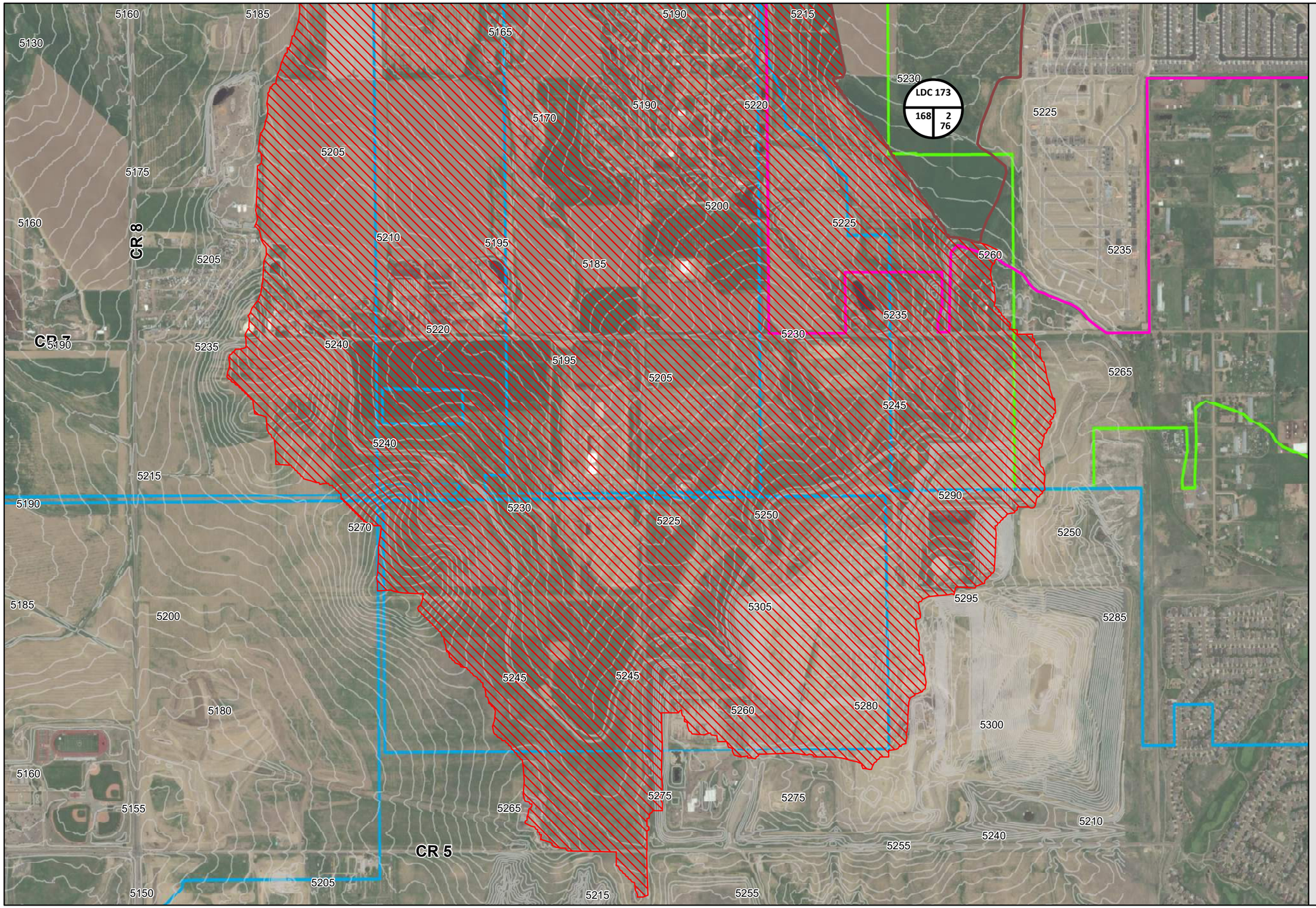
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX:



Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Paths

- Main Channel
- Tributary

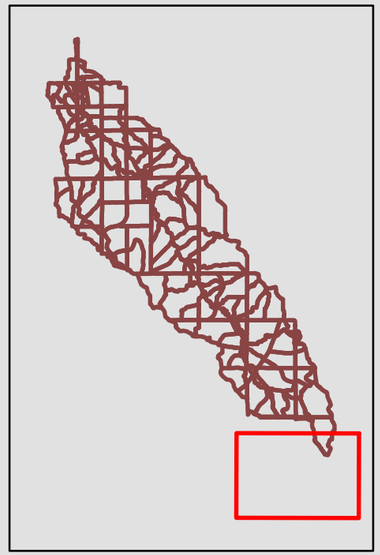
XX — Subbasin ID

XX | X — % Impervious (Existing)

X — % Impervious (Future)

Acreage

Key Map



N

0 500 1,000 2,000

Feet

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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 1

LDC 150 | 24 | 5 | 54
LDC 151 | 161 | 2 | 81
LDC 156 | 34 | 8 | 74
LDC 146 | 22 | 5 | 80
LDC 149 | 132 | 3 | 66
LDC 152 | 22 | 14 | 59
LDC 157 | 216 | 3 | 85
LDC 160 | 92 | 3 | 59
LDC 161 | 82 | 4 | 41
LDC 159 | 59 | 48 | 81
LDC 158 | 45 | 2 | 85
LDC 162 | 6 | 20 | 48
LDC 173 | 168 | 2 | 76

CR 8

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

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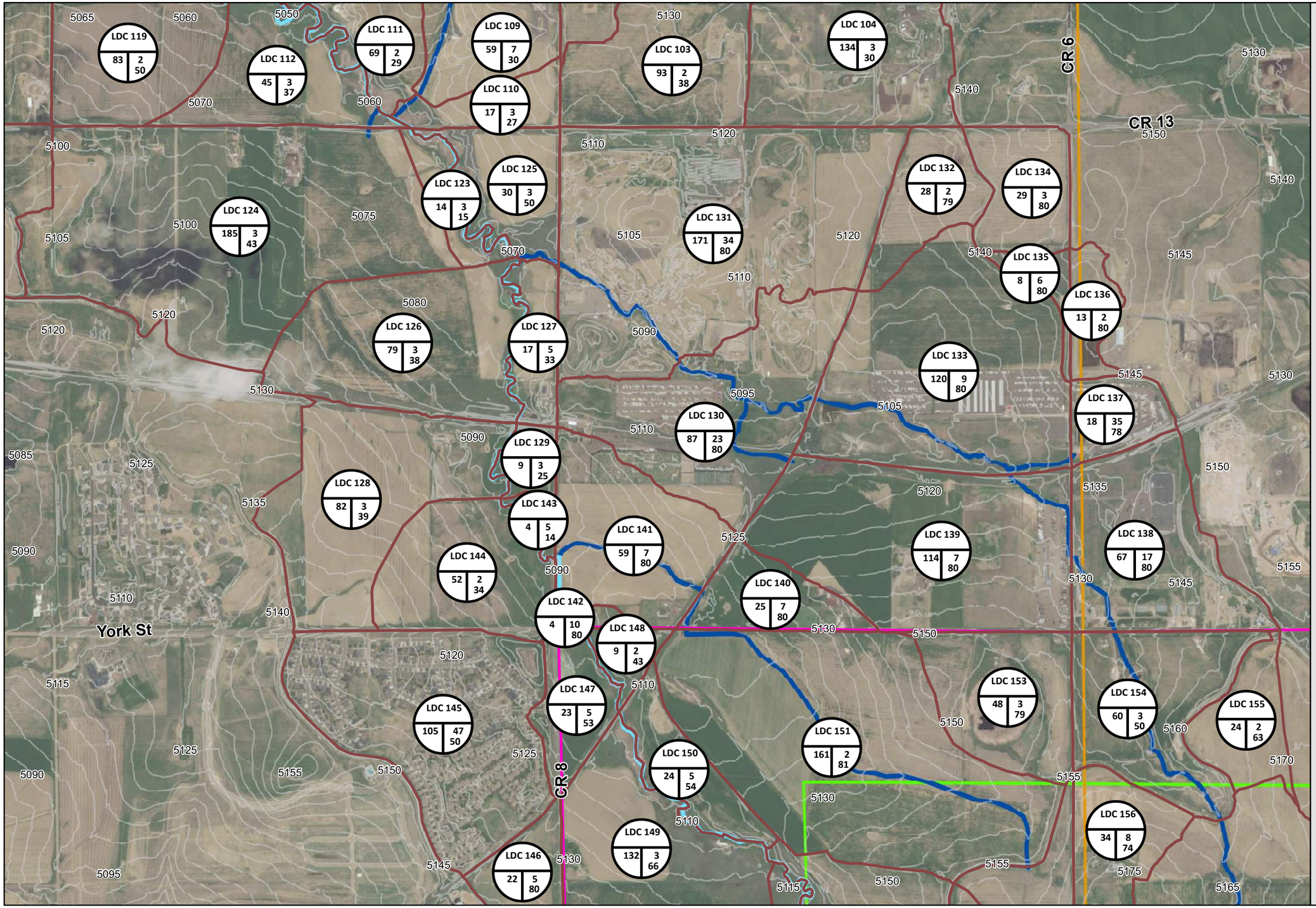
FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 2



Legend

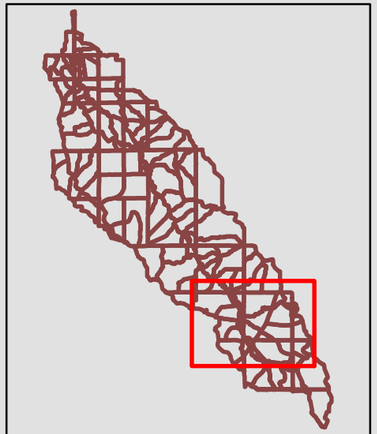
- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- 5ft_contour_not for delineation
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map



N

0 500 1,000 2,000
Feet

ICON ENGINEERING

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DACONO Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 3

LDC 093 | 102 | 2 | 30
LDC 097 | 24 | 2 | 42
LDC 101 | 312 | 3 | 28
LDC 094 | 95 | 2 | 36
LDC 096 | 26 | 3 | 40
LDC 095 | 20 | 3 | 33
LDC 102 | 94 | 3 | 25
CR 15
LDC 115 | 23 | 3 | 40
LDC 116 | 61 | 11 | 36
LDC 107 | 42 | 2 | 34
LDC 106 | 37 | 2 | 30
LDC 114 | 111 | 5 | 46
LDC 117 | 46 | 2 | 43
LDC 108 | 146 | 2 | 34
CR 8
LDC 105 | 101 | 2 | 34
LDC 118 | 50 | 2 | 47
LDC 120 | 259 | 2 | 45
LDC 104 | 134 | 3 | 30
LDC 111 | 69 | 2 | 29
LDC 109 | 59 | 7 | 30
LDC 103 | 93 | 2 | 38
LDC 119 | 83 | 2 | 50
LDC 121 | 62 | 3 | 49
LDC 112 | 45 | 3 | 37
LDC 110 | 17 | 3 | 27
Colorado Blvd
LDC 122 | 76 | 5 | 31
LDC 125 | 30 | 3 | 50
LDC 123 | 14 | 3 | 15
LDC 132 | 28 | 2 | 79
LDC 124 | 185 | 3 | 43
LDC 131 | 171 | 34 | 80

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Lines

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
XX | X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 4

LDC 100 | 60 | 4 | 43
LDC 099 | 85 | 2 | 28
LDC 091 | 127 | 3 | 25
LDC 090 | 191 | 2 | 31
LDC 098 | 78 | 3 | 29
LDC 101 | 312 | 3 | 28
LDC 093 | 102 | 2 | 30
LDC 089 | 122 | 2 | 33
LDC 097 | 24 | 2 | 42
LDC 094 | 95 | 2 | 36
LDC 096 | 26 | 3 | 40
LDC 095 | 20 | 3 | 33
LDC 102 | 94 | 3 | 25
LDC 115 | 23 | 3 | 40
LDC 116 | 61 | 11 | 36
LDC 107 | 42 | 2 | 34
LDC 106 | 37 | 2 | 30
LDC 114 | 111 | 5 | 46
LDC 117 | 46 | 2 | 43
LDC 113 | 175 | 7 | 47
LDC 108 | 146 | 2 | 34
LDC 105 | 101 | 2 | 34
LDC 118 | 50 | 2 | 47
LDC 120 | 259 | 2 | 45
LDC 111 | 69 | 2 | 29
LDC 109 | 59 | 7 | 30
LDC 119 | 83 | 2 | 50
LDC 121 | 62 | 3 | 49
LDC 112 | 45 | 3 | 37
LDC 110 | 17 | 3 | 27

CR 12
CR 10
CR 8
CR 15
Colorado Blvd

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 5

LDC 072 | 110 | 3 / 29
LDC 069 | 25 | 3 / 13
LDC 067 | 82 | 2 / 20
LDC 064 | 97 | 5 / 21
LDC 068 | 204 | 2 / 26
LDC 071 | 172 | 2 / 27
LDC 065 | 110 | 2 / 29
LDC 062 | 319 | 4 / 29
LCD 070 | 54 | 3 / 18
LDC 092 | 82 | 3 / 26
LDC 090 | 191 | 2 / 31
LDC 099 | 85 | 2 / 28
LDC 100 | 60 | 4 / 43
LDC 091 | 127 | 3 / 25
LDC 098 | 78 | 3 / 29
LDC 101 | 312 | 3 / 28
LDC 089 | 122 | 2 / 33
LDC 093 | 102 | 2 / 30
LDC 097 | 24 | 2 / 42
LDC 094 | 95 | 2 / 36
LDC 095 | 20 | 3 / 33
LDC 096 | 26 | 3 / 40
LDC 102 | 94 | 3 / 25

CR 17
CR 10
CR 12
CR 15

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Lines

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 6

LDC 077.1 | 66 | 4 | 12
LDC 077 | 58 | 15 | 20
LDC 073 | 167 | 4 | 12
LDC 072 | 110 | 3 | 29
LDC 069 | 25 | 3 | 13
LDC 079 | 113 | 2 | 12
LDC 076 | 137 | 4 | 12
LDC 068 | 204 | 2 | 26
LDC 074 | 165 | 3 | 12
LDC 071 | 172 | 2 | 27
LDC 080 | 48 | 7 | 12
LDC 075 | 70 | 2 | 12
LDC 081 | 14 | 2 | 12
LDC 070 | 5000 | 3 | 18
LDC 082 | 10 | 6 | 12
LDC 083 | 84 | 2 | 12
LDC 087 | 144 | 2 | 78
LDC 090 | 191 | 2 | 31
LDC 091 | 127 | 3 | 25
LDC 084 | 37 | 3 | 80
LDC 086 | 46 | 2 | 76
LDC 089 | 122 | 2 | 33
LDC 093 | 102 | 2 | 30
LDC 085 | 15 | 3 | 67

CR 16
CR 14
CR 17
CR 12
52

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Lines

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

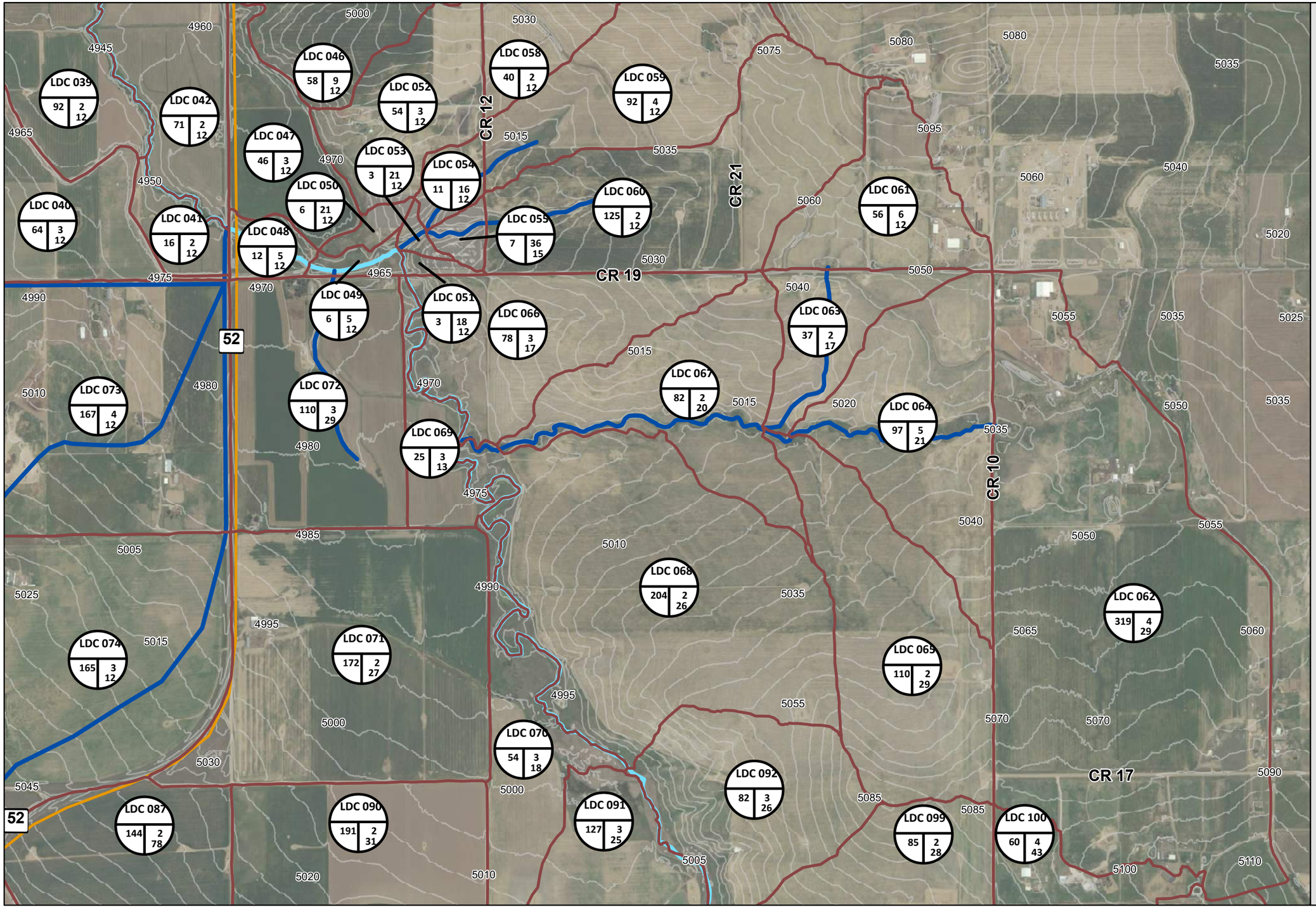
FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 7



Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 8

LDC 029 | 57 | 12 / 12
LDC 030 | 27 | 11 / 12
LDC 026 | 28 | 3 / 12
LDC 025 | 26 | 2 / 12
LDC 024 | 41 | 3 / 12
LDC 022 | 70 | 3 / 12
LCD 020 | 17 | 5 / 12
LDC 018 | 66 | 5 / 12
LDC 034 | 3 | 5 / 12
LDC 033 | 26 | 2 / 12
LDC 031 | 32 | 5 / 12
LDC 044 | 6 | 8 / 13
LDC 043 | 81 | 2 / 12
LDC 056 | 16 | 2 / 12
LDC 045 | 68 | 10 / 12
LDC 046 | 58 | 9 / 12
LDC 057 | 53 | 2 / 12
LDC 035 | 58 | 4 / 12
LDC 032 | 157 | 2 / 12
LDC 046.1 | 50 | 3 / 12
LDC 058 | 40 | 2 / 12
LDC 036 | 43 | 3 / 12
LDC 039 | 92 | 2 / 12
LDC 042 | 71 | 2 / 12
LDC 059 | 92 | 4 / 12
LDC 052 | 54 | 3 / 12
LDC 047 | 46 | 3 / 12
LDC 053 | 3 | 21 / 12
LDC 050 | 6 | 21 / 12
LDC 054 | 11 | 16 / 12
LDC 060 | 125 | 2 / 12
LDC 055 | 7 | 36 / 15
LDC 037 | 165 | 14 / 15
LDC 040 | 64 | 3 / 12
LDC 041 | 16 | 2 / 12
LDC 038 | 6 | 40 / 45
LDC 048 | 12 | 5 / 12
LDC 049 | 6 | 5 / 12
LDC 051 | 3 | 18 / 12
LDC 066 | 78 | 3 / 17
LDC 078 | 52 | 3 / 12
LDC 077.1 | 66 | 4 / 12
LDC 077 | 58 | 15 / 20
LDC 073 | 167 | 4 / 12
LDC 072 | 110 | 3 / 29
LDC 067 | 82 | 2 / 20
LDC 076 | 137 | 4 / 12
LDC 069 | 25 | 3 / 13
LDC 079 | 113 | 2 / 12
LDC 080 | 48 | 7 / 12
LDC 075 | 70 | 2 / 12
LDC 074 | 165 | 3 / 12
LDC 071 | 172 | 2 / 27
LDC 070 | 54 | 3 / 18
LDC 068 | 204 | 2 / 26

CR 21
CR 14
CR 12
CR 19
52

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX | X | X — % Impervious (Existing) / % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 9

LDC 009 | 42 | 2 | 12
LDC 012 | 19 | 8 | 12
LDC 014 | 34 | 5 | 12
LDC 015 | 77 | 3 | 12
LDC 017 | 151 | 7 | 25
LDC 010 | 31 | 3 | 12
LDC 013 | 31 | 3 | 12
LDC 008 | 30 | 6 | 12
LDC 028 | 20 | 3 | 12
LDC 023 | 51 | 11 | 12
LDC 021 | 61 | 2 | 12
LDC 019 | 18 | 5 | 12
LDC 027 | 16 | 3 | 12
LDC 029 | 57 | 12 | 12
LDC 026 | 28 | 3 | 12
LDC 024 | 41 | 3 | 12
LDC 020 | 17 | 5 | 12
LDC 022 | 70 | 3 | 12
LDC 018 | 66 | 5 | 12
LDC 030 | 27 | 11 | 12
LDC 025 | 26 | 2 | 12
LDC 034 | 3 | 5 | 12
LDC 056 | 16 | 2 | 12
LDC 033 | 26 | 2 | 12
LDC 031 | 32 | 5 | 12
LDC 044 | 6 | 8 | 13
LDC 043 | 81 | 2 | 12
LDC 045 | 68 | 10 | 12
LDC 046 | 58 | 9 | 12
LDC 057 | 53 | 2 | 12
LDC 035 | 58 | 4 | 12
LDC 032 | 157 | 2 | 12
LDC 039 | 92 | 2 | 12
LDC 046.1 | 50 | 3 | 12
LDC 058 | 40 | 2 | 12
LDC 036 | 43 | 3 | 12
LDC 042 | 71 | 2 | 12
LDC 059 | 92 | 4 | 12
LDC 052 | 54 | 3 | 12
LDC 047 | 46 | 3 | 12
LDC 050 | 6 | 21 | 12
LDC 054 | 11 | 16 | 12
LDC 055 | 7 | 36 | 15
LDC 060 | 125 | 2 | 12
LDC 037 | 165 | 14 | 15
LDC 040 | 64 | 3 | 12

CR 14 1/2
CR 21
CR 18
CR 12
CR 21
52

Legend

- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
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- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map

N

0 500 1,000 2,000
Feet

ICON ENGINEERING

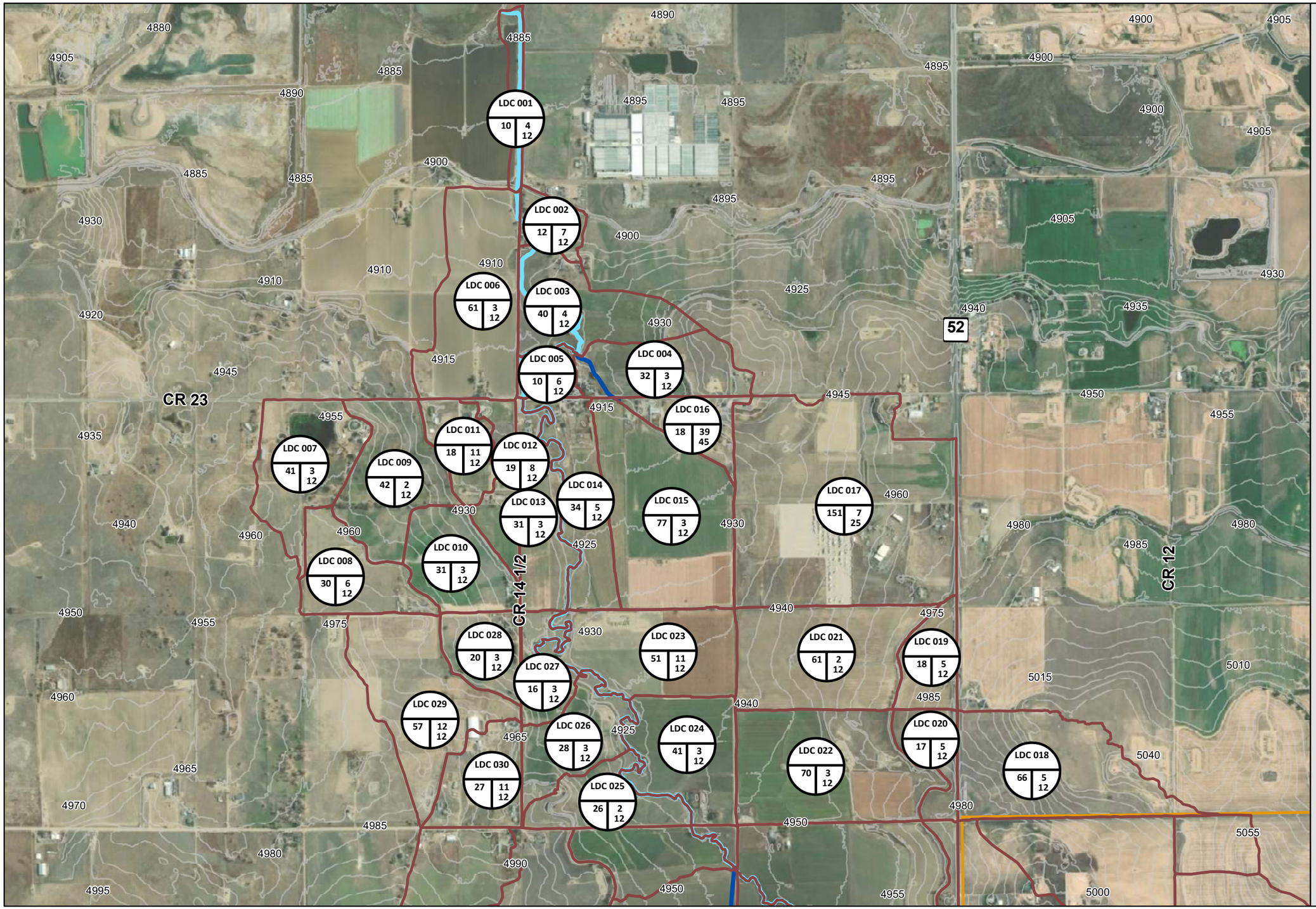
FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 10



Legend

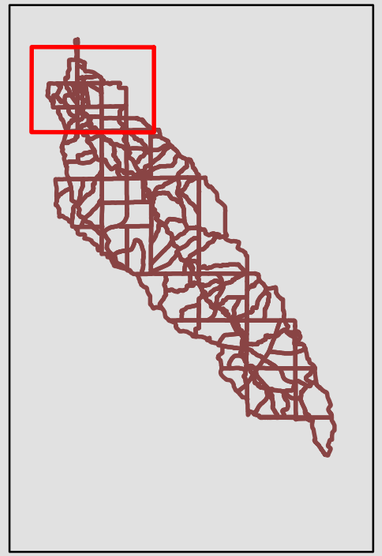
- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX | X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map



N

0 625 1,250 2,500
Feet

ICON ENGINEERING

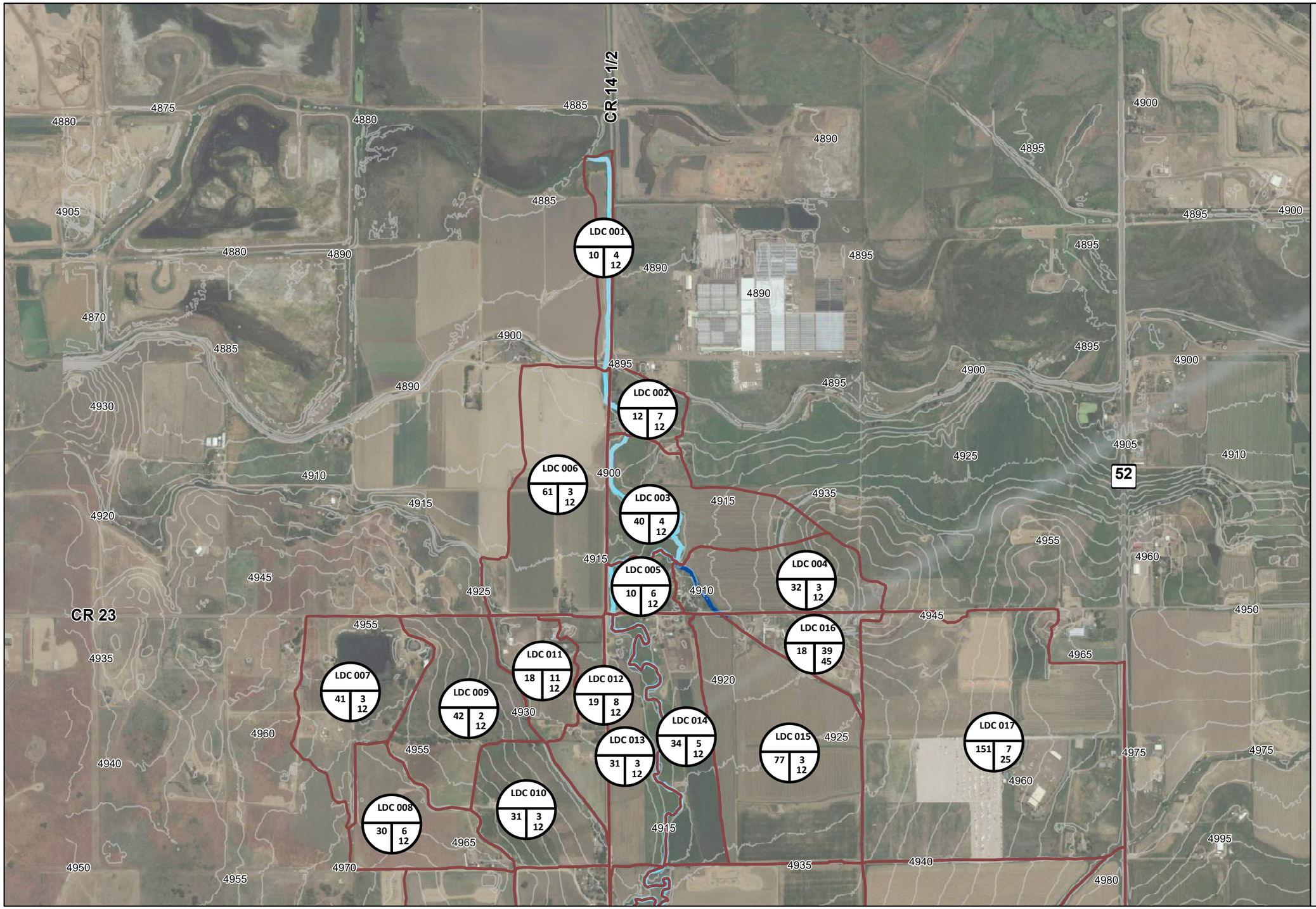
FREDERICK COLORADO

dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 11



Legend

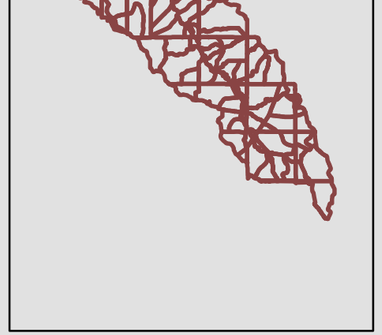
- Subbasin
- Basin Studies by Erie OSP
- Broomfield Boundary
- Dacono Planning Boundary
- Erie Boundary
- Weld County Boundary

Flow Path

- Main Channel
- Tributary

XX — Subbasin ID
XX X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map



N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
SUBBASIN MAPS

DRAWN BY:	JK
CHECKED BY:	JM
PROJECT NUMBER: 20-026_Frederick_Dacono_MP	
DATE: 9/23/2021	
SHEET: LDC	INDEX: 12

TABLE G.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
LITTLE DRY CREEK																				
1	1	0.01500	9.6	0.17000	901	0.41000	2163	0.0070	4	0.40	0.05	3.33	0.0016	0.58	6.35	0.66	4.22	0.65	0.12	0.06
2	2	0.01800	11.7	0.07000	390	0.17000	921	0.0230	7	0.40	0.05	5.00	0.0007	1.00	9.97	0.86	5.00	0.49	0.19	0.08
3	3	0.06200	39.5	0.18000	940	0.45000	2385	0.0190	4	0.40	0.05	4.77	0.0012	0.81	38.37	0.97	23.57	1.01	0.59	0.14
4	4	0.05000	32.3	0.18000	975	0.40000	2097	0.0230	3	0.40	0.05	3.69	0.0018	0.55	41.19	1.28	28.97	5.57	0.78	0.40
5	5	0.01500	9.6	0.08000	401	0.13000	667	0.0170	6	0.40	0.05	3.61	0.0016	0.61	15.27	1.59	10.90	1.91	0.55	0.26
6	6	0.09500	60.9	0.27000	1445	0.50000	2644	0.0090	3	0.40	0.05	4.64	0.0015	0.71	56.64	0.93	37.32	1.35	0.73	0.28
7	7	0.06400	41.1	0.15000	814	0.31000	1623	0.0110	3	0.40	0.05	5.00	0.0007	1.00	26.62	0.65	12.03	0.48	0.17	0.03
8	8	0.04700	29.8	0.15000	767	0.24000	1262	0.0150	6	0.40	0.05	4.77	0.0012	0.82	34.36	1.15	21.70	1.45	0.86	0.22
9	9	0.06600	42.4	0.15000	796	0.29000	1539	0.0250	2	0.40	0.05	5.00	0.0007	1.00	33.42	0.79	15.11	0.52	0.18	0.03
10	10	0.04900	31.5	0.09000	478	0.21000	1114	0.0260	3	0.40	0.05	4.90	0.0009	0.92	39.66	1.26	22.72	0.79	0.40	0.04
11	11	0.02900	18.5	0.10000	502	0.24000	1241	0.0080	11	0.40	0.05	4.81	0.0011	0.85	19.48	1.05	12.28	1.55	0.94	0.30
12	12	0.03000	18.9	0.21000	1095	0.39000	2070	0.0070	8	0.40	0.05	4.59	0.0016	0.67	14.37	0.76	9.66	1.16	0.55	0.24
13	13	0.04800	30.9	0.28000	1493	0.66000	3494	0.0100	3	0.40	0.05	4.03	0.0018	0.57	23.55	0.76	15.92	2.53	0.38	0.18
14	14	0.05300	33.8	0.31000	1657	0.57000	3001	0.0070	5	0.40	0.05	3.11	0.0018	0.51	27.25	0.81	18.84	4.25	1.12	0.39
15	15	0.12100	77.4	0.29000	1531	0.56000	2951	0.0080	3	0.40	0.05	3.02	0.0018	0.50	87.37	1.13	62.06	14.03	3.19	0.77
16	16	0.02700	17.5	0.18000	930	0.27000	1439	0.0290	39	0.40	0.05	4.00	0.0018	0.57	36.82	2.10	28.18	10.75	7.09	4.66
17	17	0.23600	151.2	0.26000	1375	0.59000	3137	0.0180	5	0.40	0.05	4.49	0.0018	0.61	222.80	1.47	156.08	23.82	6.01	2.83
18	18	0.10300	65.7	0.22000	1161	0.53000	2805	0.0250	5	0.40	0.05	3.92	0.0018	0.57	91.57	1.39	64.65	12.34	2.61	1.31
19	19	0.02900	18.5	0.07000	350	0.20000	1030	0.0220	5	0.40	0.05	4.49	0.0018	0.60	33.95	1.84	24.21	4.13	0.94	0.45
20	20	0.02600	16.6	0.16000	849	0.31000	1650	0.0190	5	0.40	0.05	4.59	0.0016	0.67	17.02	1.03	11.55	1.12	0.40	0.17
21	21	0.09600	61.2	0.23000	1196	0.52000	2756	0.0130	2	0.40	0.05	4.51	0.0016	0.68	66.19	1.08	44.24	2.53	0.68	0.28
22	22	0.10900	69.8	0.27000	1439	0.51000	2668	0.0200	3	0.40	0.05	3.81	0.0014	0.68	81.24	1.16	54.69	4.08	1.21	0.50
23	23	0.08000	51.0	0.21000	1121	0.44000	2326	0.0070	2	0.40	0.05	3.05	0.0018	0.50	58.05	1.14	41.21	9.14	1.89	0.43
24	24	0.06500	41.3	0.13000	711	0.28000	1473	0.0080	3	0.40	0.05	3.00	0.0018	0.50	62.07	1.50	44.54	10.51	2.45	0.57
25	25	0.04100	26.5	0.10000	539	0.31000	1663	0.0320	2	0.40	0.05	4.26	0.0018	0.58	42.74	1.61	30.33	4.86	0.60	0.29
26	26	0.04400	28.1	0.13000	693	0.38000	2017	0.0240	3	0.40	0.05	3.73	0.0017	0.58	38.42	1.37	26.89	4.48	0.59	0.29
27	27	0.02500	15.7	0.19000	1016	0.32000	1692	0.0330	3	0.40	0.05	4.31	0.0014	0.73	14.88	0.95	9.66	0.31	0.19	0.07
28	28	0.03200	20.5	0.13000	681	0.22000	1168	0.0280	3	0.40	0.05	4.98	0.0008	0.98	16.55	0.81	8.36	0.40	0.16	0.03
29	29	0.08900	57.1	0.20000	1043	0.44000	2312	0.0130	4	0.40	0.05	4.64	0.0011	0.83	55.72	0.98	33.65	1.48	0.84	0.18
30	30	0.04200	27.1	0.12000	610	0.29000	1544	0.0230	11	0.40	0.05	4.38	0.0017	0.62	42.32	1.56	30.33	5.93	2.45	1.21
31	31	0.05000	32.2	0.14000	742	0.33000	1748	0.0230	5	0.40	0.05	4.50	0.0018	0.60	46.32	1.44	32.60	5.28	1.21	0.58
32	32	0.24500	156.7	0.29000	1536	0.63000	3314	0.0220	2	0.40	0.05	4.50	0.0017	0.63	222.79	1.42	154.04	17.84	2.97	1.34
33	33	0.04000	25.8	0.12000	635	0.21000	1109	0.0220	2	0.40	0.05	4.39	0.0018	0.59	41.63	1.61	29.48	4.47	0.51	0.24
34	34	0.00500	3.3	0.07000	373	0.11000	575	0.0100	5	0.40	0.05	3.01	0.0018	0.50	3.95	1.20	2.83	0.69	0.20	0.06
35	35	0.09000	57.7	0.23000	1209	0.50000	2660	0.0140	3	0.40	0.05	4.41	0.0018	0.59	67.14	1.16	46.56	6.70	0.94	0.45
36	36	0.06700	42.6	0.19000	990	0.37000	1971	0.0220	3	0.40	0.05	4.34	0.0018	0.59	57.71	1.35	40.24	6.09	0.91	0.43
37	37	0.25700	164.6	0.37000	1942	0.73000	3833	0.0150	14	0.40	0.05	4.42	0.0015	0.70	200.69	1.22	138.92	21.82	14.34	7.41
38	38	0.01000	6.3	0.04000	234	0.12000	637	0.0130	40	0.40	0.05	4.47	0.0018	0.60	17.19	2.73	13.02	5.02	3.41	2.23
39	39	0.14500	92.5	0.40000	2132	0.72000	3815	0.0080	2	0.40	0.05	4.29	0.0017	0.62	80.38	0.87	54.19	5.89	0.92	0.40
40	40	0.10000	63.8	0.22000	1165	0.43000	2295	0.0120	3	0.40	0.05	4.46	0.0018	0.60	80.00	1.25	55.41	7.70	1.17	0.55
41	41	0.02500	16.3	0.15000	797	0.25000	1297	0.0210	2	0.40	0.05	3.86	0.0017	0.57	20.14	1.24	14.02	2.30	0.28	0.14
42	42	0.11000	70.6	0.29000	1533	0.63000	3301	0.0070	2	0.40	0.05	3.45	0.0016	0.58	67.63	0.96	46.58	7.05	0.93	0.44
43	43	0.12600	80.6	0.28000	1492	0.47000	2458	0.0110	2	0.40	0.05	3.51	0.0015	0.62	95.14	1.18	65.43	8.25	1.27	0.58
44	44	0.00900	5.7	0.02000	82	0.12000	628	0.0110	8	0.40	0.05	5.00	0.0007	1.00	6.78	1.19	3.45	0.38	0.15	0.07
45	45	0.10700	68.5	0.36000	1902	0.69000	3645	0.0150	10	0.40	0.05	4.51	0.0018	0.61	67.81	0.99	47.47	8.73	3.35	1.62
46	46	0.09100	58.1	0.20000	1055	0.52000	2754	0.0210	9	0.40	0.05	4.23	0.0017	0.62	77.58	1.34	54.49	9.70	3.86	1.84
46.1	46.1	0.07800	49.7	0.13000	666	0.40000	2102	0.0600	3	0.40	0.05	3.86	0.0018	0.56	96.18	1.94	68.91	13.29	1.69	0.84
47	47	0.07100	45.5	0.20000	1030	0.43000	2263	0.0070	3	0.40	0.05	3.11	0.0018	0.52	52.69	1.16	37.37	8.14	1.58	0.53
48	48	0.01800	11.8	0.09000	452	0.20000	1051	0.0100	5	0.40	0.05	4.01	0.0018	0.57	15.42	1.31	10.83	2.04	0.44	0.22
49	49	0.01000	6.4	0.10000	543	0.21000	1122	0.0130	5	0.40	0.05	3.10	0.0018	0.51	6.86	1.07	4.90	1.14	0.30	0.11
50	50	0.00900	5.6	0.10000	549	0.21000	1123	0.0180	5	0.40	0.05	3.10	0.0018	0.51	6.04	1.08	4.31	1.00	0.27	0.09
51	51	0.00500	3.0	0.07000	392	0.18000	955	0.0350	9	0.40	0.05	3.04	0.0018	0.51	3.62	1.21	2.61	0.68	0.24	0.10
52	52	0.08400	54.0	0.31000	1619	0.59000	3140	0.0210	2	0.40	0.05	3.43	0.0018	0.54	58.85	1.09	41.21	7.55	0.70	0.35
53	53	0.00500	3.2	0.04000	207	0.12000	639	0.0410	5	0.40	0.05	3.01	0.0018	0.50	5.65	1.77	4.13	1.04	0.29	0.09
54	54	0.01700	11.0	0.10000	552	0.23000	1189	0.0320	3	0.40	0.05	4.52	0.0014	0.74	12.96	1.18	8.52	0.30	0.19	0.07
55	55	0.01000	6.6	0.08000	405	0.14000	760	0.0360	13	0.40	0.05	3.06	0.0018	0.51	11.39	1.73	8.42	2.42	1.00	0.51
56	56	0.02600	16.4	0.10000	524	0.21000	1117	0.0440	2	0.40	0.05	4.57	0.0016	0.67	25.68	1.57	17.77	1.38	0.29	0.12
57	57	0.08200	52.7	0.16000	858	0.39000	2036	0.0300	2	0.40	0.05	4.59	0.0016	0.67	78.02	1.48	53.53	3.72	0.85	0.36
58	58	0.06300	40.3	0.19000	1023	0.51000	2675	0.0290	2	0.40	0.05	4.61	0.0015	0.69	45.71	1.13	30.45	1.46	0.47	0.19
59	59	0.14400	92.2	0.36000	1901	0.67000	3513	0.0240	4	0.40	0.05	4.45	0.0016	0.67	101.64	1.10	68.77	6.16	2.23	0.95
60	60	0.19500	125.1	0.41000	2186	0.86000	4558	0.0230	2	0.40	0.05	3.48	0.0017	0.56	142.82	1.14	99.79	17.53	1.89	0.94
61	61	0.08800	56.3	0.15000	796	0.41000	2158	0.0280	6	0.40	0.05	4.06	0.0018	0.58	93.89	1.67	67.28	13.17	3.47	1.72
62	62	0.49900	319.1	0.55000	2906	1.23000	6478	0.0120	4	0.40	0.05	3.37	0.0018	0.52	335.08	1.05	234.71	48.92	9.17	3.95
63	63	0.05800	37.0	0.25000	1300	0.57000	3015	0.0170	2	0.40	0.05	3.00	0.0018	0.50	38.78	1.05	27.50	6.13	1.33	0.28
64	64	0.15100	96.7	0.27000	1434	0.67000	3532	0.0160	5	0.40	0.05	3.34	0.0018	0.52	127.22	1.32	90.64	20.56	4.70	2.13
65	65	0.17200	110.0	0.53000	2772	0.89000	4708	0.0180	2	0.40	0.05	3.63	0.0018	0.54	106.18	0.97	73.55	13.12	1.21	0.59
66	66	0.12300	78.4	0.26000	1379	0.86000	4542	0.0170	3	0.40	0.05	3.00	0.0018	0.50	90.51	1.15	64.40	14.72	3.46	0.84
67	67	0.12900	82.4	0.41000	2166	0.69000	3659	0.0180	2	0.40	0.05	3.00	0.0018	0.50	89.68	1.09	63.47	14.05	2.93	0.56
68	68	0.31900	204.4	0.44000	2309	0.99000	5216	0.0180	2	0.40	0.05	3.09	0.0018	0.51	245.92	1.20	174.30	38.19	7.53	1.77
69	69	0.03900	24.7	0.33000	1765	0.49000	2597	0.0090	3	0.40	0.05	3.04	0.0018	0.50	18.96	0.77	13.02	2.84	0.65	0.17
70	70	0.08400	53.6	0.48000	2545	0.86000	4565	0.0090	3	0.40	0.05	3.52	0.0018	0.53	36.77	0.69	24.95	4.64	0.65	0.31
71	71	0.26800	171.5	0.32000	1692	0.72000	3807	0.0130	2	0.40	0.05	3.18	0.0018	0.51	229.75	1.34	163.24	35.45	6.28	1.74
72	72	0.17100	109.5	0.27000	1417	0.55000	2895	0.0080	3	0.40	0.05	3.19	0.0018	0.51	141.71	1.29	100.73	22.22	4.36	1.38
73	73	0.26200	167.4	0.31000	1627	0.78000	4093	0.0150	4	0.40	0.05	4.07	0.0018	0.57	216.29	1.29	151.82	26.41	4.73	2.32
74	74	0.25800	165.2	0.42000	2230	0.88000	4634	0.0180	3	0.40	0.05	3.79	0.0018	0.55	191.58	1.16	134.12	23.97	3.04	1.50
75	75	0.11000	70.5	0.29000	1514	0.49000	2581	0.0160	2	0.40	0.05	4.44	0.0018	0.60	84.31	1.20	58.39	8.13	0.97	0.46
76	76	0.21400	136.9	0.55000	2909	0.92000	4874	0.0140	4	0.40	0.05	4.68	0.0014	0.75	107.65	0.79	68.63	3.42	2.06	0.73
77	77	0.09100	58.2	0.34000	1802	0.72000	3782	0.0160	15	0.40	0.05	4.16	0.0016	0.63	57.48	0.99	40.56	8.46	4.53	2.50
77.1	77.1	0.10400	66.3	0.24000	1291	0.58000	3042	0.0200	3	0.40	0.05	3.00	0.0018	0.50	87.47	1.32	62.45	14.61	3.53	0.94
78	78	0.08100	51.7	0.18000	956	0.44000	2300	0.0160	3	0.40	0.05	4.51	0.0016	0.65	65.27	1.26	44.62	4.63	1.22	0.54
79	79	0.17700	113.3	0.34000	1792	0.72000	3783	0.0170	2	0.40	0.05	4.52	0.0016	0.67	123.93	1.09	83.35	5.87	1.39	0.58
80	80	0.07500	48.0	0.20000	1031	0.43000	2250	0.0200	7	0.40	0.05	4.50	0.0018	0.60	64.41	1.34	45.31	8.22	2.61	1.27
81	81	0.02200	14.2	0.06000	291	0.18000	937	0.0360	2	0.40	0.05	4.49	0.0018	0.60	27.96	1.97	19.82	3.01	0.34	0.16
82	82	0.01600	10.5	0.07000	392	0.20000	1061	0.0150	6	0.40	0.05	3.05	0.0018	0.50	15.76	1.50	11.39	2.89	0.89	0.33
83	83	0.13200	84.3	0.16000	839	0.48000	2536	0.0130	2	0.40	0.05	4.12	0.0018	0.57	129.40	1.53	91.23	15.00	1.63	0.79
84	84	0.05800	36.9	0.15000	772	0.32000	1708	0.0070	3	0.40	0.05	4.11	0.0018	0.57	45.88	1.24	31.99	5.24	0.67	0.33
85	85	0.02400	15.2	0.15000	818	0.29000	1557	0.0060	3	0.40	0.05	4.34	0.0018	0.59	13.50	0.89	9.31	1.33	0.20	0.09
86	86	0.07200	46.1	0.18000	960	0.39000	2044	0.0130	2	0.40	0.05	4.22	0.0018	0.58	59.23	1.28	41.21	6.34	0.68	0.33
87	87	0.22400	143.5	0.42000	2205	0.64000	3370	0.0150	2	0.40	0.05	4.17	0.0018	0.58	169.53	1.18	117.93	18.04	2.03	0.97
89	89	0.19000	121.8	0.40000	2087	0.72000	3776	0.0180	2	0.40	0.05	4.25	0.0018	0.58	140.23	1.15	97.34	14.40	1.71	0.81
90	90	0.29900	191.1	0.43000	2295	1.01000	5314	0.0150	2	0.40	0.05	3.90	0.0018	0.56	205.52	1.08	142.75	23.62	2.50	1.20
91	91	0.19800	126.9	0.37000	1960	0.85000	4493	0.0130	3	0.40	0.05	3.65	0.0018	0.54	138.95	1.09	97.37	18.34	2.53	1.26
92	92	0.12800	81.9	0.19000	986	0.54000	2838	0.0250	3	0.40	0.05	3.37	0.0018	0.53	132.26	1.61	94.70	20.30	2.81	1.20
93	93	0.16000	102.4	0.42000	2200	0.86000	4553	0.0150	2	0.40	0.05	3.28	0.0018	0.52	105.75	1.03	74.13	15.05	2.21	0.69
94	94	0.14900	95.1	0.25000	1295	0.75000	3965	0.0170	2	0.40	0.05	3.22	0.0018	0.51	123.76	1.30	87.77	18.77	3.05	0.86
95	95	0.03100	19.8	0.16000	863	0.26000	1378	0.0140	3	0.40	0.05	3.46	0.0018	0.53	23.99	1.21	16.94	3.46	0.45	0.23
96	96	0.04100	26.0	0.19000	1016	0.29000	1541	0.0270	3	0.40	0.05	3.00	0.0018	0.50	36.27	1.40	25.88	6.06	1.41	0.32
97	97	0.03800	24.2	0.21000	1093	0.36000	1913	0.0230	2	0.40	0.05	3.23	0.0018	0.52	28.32	1.17	20.04	4.21	0.66	0.18
98	98	0.12200	77.9	0.28000	1482	0.49000	2570	0.0190	3	0.40	0.05	3.82	0.0018	0.55	103.65	1.33	72.85	13.38	1.74	0.87
99	99	0.13300	84.9	0.35000	1847	0.72000	3823	0.0210	2	0.40	0.05	3.86	0.0018	0.56	95.03	1.12	66.37	11.39	1.27	0.63
100	100	0.09300	59.8	0.19000	1013	0.48000	2536	0.0170	4	0.40	0.05	3.37	0.0018	0.52	84.90	1.42	60.46	13.38	2.54	1.16
101	101	0.48700	311.6	0.53000	2779	1.16000	6125	0.0210	3	0.40	0.05	3.31	0.0018	0.52	372.45	1.20	262.61	54.05	8.06	2.81
102	102	0.14600	93.7	0.53000	2783	0.99000	5204	0.0250	3	0.40	0.05	3.00	0.0018	0.50	91.78	0.98	64.56	14.54	3.48	0.88
103	103	0.14500	92.5	0.33000	1746	0.75000	3942	0.0170	2	0.40	0.05	3.02	0.0018	0.50	109.06	1.18	77.43	17.20	3.51	0.69
104	104	0.21000	134.1	0.35000	1851	0.75000	3948	0.0150	3	0.40	0.05	3.02	0.0018	0.50	170.04	1.27	121.34	28.17	6.81	1.85
105	105	0.15800	101.0	0.19000	1008	0.44000	2305	0.0230	2	0.40	0.05	3.00	0.0018	0.50	186.56	1.85	135.19	32.23	7.07	1.44
106	106	0.05700	36.6	0.33000	1720	0.47000	2485	0.0100	2	0.40	0.05	3.00	0.0018	0.50	33.41	0.91	23.40	5.10	1.06	0.20
107	107	0.06600	42.3	0.19000	1027	0.52000	2748	0.0300	2	0.40	0.05	3.00	0.0018	0.50	57.51	1.36	40.96	9.38	1.99	0.38
108	108	0.22800	145.8	0.55000	2914	0.99000	5220	0.0220	2	0.40	0.05	3.00	0.0018	0.50	153.73	1.05	108.32	23.79	4.96	0.94
109	109	0.09300	59.2	0.34000	1789	0.52000	2734	0.0200	7	0.40	0.05	3.58	0.0018	0.54	69.29	1.17	49.30	10.98	2.89	1.50
110	110	0.02600	16.6	0.20000	1043	0.37000	1968	0.0230	3	0.40	0.05	3.81	0.0018	0.55	16.67	1.00	11.65	2.02	0.24	0.12
111	111	0.10800	68.9	0.27000	1405	0.50000	2662	0.0260	2	0.40	0.05	3.00	0.0018	0.50	97.58	1.42	69.68	16.17	3.59	0.77
112	112	0.07000	44.8	0.15000	809	0.39000	2076	0.0170	3	0.40	0.05	3.00	0.0018	0.50	67.40	1.50	48.37	11.41	2.65	0.61
113	113	0.27400	175.2	0.29000	1517	0.75000	3959	0.0140	7	0.40	0.05	3.25	0.0018	0.52	252.26	1.44	181.19	44.34	12.81	5.69
114	114	0.17400	111.1	0.35000	1825	0.59000	3091	0.0170	5	0.40	0.05	3.63	0.0018	0.54	146.20	1.32	103.55	21.39	4.13	2.12
115	115	0.03500	22.6	0.11000	607	0.19000	998	0.0180	3	0.40	0.05	3.36	0.0018	0.52	37.78	1.67	27.22	5.87	0.81	0.33
116	116	0.09500	60.6	0.31000	1630	0.65000	3454	0.0250	11	0.40	0.05	3.00	0.0018	0.50	74.89	1.24	54.28	14.91	5.97	2.66
117	117	0.07200	46.1	0.27000	1421	0.53000	2816	0.0270	2	0.40	0.05	3.00	0.0018	0.50	55.99	1.21	39.87	9.08	2.03	0.45
118	118	0.07900	50.4	0.23000	1226	0.56000	2943	0.0230	2	0.40	0.05	3.01	0.0018	0.50	63.60	1.26	45.29	10.31	2.25	0.48
119	119	0.13000	83.1	0.30000	1581	0.54000	2827	0.0190	2	0.40	0.05	3.14	0.0018	0.51	111.14	1.34	78.97	17.35	3.17	0.77
120	120	0.40400	258.6	0.47000	2458	0.94000	4964	0.0160	2	0.40	0.05	3.45	0.0018	0.53	311.16	1.20	218.87	42.53	3.96	1.88
121	121	0.09700	61.9	0.25000	1301	0.49000	2579	0.0150	3	0.40	0.05	3.43	0.0018	0.53	78.32	1.27	55.32	11.21	1.31	0.61
122	122	0.11900	76.3	0.14000	765	0.46000	2428	0.0190	2	0.40	0.05	3.05	0.0018	0.50	134.11	1.76	97.00	22.54	4.54	0.91

TABLE G.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

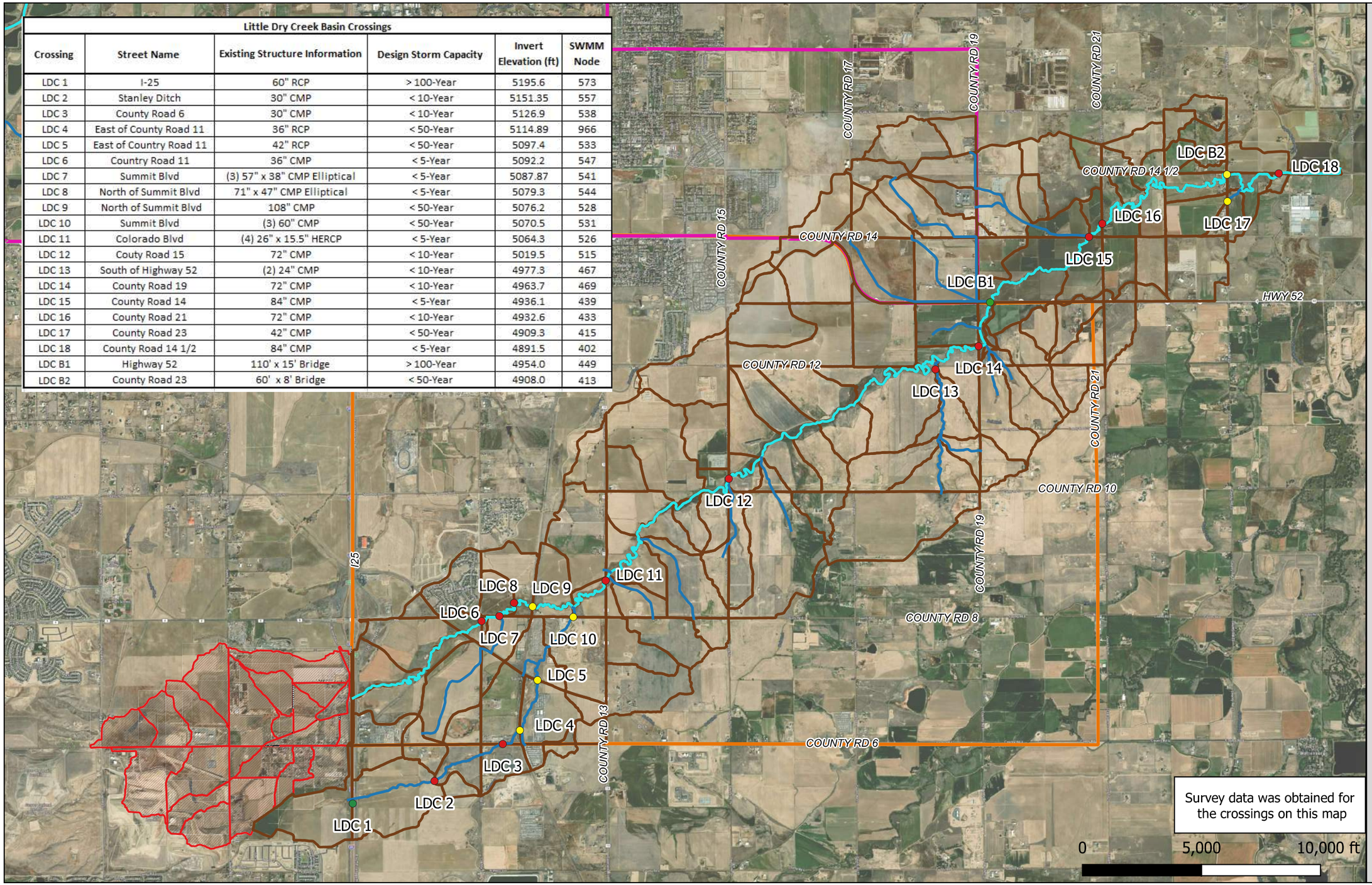
Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
LITTLE DRY CREEK																				
123	123	0.02200	14.1	0.14000	735	0.29000	1557	0.0050	3	0.40	0.05	3.46	0.0018	0.54	12.95	0.92	9.07	1.77	0.23	0.12
124	124	0.28900	185.0	0.50000	2661	0.81000	4276	0.0110	3	0.40	0.05	3.22	0.0018	0.51	201.87	1.09	142.11	30.02	5.45	1.69
125	125	0.04700	30.2	0.20000	1038	0.29000	1542	0.0210	3	0.40	0.05	3.85	0.0018	0.56	39.87	1.32	27.99	5.16	0.73	0.37
126	126	0.12300	78.6	0.28000	1503	0.58000	3060	0.0150	3	0.40	0.05	3.10	0.0018	0.51	98.80	1.26	70.26	15.72	3.27	0.86
127	127	0.02700	17.3	0.17000	893	0.34000	1801	0.0200	5	0.40	0.05	3.31	0.0018	0.52	19.59	1.13	13.93	3.08	0.67	0.29
128	128	0.12900	82.3	0.38000	2003	0.61000	3246	0.0180	3	0.40	0.05	3.35	0.0018	0.52	94.38	1.15	66.68	13.85	2.20	0.89
129	129	0.01400	8.8	0.08000	415	0.14000	747	0.0150	3	0.40	0.05	3.00	0.0018	0.50	13.44	1.53	9.69	2.30	0.55	0.13
130	130	0.13600	87.1	0.10000	549	0.38000	2013	0.0200	23	0.40	0.05	3.27	0.0018	0.52	218.44	2.51	163.08	55.11	27.54	17.33
131	131	0.26700	170.8	0.31000	1629	0.76000	4025	0.0160	34	0.40	0.05	3.43	0.0018	0.53	350.69	2.05	266.38	98.69	59.66	38.68
132	132	0.04400	28.0	0.13000	687	0.25000	1327	0.0130	2	0.40	0.05	3.51	0.0018	0.53	40.85	1.46	28.99	5.76	0.50	0.26
133	133	0.18800	120.1	0.28000	1472	0.53000	2783	0.0140	9	0.40	0.05	3.02	0.0018	0.50	185.79	1.55	134.93	36.57	13.40	5.60
134	134	0.04500	28.7	0.09000	489	0.47000	2463	0.0160	3	0.40	0.05	3.43	0.0018	0.53	40.00	1.39	28.32	5.86	0.69	0.33
135	135	0.01300	8.5	0.12000	649	0.18000	976	0.0180	6	0.40	0.05	3.00	0.0018	0.50	10.56	1.24	7.58	1.91	0.60	0.21
136	136	0.02100	13.3	0.15000	784	0.27000	1445	0.0090	2	0.40	0.05	3.01	0.0018	0.50	13.51	1.02	9.58	2.11	0.44	0.08
137	137	0.02800	18.1	0.11000	585	0.24000	1245	0.0100	35	0.40	0.05	3.00	0.0018	0.50	37.95	2.10	29.08	11.29	7.01	4.40
138	138	0.10500	67.2	0.14000	765	0.44000	2324	0.0150	17	0.40	0.05	3.00	0.0018	0.50	121.76	1.81	90.60	28.10	13.20	6.98
139	139	0.17900	114.3	0.28000	1474	0.77000	4054	0.0080	7	0.40	0.05	3.00	0.0018	0.50	138.23	1.21	99.31	25.14	8.28	3.10
140	140	0.03900	25.0	0.13000	701	0.35000	1868	0.0200	7	0.40	0.05	3.00	0.0018	0.50	35.56	1.42	25.59	6.56	2.09	0.76
141	141	0.09300	59.2	0.15000	794	0.37000	1951	0.0160	7	0.40	0.05	3.00	0.0018	0.50	100.95	1.71	73.69	19.21	6.16	2.27
142	142	0.00600	3.8	0.07000	353	0.15000	791	0.0210	10	0.40	0.05	3.41	0.0018	0.53	4.96	1.31	3.55	0.89	0.28	0.15
143	143	0.00600	3.9	0.09000	468	0.12000	649	0.0120	5	0.40	0.05	3.01	0.0018	0.50	4.49	1.15	3.22	0.77	0.22	0.07
144	144	0.08200	52.4	0.12000	648	0.36000	1878	0.0300	2	0.40	0.05	3.63	0.0018	0.54	97.25	1.86	69.83	13.99	1.36	0.69
145	145	0.16400	105.2	0.24000	1267	0.53000	2809	0.0180	47	0.40	0.05	3.72	0.0018	0.55	298.45	2.84	230.34	98.19	67.28	45.09
146	146	0.03400	21.7	0.18000	945	0.28000	1503	0.0190	5	0.40	0.05	3.35	0.0018	0.52	27.45	1.26	19.50	4.37	0.94	0.42
147	147	0.03500	22.6	0.15000	769	0.33000	1734	0.0150	5	0.40	0.05	3.02	0.0018	0.50	28.93	1.28	20.68	5.00	1.38	0.44
148	148	0.01400	8.7	0.10000	503	0.16000	828	0.0210	2	0.40	0.05	3.77	0.0018	0.55	12.12	1.39	8.55	1.59	0.18	0.09
149	149	0.20700	132.2	0.41000	2159	0.75000	3985	0.0170	3	0.40	0.05	3.02	0.0018	0.50	161.07	1.22	114.74	26.34	6.21	1.63
150	150	0.03800	24.1	0.17000	884	0.35000	1848	0.0160	5	0.40	0.05	4.19	0.0018	0.58	27.76	1.15	19.43	3.38	0.74	0.36
151	151	0.25200	161.1	0.30000	1570	0.83000	4373	0.0100	2	0.40	0.05	3.00	0.0018	0.50	202.40	1.26	143.98	32.36	6.78	1.30
152	152	0.03500	22.2	0.05000	250	0.20000	1050	0.0100	14	0.40	0.05	3.00	0.0018	0.50	48.02	2.16	35.68	10.84	4.68	2.33
153	153	0.07500	48.1	0.15000	771	0.32000	1685	0.0080	3	0.40	0.05	3.00	0.0014	0.50	68.32	1.42	48.17	8.98	1.39	0.70
154	154	0.09300	59.8	0.16000	852	0.45000	2374	0.0100	3	0.40	0.05	3.00	0.0018	0.50	84.61	1.41	60.46	14.18	3.31	0.78
155	155	0.03800	24.1	0.13000	700	0.30000	1580	0.0090	2	0.40	0.05	3.00	0.0018	0.50	30.23	1.25	21.51	4.87	1.03	0.20
156	156	0.05300	34.1	0.17000	906	0.34000	1783	0.0120	8	0.40	0.05	3.00	0.0018	0.50	45.98	1.35	33.13	8.70	3.03	1.19
157	157	0.33700	215.7	0.35000	1852	0.87000	4580	0.0150	3	0.40	0.05	3.00	0.0018	0.50	291.41	1.35	208.43	48.81	11.88	3.10
158	158	0.07100	45.3	0.19000	1002	0.29000	1545	0.0170	2	0.40	0.05	3.00	0.0018	0.50	70.09	1.55	50.36	11.73	2.54	0.49
159	159	0.09200	59.1	0.29000	1532	0.52000	2763	0.0110	48	0.40	0.05	3.00	0.0018	0.50	128.96	2.18	100.66	44.04	30.30	20.21
160	160	0.14400	92.1	0.36000	1885	0.61000	3201	0.0130	3	0.40	0.05	3.02	0.0018	0.50	108.04	1.17	76.83	17.41	3.93	0.95
161	161	0.12800	82.2	0.39000	2085	0.59000	3105	0.0170	4	0.40	0.05	3.01	0.0018	0.50	96.20	1.17	68.56	15.96	4.01	1.11
162	162	0.00900	5.8	0.02000	115	0.35000	1865	0.0220	20	0.40	0.05	3.00	0.0018	0.50	10.70	1.84	8.03	2.62	1.33	0.74
173	173	0.26200	167.5	0.71000	3774	1.22000	6442	0.0130	2	0.40	0.05	3.00	0.0018	0.50	141.55	0.85	97.81	20.94	4.42	0.89
Totals/Averages			**10849.3**						**6**						**84.50**	**1.28**	**59.70**	**12.56**	**3.56**	**1.67**

[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Little Dry Creek Basin Crossings

Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
LDC 1	I-25	60" RCP	> 100-Year	5195.6	573
LDC 2	Stanley Ditch	30" CMP	< 10-Year	5151.35	557
LDC 3	County Road 6	30" CMP	< 10-Year	5126.9	538
LDC 4	East of County Road 11	36" RCP	< 50-Year	5114.89	966
LDC 5	East of Country Road 11	42" RCP	< 50-Year	5097.4	533
LDC 6	Country Road 11	36" CMP	< 5-Year	5092.2	547
LDC 7	Summit Blvd	(3) 57" x 38" CMP Elliptical	< 5-Year	5087.87	541
LDC 8	North of Summit Blvd	71" x 47" CMP Elliptical	< 5-Year	5079.3	544
LDC 9	North of Summit Blvd	108" CMP	< 50-Year	5076.2	528
LDC 10	Summit Blvd	(3) 60" CMP	< 50-Year	5070.5	531
LDC 11	Colorado Blvd	(4) 26" x 15.5" HERCP	< 5-Year	5064.3	526
LDC 12	Couty Road 15	72" CMP	< 10-Year	5019.5	515
LDC 13	South of Highway 52	(2) 24" CMP	< 10-Year	4977.3	467
LDC 14	County Road 19	72" CMP	< 10-Year	4963.7	469
LDC 15	County Road 14	84" CMP	< 5-Year	4936.1	439
LDC 16	County Road 21	72" CMP	< 10-Year	4932.6	433
LDC 17	County Road 23	42" CMP	< 50-Year	4909.3	415
LDC 18	County Road 14 1/2	84" CMP	< 5-Year	4891.5	402
LDC B1	Highway 52	110' x 15' Bridge	> 100-Year	4954.0	449
LDC B2	County Road 23	60' x 8' Bridge	< 50-Year	4908.0	413



Legend

- Crossing with <10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Little Dry Creek Basin Studied By Erie OSP

Flow Path

- Little Dry Creek
- Tributary

ICON ENGINEERING

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LITTLE DRY CREEK
EXISTING CONDITIONS
EXISING STRUCTURES
CAPACITY

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LDC	INDEX: EX-CROSS

Table G.1.2: Little Dry Creek Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information*			Design Storm Capacity			Existing Conditions SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)	Existing Conditions	Future Conditions with Future Conditions Upstream in Erie OSP	Future Conditions with Existing Conditions Upstream in Erie OSP	2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																								
LDC 6-D	County Road 11, South of Summit Blvd	547	36" CMP	5092.2	54	< 5YR	< 5 YR	< 2 YR	50	297	329	1385	2028	37	82	140	481	679	67	165	383	1481	2151	Good Condition - Heavy Vegetation on upstream side.
LDC 7-D	Summit Blvd, East of County Road 11	541	(3) 57" x 38" CMP Elliptical	5087.87	276	< 5 YR	< 50 YR	< 10 YR	59	319	372	1568	2316	55	121	202	665	932	85	203	446	1654	2392	Good Condition - Heavy Vegetation on upstream and downstream sides.
LDC 8-D*	East of County Road 11, North of Summit Blvd	544	71" x 47" CMP Elliptical	5079.3	206	< 5 YR	< 10 YR	< 5 YR	59	317	370	1572	2327	64	136	226	728	1042	94	217	469	1707	2476	Condition Unknown
LDC 9-D*	East of County Road 11, North of Summit Blvd	528	108" CMP	5076.2	1455	< 50 YR	> 100 YR	< 50 YR	59	317	373	1601	2376	66	142	238	771	1142	96	223	481	1742	2545	Condition Unknown - Very Heavy vegetation on upstream and downstream sides
LDC 11-D	Colorado Blvd, North of Summit Blvd	526	(4) 26" x 15.5" HERCP	5064.3	44	< 2 YR	< 2 YR	< 2 YR	63	332	472	2249	3399	150	312	510	1749	2585	172	374	733	2468	3715	Good Condition - Heavy Vegetation on upstream side.
LDC 12-D	County Road 15, North of County Road 10	515	72" CMP	5019.5	285	< 5 YR	< 5 YR	< 5 YR	60	314	485	2520	3883	166	362	615	2210	3284	180	406	824	2708	4113	Condition Unknown
LDC 14-D	County Road 19, North of County Road 12	469	72" CMP	4963.7	286	< 10 YR	< 5 YR	< 5 YR	56	274	484	2769	4363	165	381	679	2453	3636	178	416	847	2836	4274	Good Condition
LDC 15	County Road 14, West of County Road 21	439	84" CMP	4936.1	258	< 5 YR	< 5 YR	< 5 YR	47	269	491	2965	4754	170	403	721	2625	3931	170	437	882	2947	4458	Good Condition
LDC 16	County Road 21, North of County Road 14	433	72" CMP	4932.6	306	< 10 YR	< 5 YR	< 5YR	42	269	492	2996	4821	162	405	725	2646	3974	156	439	885	2960	4484	Good Condition
LDC 18	County Road 14 1/2, West of County Road 23 1/2	402	72" CMP	4891.5	388	< 5 YR	< 10 YR	< 10 YR	12	246	468	3011	4862	29	347	714	2630	3966	24	372	866	2932	4445	Good Condition - Vegetation on upstream side
LDC 30-D*	Brantner Ditch, east of County Road 19	449	--	--	--	--	--	--	56	145	490	2884	4584	175	403	735	2563	3816	187	436	883	2919	4395	--
Tributaries to Little Dry Creek																								
LDC 1	I-25 south of Country Road 6	573	60" RCP	5195.6	231	> 100 YR	> 100 YR	> 100 YR	1	4	21	98	142	1	5	21	99	142	1	5	21	101	142	Good Condition - Vegetation on downstream side
LDC 2	Stanley Ditch crossing South of County Road 6	557	30" CMP	5151.35	48	< 10 YR	< 10 YR	< 10 YR	3	12	49	234	349	21	35	62	291	420	21	35	62	293	420	Good Condition - Vegetation on upstream side, culvert goes under Brantner Ditch
LDC 3	County Road 6, East of County Road 11	538	30" CMP	5126.9	36	< 10 YR	< 2 YR	< 2 YR	7	20	81	376	548	41	71	102	468	578	41	68	102	462	578	Poor Condition - Sediment build up in pipe
LDC 4	East of County Road 11, North of County road 6	966	36" RCP	5114.89	105	< 50 YR	< 10 YR	< 10 YR	6	21	85	412	603	46	78	111	514	643	43	75	111	507	643	Condition Unknown
LDC 5	East of Country Road 11, South of Summit Blvd	533	42" RCP	5097.4	156	< 50 YR	< 50 YR	< 50 YR	12	28	107	522	767	63	109	150	602	866	58	104	150	591	866	Condition Unknown
LDC 10-D	Summit Blvd, West of Colorado Blvd	531	(3) 60" CMP	5070.5	733	< 50 YR	< 50 YR	< 50 YR	51	82	207	964	1437	118	219	308	1120	1539	105	203	308	1097	1539	Poor Condition - Vegetation on upstream side, sediment build up in pipe
LDC 13-D*	West of Country Road 19, South of Highway 52	467	(2) 24" CMP	4977.3	60	< 10 YR	< 10 YR	< 10 YR	5	15	86	482	712	10	38	93	552	766	10	39	93	552	766	Good Condition - Vegetation on upstream and downstream sides.
LDC 19	County Road 11, south of County Road 6	554	--	--	--	--	--	--	4	15	67	321	472	32	54	85	421	540	30	53	85	414	540	--
LDC 17	County Road 23, South of County Road 14 1/2	415	42" CMP	4909.3	74	< 50 YR	< 50 YR	< 50 YR	6	12	40	262	385	6	19	43	277	407	6	19	43	277	407	Good Condition - Vegetation on upstream and downstream sides.
LDC 20	County Road 11, south of Summit Blvd	551	--	--	--	--	--	--	2	8	36	160	225	13	27	40	175	241	13	27	40	172	241	--
LDC 21-D	Colorado Blvd, north of Summit Blvd	523	--	--	--	--	--	--	2	5	30	142	225	8	18	30	190	202	8	18	30	190	202	--
LDC 22-D	County Road 15, south of County Road 10	507	--	--	--	--	--	--	0	2	9	41	58	3	7	9	42	58	2	6	9	47	58	--

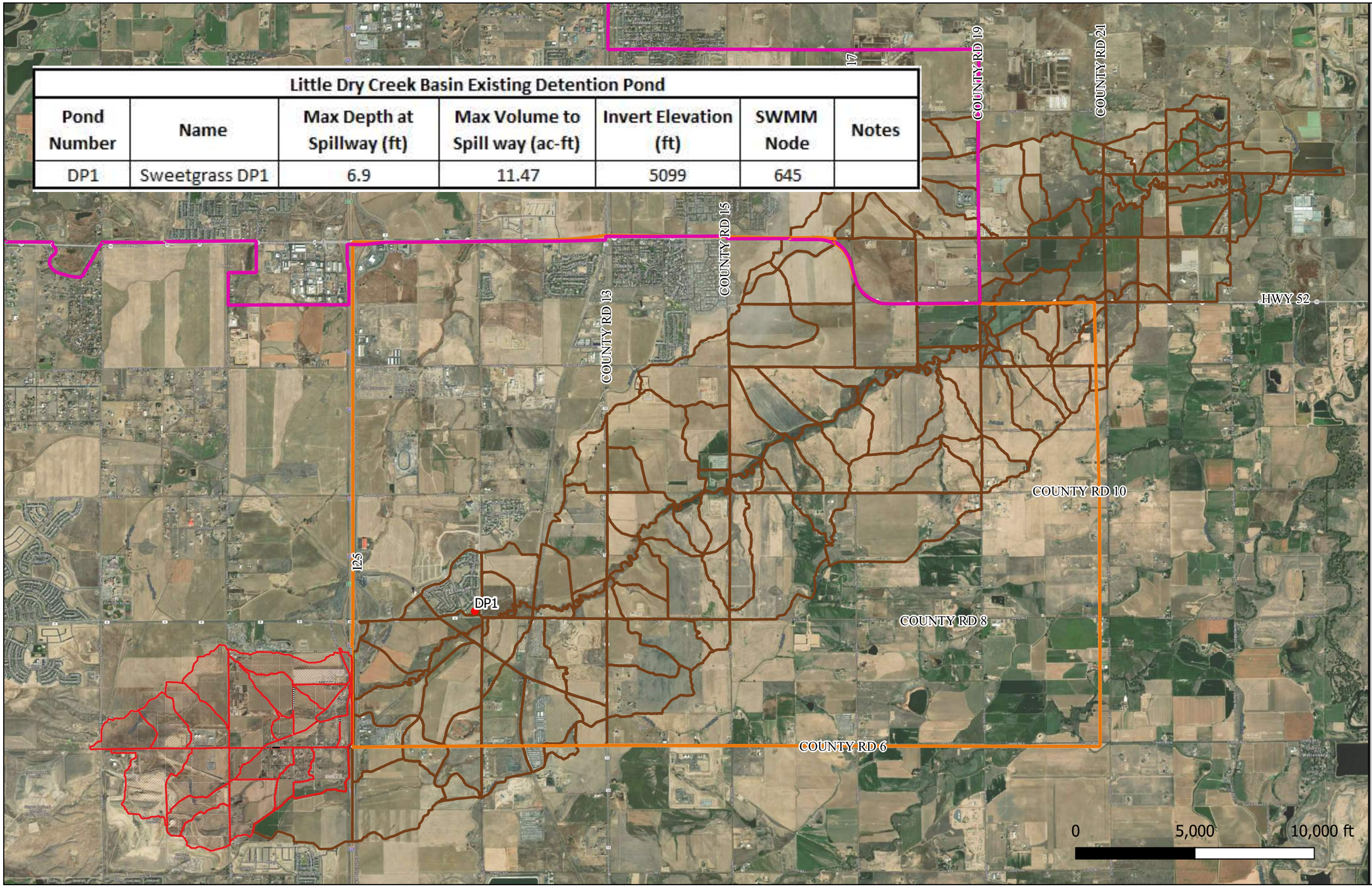
Table G.1.2: Little Dry Creek Basin Crossings

Crossing Number	Location	SWMM Node	Existing Crossing Information*			Design Storm Capacity			Existing Conditions SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)	Existing Conditions	Future Conditions with Future Conditions Upstream in Erie OSP	Future Conditions with Existing Conditions Upstream in Erie OSP	2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)																								
LDC 23-D	County Road 15, and County Road 10	502	--	--	--	--	--	--	1	4	21	101	144	2	12	24	105	149	2	12	24	109	149	--
LDC 24-D	County Road 10, east of County Road 15	501	--	--	--	--	--	--	3	8	54	263	372	8	25	54	310	372	8	25	54	310	372	--
LDC 25-D	County Road 10, west of County Road 19	462	--	--	--	--	--	--	4	9	49	235	335	6	23	49	317	335	6	23	49	317	335	--
LDC 26-D	County Road 19, north of County Road 10	461	--	--	--	--	--	--	2	3	13	67	94	0	2	13	67	94	0	2	13	67	94	--
LDC 27-D	County Road 12, east of County Road 19	460	--	--	--	--	--	--	1	2	18	100	143	0	3	17	103	143	0	3	17	103	143	--
LDC 28-D	County Road 12, east of County Road 19	459	--	--	--	--	--	--	1	2	6	69	102	0	1	6	69	101	0	1	6	46	101	--
LDC 29-D	County Road 19, south of Highway 52	472	--	--	--	--	--	--	2	7	60	493	761	18	46	90	560	805	18	46	90	560	805	--
LDC 31-F	County Road 14, and County Road 17	482	--	--	--	--	--	--	1	2	17	102	144	3	7	17	104	144	3	7	17	104	144	--
LDC 32-F	County Road 14, west of County Road 19	475	--	--	--	--	--	--	0	1	9	72	105	2	4	10	75	108	2	4	10	75	108	--
LDC 33-F	North of Highway 52, east of County Road 19	474	--	--	--	--	--	--	2	3	29	200	297	5	14	37	211	309	5	14	37	211	309	--
LDC 34-F	County Road 19, north of Highway 52	473	--	--	--	--	--	--	3	8	52	441	680	7	22	66	463	700	7	22	66	463	700	--
LDC 35-F	County Road 14, west of County Road 19	476	--	--	--	--	--	--	1	3	8	94	150	0	3	8	100	156	0	3	8	100	156	--
LDC 36-F	County Road 19, north of County Road 14	477	--	--	--	--	--	--	3	5	8	41	57	1	4	9	40	57	1	4	9	40	57	--
LDC 37-F	County Road 19, north of County Road 14	477.1	--	--	--	--	--	--	1	4	18	172	258	2	8	20	177	263	2	8	20	177	263	--
Bridges on Main Flow Path																								
LDC B1-D	Highway 52, East of County Road 19	449	110' x 15' Bridge	4954.0	--	> 100 YR	> 100 YR	> 100 YR	56	145	490	2884	4584	175	403	718	2563	3816	187	436	883	2919	4395	Bridge will not need to be replaced
LDC B2	County Road 23, South of County Road 14 1/2	413	60' x 8' Bridge	4908.0	--	< 50YR	< 50YR	< 50YR	12	131	487	3010	4851	34	391	715	2632	3966	31	420	867	2936	4450	Bridge will need to be replaced

* HY-8 program used to evaluate capacities unless noted otherwise

-D Crossings in Dacono Planning Boundary
-F Crossings in Frederick Planning Boundary
-D* Crossings not included in cost estimate for City of Dacono
Crossings without notation are located outside of the Dacono and Frederick Planning Boundaries

Little Dry Creek Basin Existing Detention Pond						
Pond Number	Name	Max Depth at Spillway (ft)	Max Volume to Spill way (ac-ft)	Invert Elevation (ft)	SWMM Node	Notes
DP1	Sweetgrass DP1	6.9	11.47	5099	645	



Legend

- Detention Pond Anticipated to Overtop in 100-Year Flow Event
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Little Dry Creek Basin Studied By Erie OSP

ICON ENGINEERING

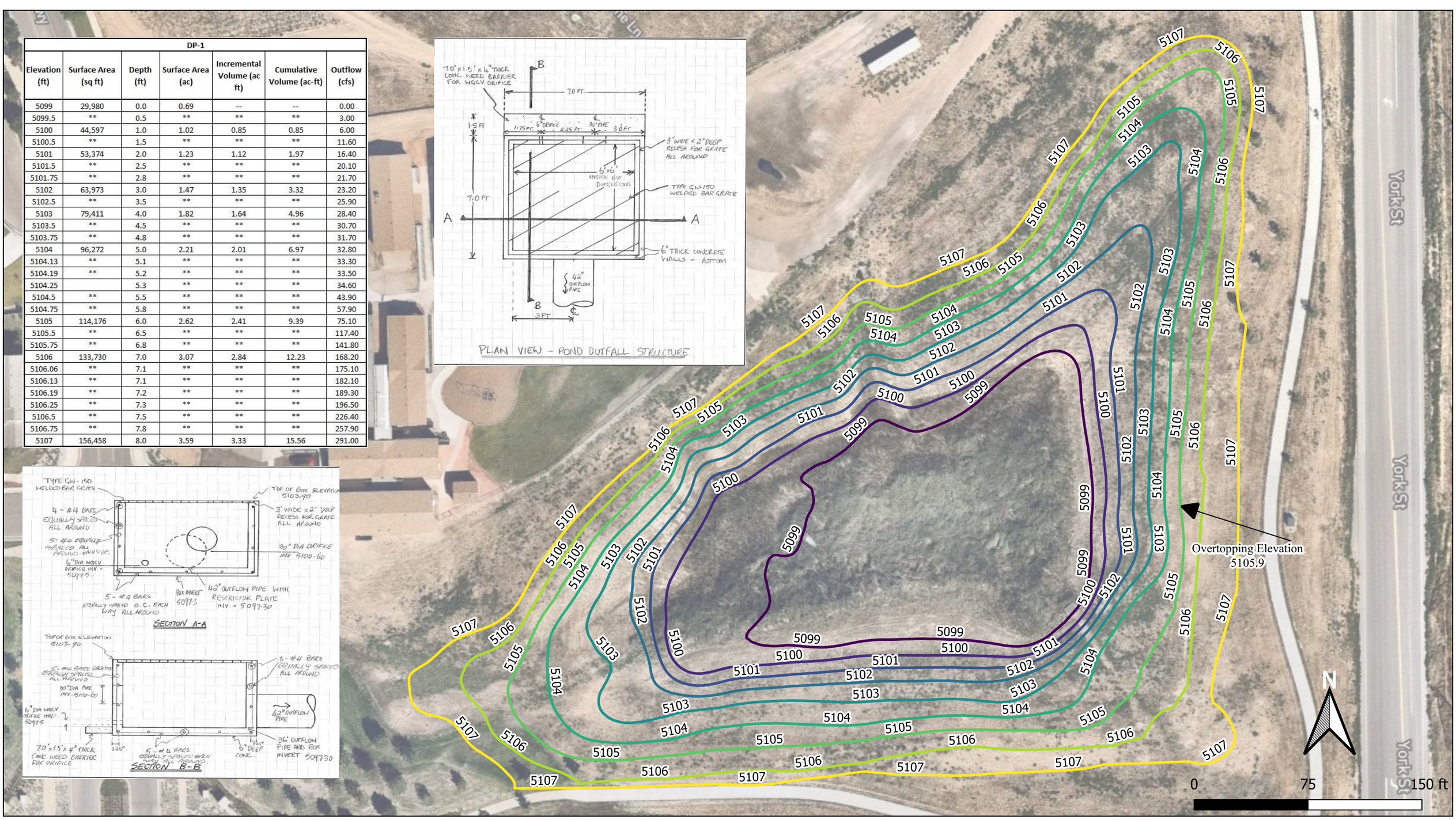
FREDERICK AND DACONO OUTFALL SYSTEMS PLAN

LITTLE DRY CREEK DETENTION POND MAP

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/02/2021	
SHEET: LDC	INDEX: POND

DP-1						
Elevation (ft)	Surface Area (sq ft)	Depth (ft)	Surface Area (ac)	Incremental Volume (ac ft)	Cumulative Volume (ac-ft)	Outflow (cfs)
5099	29,980	0.0	0.69	--	--	0.00
5099.5	**	0.5	**	**	**	3.00
5100	44,597	1.0	1.02	0.85	0.85	6.00
5100.5	**	1.5	**	**	**	11.60
5101	53,374	2.0	1.23	1.12	1.97	16.40
5101.5	**	2.5	**	**	**	20.10
5101.75	**	2.8	**	**	**	21.70
5102	63,973	3.0	1.47	1.35	3.32	23.20
5102.5	**	3.5	**	**	**	25.90
5103	79,411	4.0	1.82	1.64	4.96	28.40
5103.5	**	4.5	**	**	**	30.70
5103.75	**	4.8	**	**	**	31.70
5104	96,272	5.0	2.21	2.01	6.97	32.80
5104.13	**	5.1	**	**	**	33.30
5104.19	**	5.2	**	**	**	33.50
5104.25		5.3	**	**	**	34.60
5104.5	**	5.5	**	**	**	43.90
5104.75	**	5.8	**	**	**	57.90
5105	114,176	6.0	2.62	2.41	9.39	75.10
5105.5	**	6.5	**	**	**	117.40
5105.75	**	6.8	**	**	**	141.80
5106	133,730	7.0	3.07	2.84	12.23	168.20
5106.06	**	7.1	**	**	**	175.10
5106.13	**	7.1	**	**	**	182.10
5106.19	**	7.2	**	**	**	189.30
5106.25	**	7.3	**	**	**	196.50
5106.5	**	7.5	**	**	**	226.40
5106.75	**	7.8	**	**	**	257.90
5107	156,458	8.0	3.59	3.33	15.56	291.00

PLAN VIEW - POND OUTFALL STRUCTURE



ICON ENGINEERING

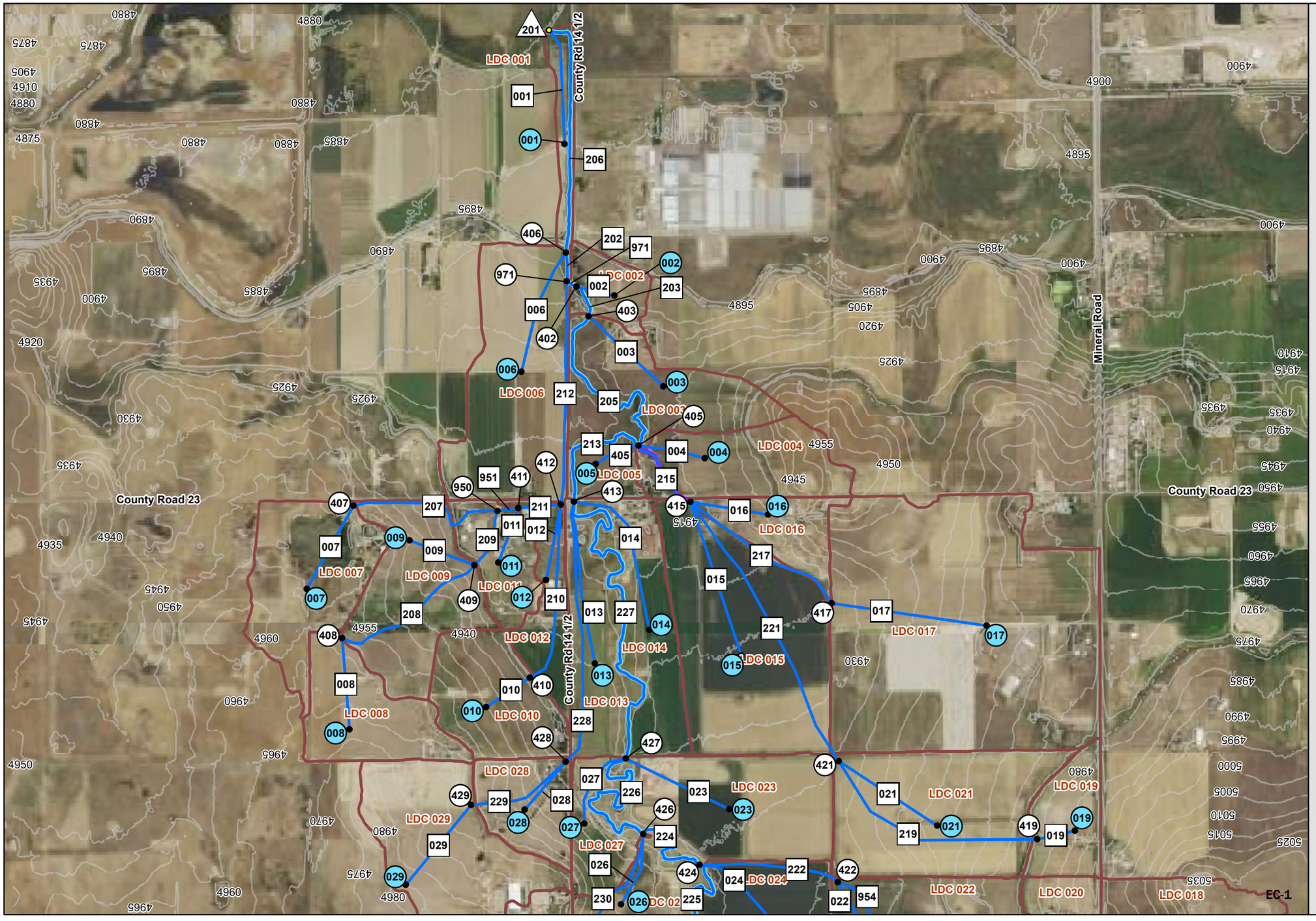
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LITTLE DRY CREEK
POND DP 1

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 9/24/2021	
SHEET: LDC	INDEX: DP1



Legend

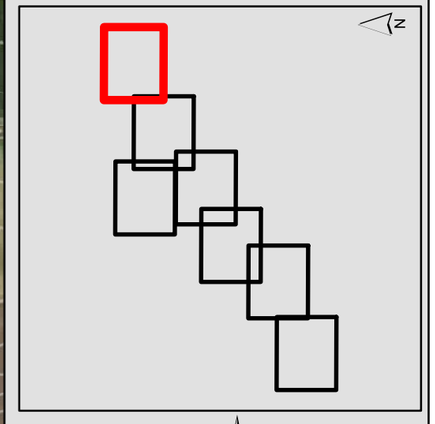
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



ICON ENGINEERING

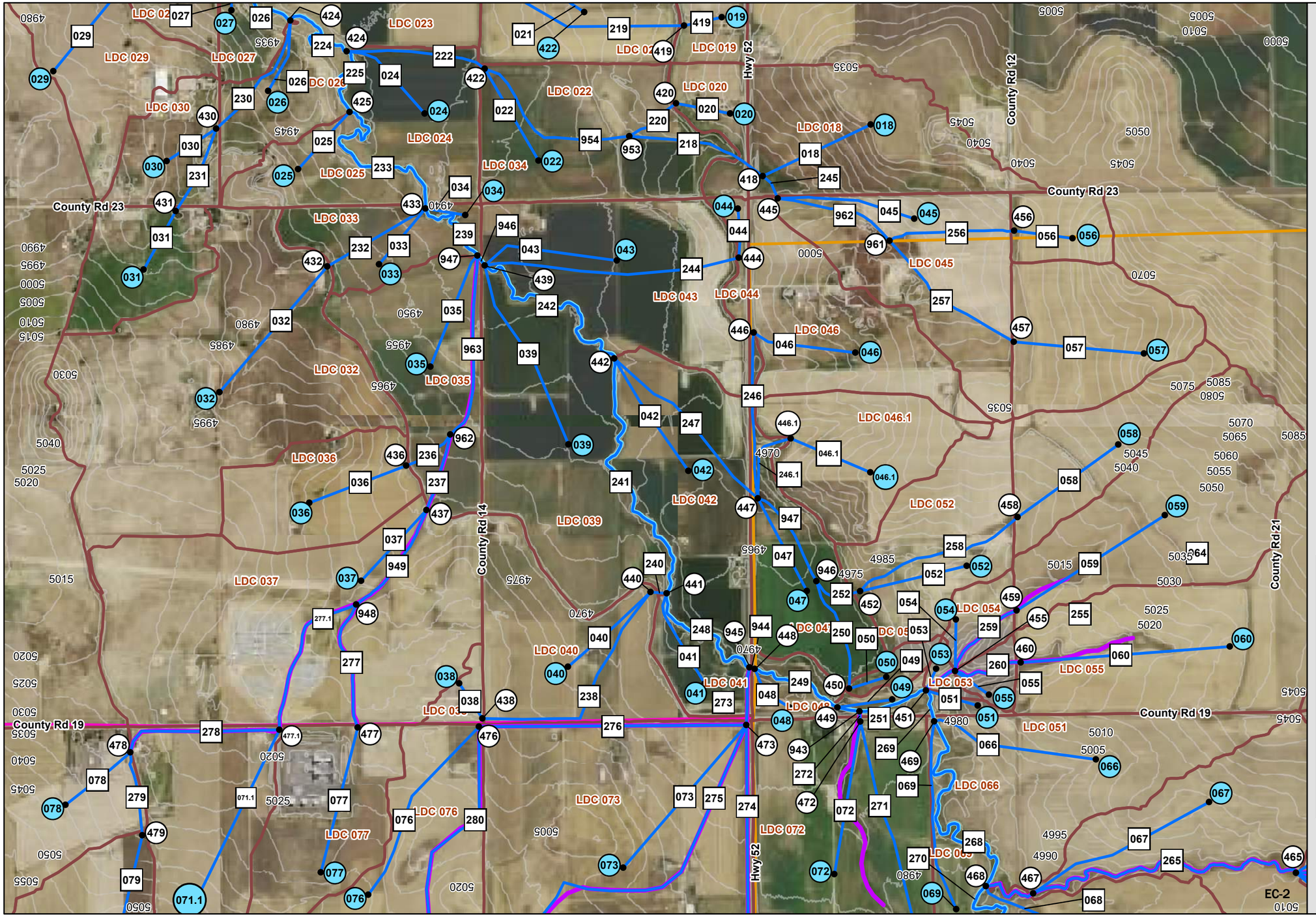
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 1 of 7



Legend

- Junction
- Outfall
- Detention Pond
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Flow Path

- Main Channel
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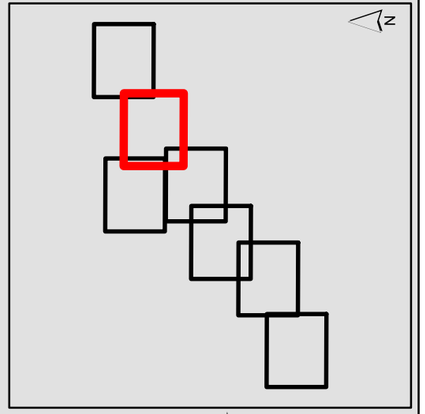
Key Map



ICON ENGINEERING

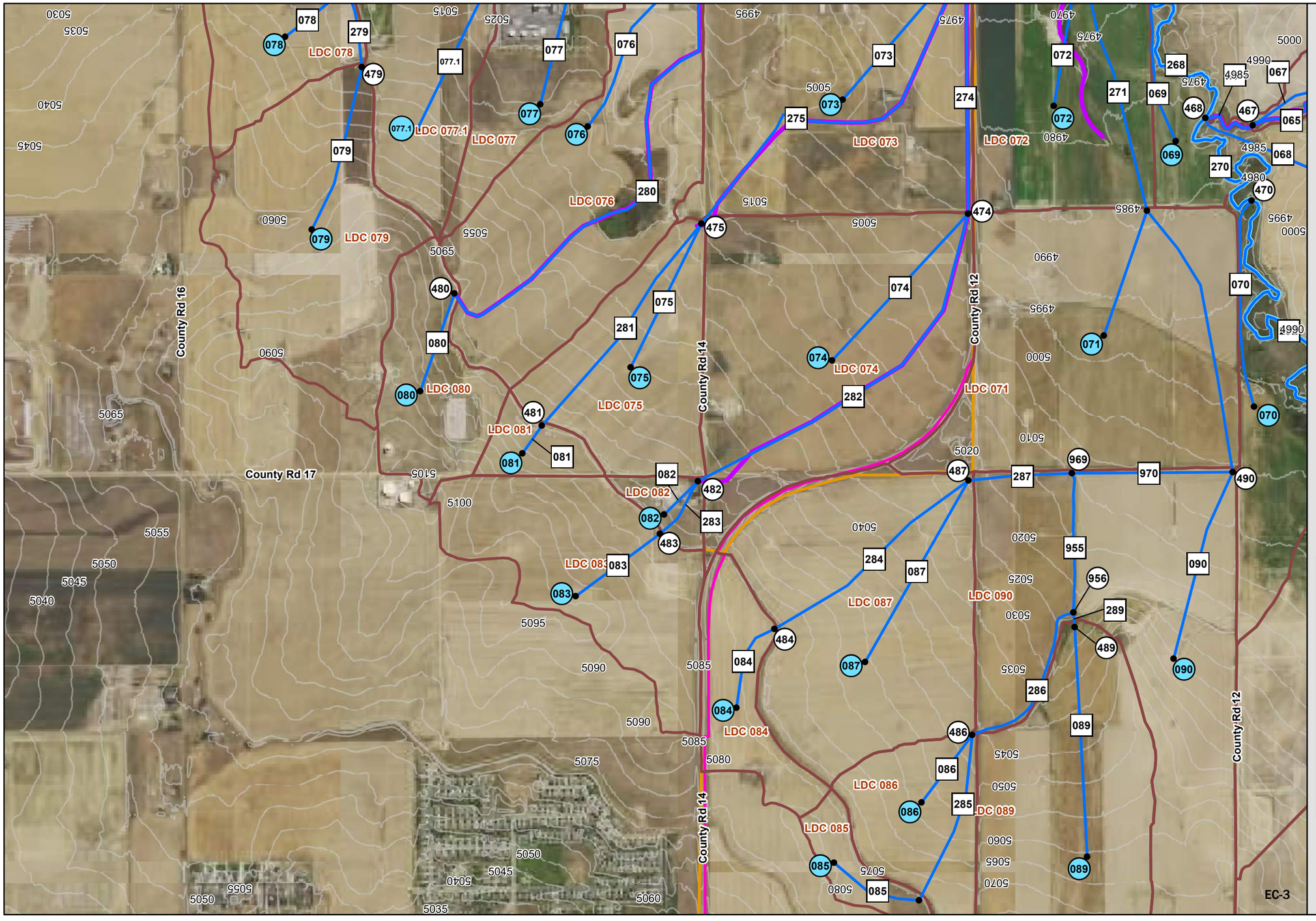
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 2 of 7



ICON ENGINEERING

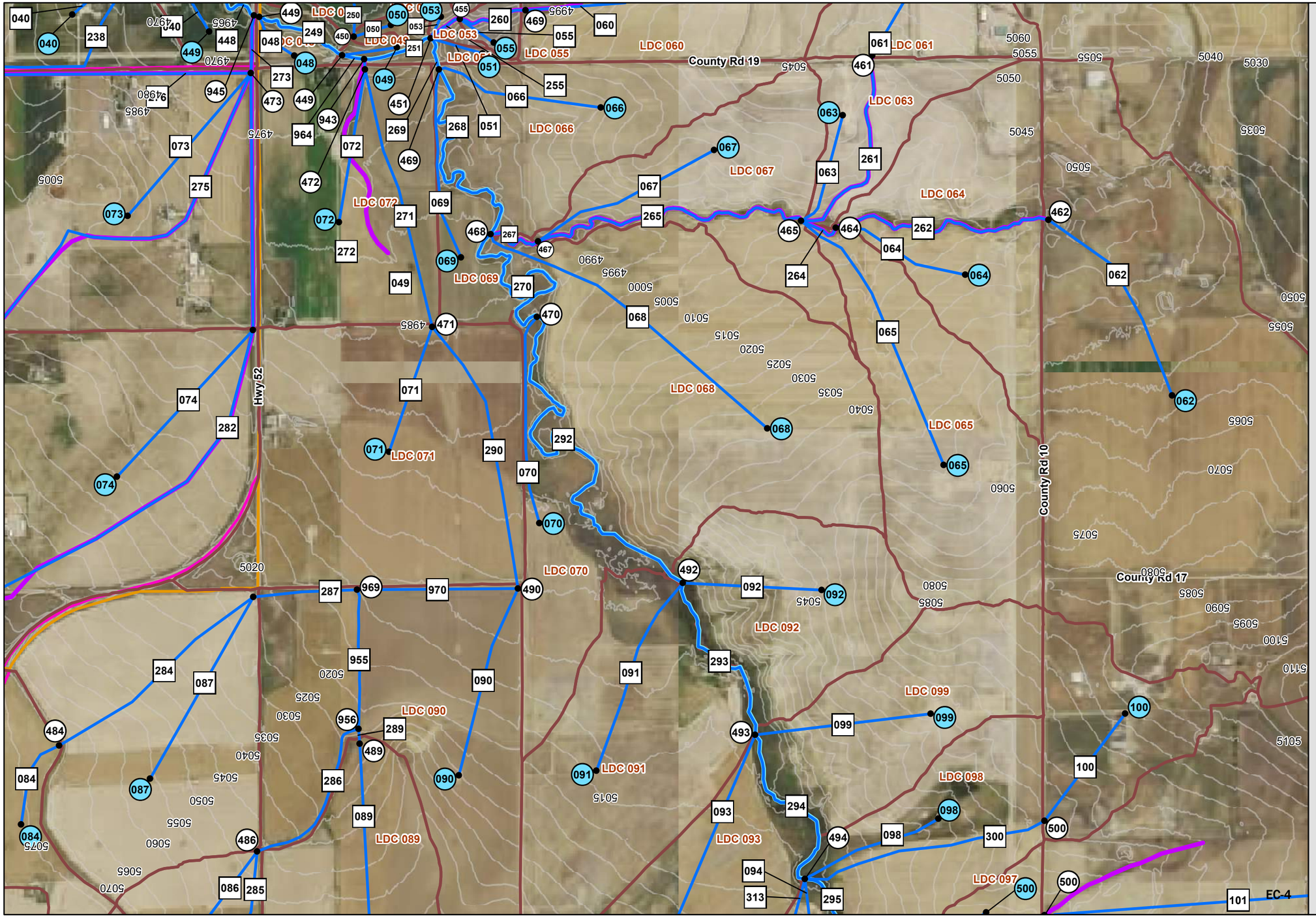
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 3 of 7



Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
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- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

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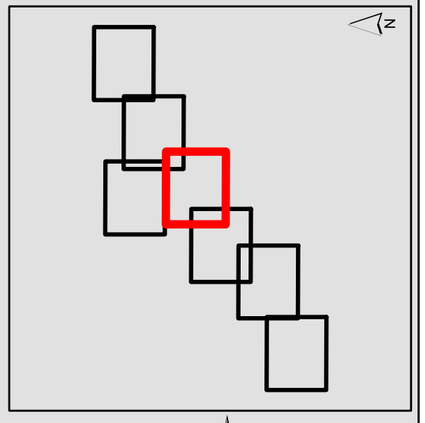
Key Map



0 500 1,000 2,000 Feet

EC-4

ICON ENGINEERING

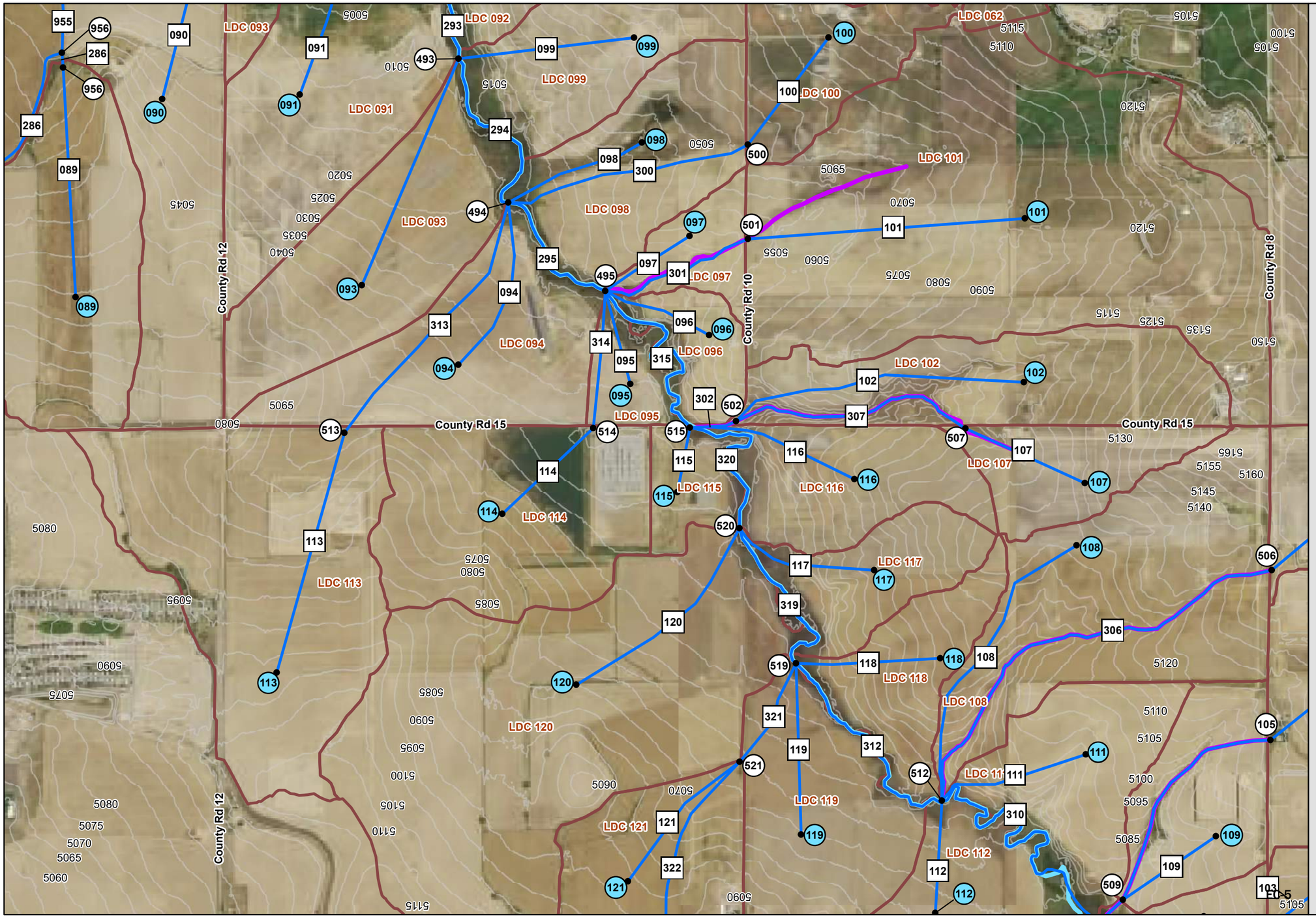
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK EXISTING CONDITION SWMM CONVEYANCE ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 4 of 7



Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
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- Subbasin
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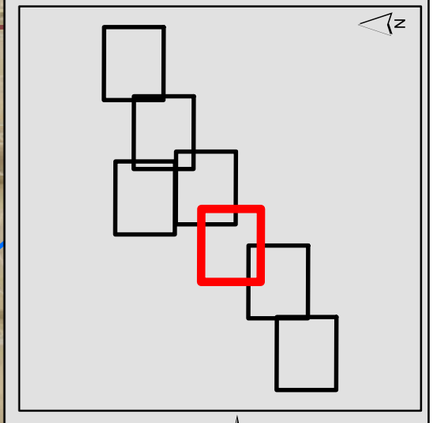
Key Map



0 500 1,000 2,000 Feet

ICON ENGINEERING

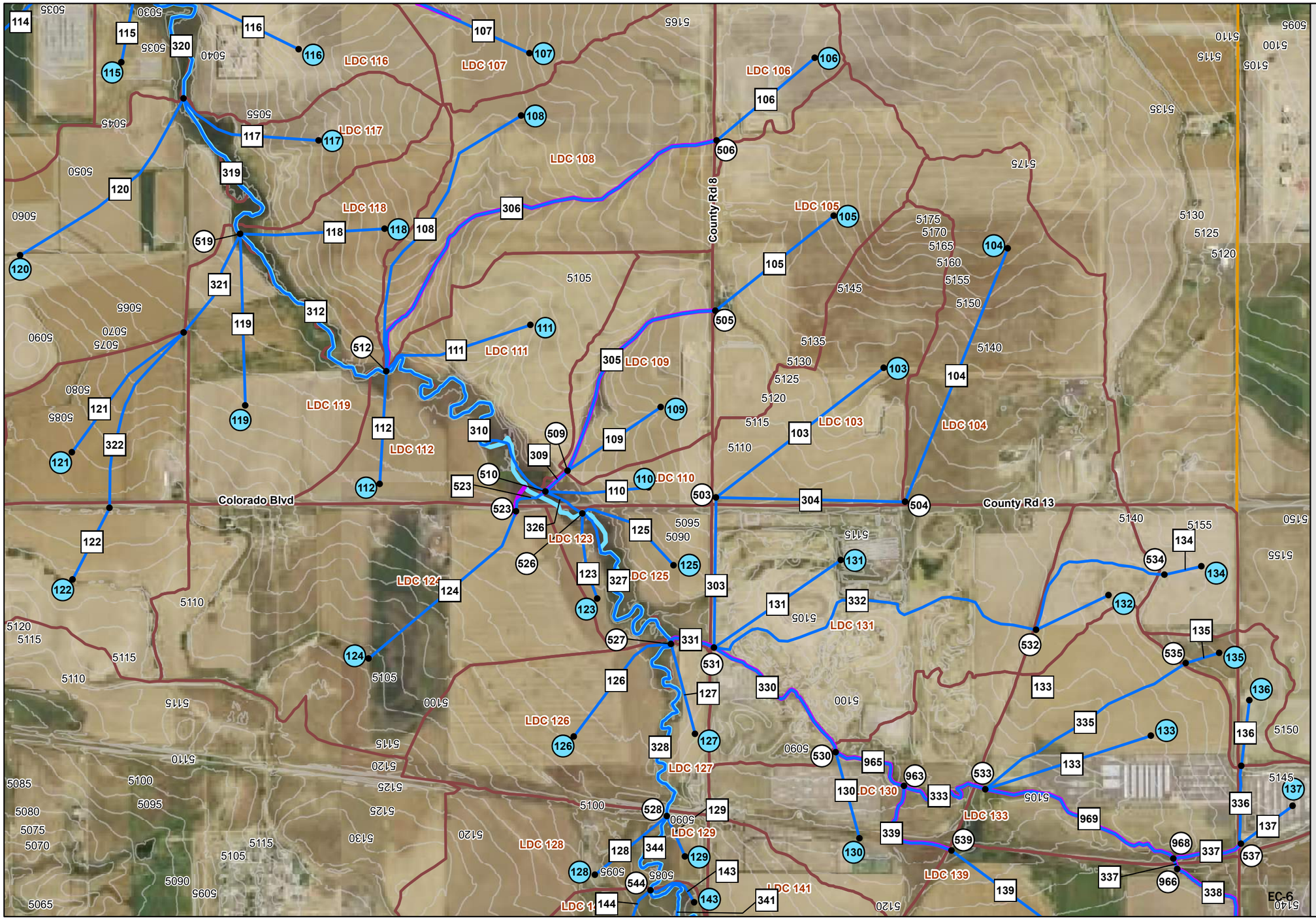
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER:	20-026
DATE:	10/25/2021
SHEET:	LDC
INDEX:	5 of 7



Legend

- Junction
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Flow Path

- Main Channel
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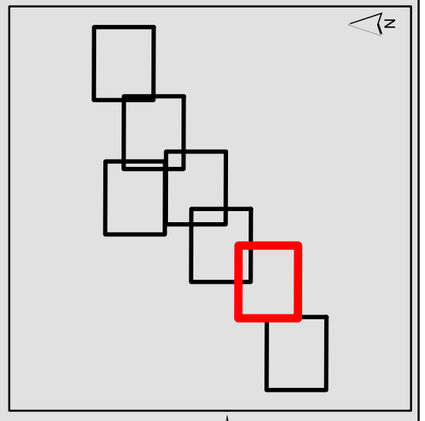
Key Map



0 500 1,000 2,000
Feet

ICON ENGINEERING

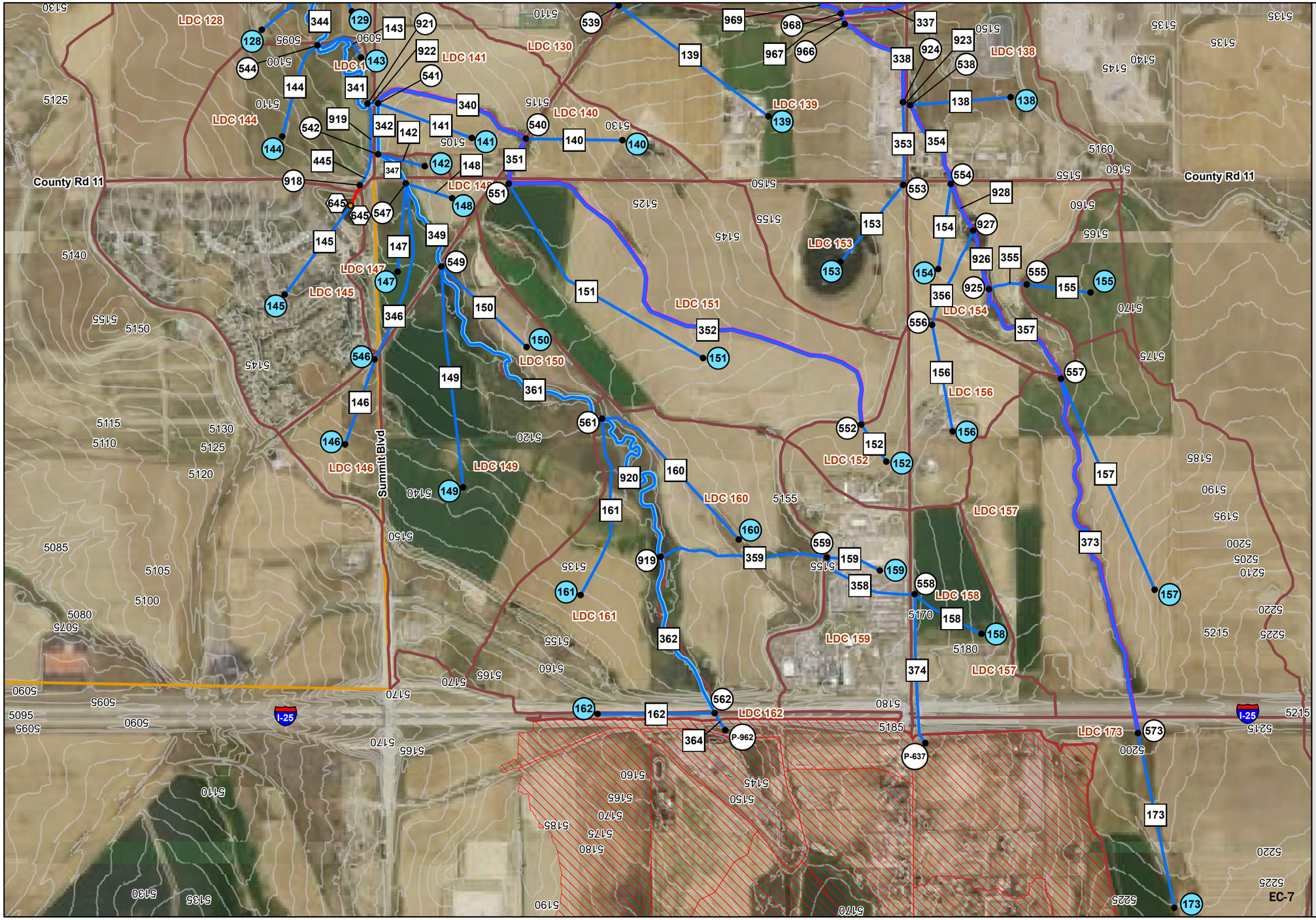
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 6 of 7



Legend

- Junction
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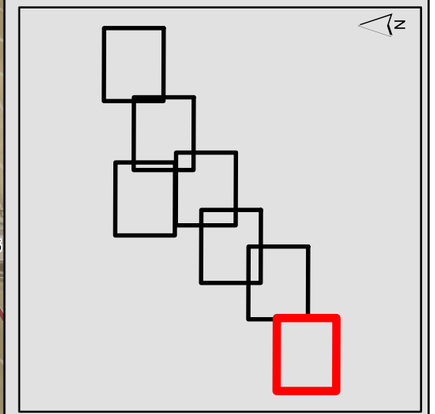
Key Map



ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: LDC	INDEX: 7 of 7

Table G.1.3: Little Dry Creek Basin Peak Discharge Existing Conditions

Location	SWMM Node	Drainage Area (acres)	Existing Conditions SWMM Model Peak Discharge (cfs)					Notes:
			2	5	10	50	100	
Main Flow Path								
County Road 11, South of Summit Blvd	547	1229	50	297	329	1385	2028	
Summit Blvd, East of County Road 11	541	1314	59	319	372	1568	2316	
East of County Road 11, North of Summit Blvd	544	2272	59	317	370	1572	2327	
Colorado Blvd, North of Summit Blvd	526	2363	63	332	472	2249	3399	
County Road 15, North of County Road 10	515	3344	60	314	485	2520	3883	
County Road 19, North of County Road 12	469	6403	56	274	484	2769	4363	
County Road 14, West of County Road 21	439	8784	47	269	491	2965	4754	
County Road 21, North of County Road 14	433	9524	42	269	492	2996	4821	
County Road 14 1/2, West of County Road 23 1/2	402	10597	12	246	468	3011	4862	
Tributaries to Little Dry Creek								
I-25 south of Country Road 6	573	168	1	4	21	98	142	
County Road 6, East of County Road 11	538	614	7	20	81	376	548	
Summit Blvd, West of Colorado Blvd	531	1384	51	82	207	964	1437	
West of Country Road 19, South of Highway 52	467	702	5	15	86	482	712	
County Road 11, south of County Road 6	554	501	4	15	67	321	472	
County Road 23, South of County Road 14 1/2	415	326	6	12	40	262	385	
County Road 11, south of Summit Blvd	551	183	2	8	36	160	225	
Colorado Blvd, north of Summit Blvd	523	185	2	5	30	142	225	
County Road 15, south of County Road 10	507	42	0	2	9	41	58	
County Road 15, and County Road 10	502	136	1	4	21	101	144	
County Road 10, east of County Road 15	501	311	3	8	54	263	372	
County Road 10, west of County Road 19	462	319	4	9	49	235	335	
County Road 19, north of County Road 10	461	56	2	3	13	67	94	
County Road 12, east of County Road 19	460	125	1	2	18	100	143	
County Road 12, east of County Road 19	459	92	1	2	6	69	102	
County Road 19, south of Highway 52	472	836	2	7	60	493	761	
County Road 14, and County Road 17	482	94	1	2	17	102	144	
County Road 14, west of County Road 19	475	84	0	1	9	72	105	
North of Highway 52, east of County Road 19	474	259	2	3	29	200	297	
County Road 19, north of Highway 52	473	251	3	8	52	441	680	
County Road 14, west of County Road 19	476	185	1	3	8	94	150	
County Road 19, north of County Road 14	477	58	3	5	8	41	57	
County Road 19, north of County Road 14	477.1	231	1	4	18	172	258	

Appendix G.2. Little Dry Creek Future Condition Documentation

TABLE G.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
LITTLE DRY CREEK																				
1	1	0.01500	9.6	0.17000	901	0.41000	2163	0.0070	12	0.40	0.05	3.33	0.0016	0.58	6.84	0.71	4.67	1.00	0.42	0.22
2	2	0.01800	11.7	0.07000	390	0.17000	921	0.0230	12	0.40	0.05	5.00	0.0007	1.00	11.01	0.94	6.01	0.98	0.49	0.24
3	3	0.06200	39.5	0.18000	940	0.45000	2385	0.0190	12	0.40	0.05	4.77	0.0012	0.81	42.20	1.07	27.28	3.63	2.30	0.91
4	4	0.05000	32.3	0.18000	975	0.40000	2097	0.0230	12	0.40	0.05	3.69	0.0018	0.55	43.80	1.36	31.44	7.83	2.90	1.61
5	5	0.01500	9.6	0.08000	401	0.13000	667	0.0170	12	0.40	0.05	3.61	0.0016	0.61	16.02	1.67	11.58	2.52	1.07	0.56
6	6	0.09500	60.9	0.27000	1445	0.50000	2644	0.0090	12	0.40	0.05	4.64	0.0015	0.71	61.64	1.01	42.11	5.53	3.59	1.73
7	7	0.06400	41.1	0.15000	814	0.31000	1623	0.0110	12	0.40	0.05	5.00	0.0007	1.00	32.80	0.80	17.81	2.86	1.46	0.74
8	8	0.04700	29.8	0.15000	767	0.24000	1262	0.0150	12	0.40	0.05	4.77	0.0012	0.82	36.93	1.24	24.22	3.25	2.07	0.80
9	9	0.06600	42.4	0.15000	796	0.29000	1539	0.0250	12	0.40	0.05	5.00	0.0007	1.00	41.19	0.97	22.47	3.65	1.84	0.91
10	10	0.04900	31.5	0.09000	478	0.21000	1114	0.0260	12	0.40	0.05	4.90	0.0009	0.92	45.30	1.44	28.16	4.12	2.44	0.82
11	11	0.02900	18.5	0.10000	502	0.24000	1241	0.0080	12	0.40	0.05	4.81	0.0011	0.85	19.70	1.06	12.49	1.69	1.05	0.37
12	12	0.03000	18.9	0.21000	1095	0.39000	2070	0.0070	12	0.40	0.05	4.59	0.0016	0.67	14.90	0.79	10.16	1.55	0.84	0.41
13	13	0.04800	30.9	0.28000	1493	0.66000	3494	0.0100	12	0.40	0.05	4.03	0.0018	0.57	25.28	0.82	17.59	3.91	1.59	0.83
14	14	0.05300	33.8	0.31000	1657	0.57000	3001	0.0070	12	0.40	0.05	3.11	0.0018	0.51	28.71	0.85	20.23	5.37	2.18	1.03
15	15	0.12100	77.4	0.29000	1531	0.56000	2951	0.0080	12	0.40	0.05	3.02	0.0018	0.50	92.68	1.20	67.22	18.61	7.63	3.54
16	16	0.02700	17.5	0.18000	930	0.27000	1439	0.0290	45	0.40	0.05	4.00	0.0018	0.57	40.60	2.32	31.35	12.85	8.86	5.91
17	17	0.23600	151.2	0.26000	1375	0.59000	3137	0.0180	25	0.40	0.05	4.49	0.0018	0.61	270.76	1.79	200.48	58.99	35.71	22.00
18	18	0.10300	65.7	0.22000	1161	0.53000	2805	0.0250	12	0.40	0.05	3.92	0.0018	0.57	96.32	1.47	69.26	16.52	6.41	3.50
19	19	0.02900	18.5	0.07000	350	0.20000	1030	0.0220	12	0.40	0.05	4.49	0.0018	0.60	35.87	1.94	26.03	5.81	2.44	1.28
20	20	0.02600	16.6	0.16000	849	0.31000	1650	0.0190	12	0.40	0.05	4.59	0.0016	0.67	18.16	1.09	12.61	2.04	1.10	0.55
21	21	0.09600	61.2	0.23000	1196	0.52000	2756	0.0130	12	0.40	0.05	4.51	0.0016	0.68	71.90	1.17	49.69	7.63	4.36	2.15
22	22	0.10900	69.8	0.27000	1439	0.51000	2668	0.0120	12	0.40	0.05	3.81	0.0014	0.68	80.40	1.15	55.68	8.91	4.95	2.43
23	23	0.08000	51.0	0.21000	1121	0.44000	2326	0.0070	12	0.40	0.05	3.05	0.0018	0.50	61.82	1.21	44.82	12.36	5.02	2.37
24	24	0.06500	41.3	0.13000	711	0.28000	1473	0.0080	12	0.40	0.05	3.00	0.0018	0.50	65.74	1.59	48.18	13.78	5.66	2.63
25	25	0.04100	26.5	0.10000	539	0.32000	1663	0.0320	12	0.40	0.05	4.26	0.0018	0.58	45.53	1.72	33.08	7.50	2.96	1.56
26	26	0.04400	28.1	0.13000	693	0.38000	2017	0.0240	12	0.40	0.05	3.73	0.0017	0.58	41.03	1.46	29.47	6.87	2.73	1.48
27	27	0.02500	15.7	0.19000	1016	0.32000	1692	0.0330	12	0.40	0.05	4.31	0.0014	0.73	16.30	1.04	11.00	1.43	0.94	0.44
28	28	0.03200	20.5	0.13000	681	0.22000	1168	0.0280	12	0.40	0.05	4.98	0.0008	0.98	19.56	0.95	11.20	1.70	0.91	0.40
29	29	0.08900	57.1	0.20000	1043	0.44000	2312	0.0130	12	0.40	0.05	4.64	0.0011	0.83	61.50	1.08	39.30	5.30	3.33	1.25
30	30	0.04200	27.1	0.12000	610	0.29000	1544	0.0230	12	0.40	0.05	4.38	0.0017	0.62	42.88	1.58	30.86	6.37	2.83	1.47
31	31	0.05000	32.2	0.14000	742	0.33000	1748	0.0230	12	0.40	0.05	4.50	0.0018	0.60	48.98	1.52	35.22	7.64	3.23	1.71
32	32	0.24500	156.7	0.29000	1536	0.63000	3314	0.0220	12	0.40	0.05	4.50	0.0017	0.63	238.42	1.52	169.54	33.15	15.33	7.89
33	33	0.04000	25.8	0.12000	635	0.21000	1109	0.0220	12	0.40	0.05	4.39	0.0018	0.59	44.80	1.74	32.55	7.36	3.06	1.63
34	34	0.00500	3.3	0.07000	373	0.11000	575	0.0100	12	0.40	0.05	3.01	0.0018	0.50	4.16	1.26	3.02	0.85	0.35	0.16
35	35	0.09000	57.7	0.23000	1209	0.50000	2660	0.0140	12	0.40	0.05	4.41	0.0018	0.59	71.95	1.25	51.11	11.01	4.62	2.46
36	36	0.06700	42.6	0.19000	990	0.37000	1971	0.0220	12	0.40	0.05	4.34	0.0018	0.59	61.75	1.45	44.19	9.73	4.06	2.17
37	37	0.25700	164.6	0.37000	1942	0.73000	3833	0.0150	15	0.40	0.05	4.42	0.0015	0.70	202.71	1.23	140.69	23.21	15.45	8.17
38	38	0.01000	6.3	0.04000	234	0.12000	637	0.0130	45	0.40	0.05	4.47	0.0018	0.60	18.67	2.96	14.27	5.86	4.12	2.73
39	39	0.14500	92.5	0.40000	2132	0.72000	3815	0.0080	12	0.40	0.05	4.29	0.0017	0.62	86.84	0.94	60.58	11.46	5.35	2.73
40	40	0.10000	63.8	0.22000	1165	0.43000	2295	0.0120	12	0.40	0.05	4.46	0.0018	0.60	85.71	1.34	60.86	12.88	5.53	2.92
41	41	0.02500	16.3	0.15000	797	0.25000	1297	0.0210	12	0.40	0.05	3.86	0.0017	0.57	21.61	1.33	15.41	3.58	1.42	0.77
42	42	0.11000	70.6	0.29000	1533	0.63000	3301	0.0070	12	0.40	0.05	3.45	0.0016	0.58	72.62	1.03	51.46	11.34	4.64	2.48
43	43	0.12600	80.6	0.28000	1492	0.47000	2458	0.0110	12	0.40	0.05	3.51	0.0015	0.62	102.17	1.27	72.15	14.68	6.55	3.41
44	44	0.00900	5.7	0.02000	82	0.12000	628	0.0110	13	0.40	0.05	5.00	0.0007	1.00	7.53	1.32	4.14	0.75	0.39	0.18
45	45	0.10700	68.5	0.36000	1902	0.69000	3645	0.0150	12	0.40	0.05	4.51	0.0018	0.61	69.31	1.01	48.87	9.86	4.31	2.25
46	46	0.09100	58.1	0.20000	1055	0.52000	2754	0.0210	12	0.40	0.05	4.23	0.0017	0.62	79.46	1.37	56.23	11.21	5.12	2.66
46.1	46.1	0.07800	49.7	0.13000	666	0.40000	2102	0.0600	12	0.40	0.05	3.86	0.0018	0.56	102.13	2.05	74.61	18.87	7.15	3.89
47	47	0.07100	45.5	0.20000	1030	0.43000	2263	0.0070	12	0.40	0.05	3.11	0.0018	0.52	55.84	1.23	40.37	10.81	4.17	2.09
48	48	0.01800	11.8	0.09000	452	0.20000	1051	0.0100	12	0.40	0.05	4.01	0.0018	0.57	16.27	1.38	11.63	2.75	1.07	0.59
49	49	0.01000	6.4	0.10000	543	0.21000	1122	0.0130	12	0.40	0.05	3.10	0.0018	0.51	7.23	1.13	5.24	1.42	0.57	0.28
50	50	0.00900	5.6	0.10000	549	0.21000	1123	0.0180	12	0.40	0.05	3.10	0.0018	0.51	6.36	1.14	4.61	1.25	0.50	0.24
51	51	0.00500	3.0	0.07000	392	0.18000	955	0.0350	12	0.40	0.05	3.04	0.0018	0.51	3.72	1.24	2.70	0.75	0.31	0.15
52	52	0.08400	54.0	0.31000	1619	0.59000	3140	0.0210	12	0.40	0.05	3.43	0.0018	0.54	63.02	1.17	45.24	11.20	4.13	2.29
53	53	0.00500	3.2	0.04000	207	0.12000	639	0.0410	12	0.40	0.05	3.01	0.0018	0.50	5.93	1.85	4.40	1.27	0.52	0.24
54	54	0.01700	11.0	0.10000	552	0.23000	1189	0.0320	12	0.40	0.05	4.52	0.0014	0.74	14.13	1.28	9.66	1.27	0.84	0.39
55	55	0.01000	6.6	0.08000	405	0.14000	760	0.0360	15	0.40	0.05	3.06	0.0018	0.51	11.58	1.75	8.59	2.55	1.11	0.59
56	56	0.02600	16.4	0.10000	524	0.21000	1117	0.0440	12	0.40	0.05	4.57	0.0016	0.67	27.84	1.70	19.82	3.35	1.79	0.89
57	57	0.08200	52.7	0.16000	858	0.39000	2036	0.0300	12	0.40	0.05	4.59	0.0016	0.67	84.46	1.60	59.87	9.80	5.38	2.66
58	58	0.06300	40.3	0.19000	1023	0.51000	2675	0.0290	12	0.40	0.05	4.61	0.0015	0.69	49.74	1.23	34.33	5.05	3.02	1.48
59	59	0.14400	92.2	0.36000	1901	0.67000	3513	0.0240	12	0.40	0.05	4.45	0.0016	0.67	108.47	1.18	75.25	12.07	6.62	3.29
60	60	0.19500	125.1	0.41000	2186	0.86000	4558	0.0230	12	0.40	0.05	3.48	0.0017	0.56	152.46	1.22	109.18	26.32	9.98	5.48
61	61	0.08800	56.3	0.15000	796	0.41000	2158	0.0280	12	0.40	0.05	4.06	0.0018	0.58	97.99	1.74	71.22	16.72	6.68	3.59
62	62	0.49900	319.1	0.55000	2906	1.23000	6478	0.0120	29	0.40	0.05	3.37	0.0018	0.52	441.59	1.38	327.42	110.17	62.28	38.92
63	63	0.05800	37.0	0.25000	1300	0.57000	3015	0.0170	17	0.40	0.05	3.00	0.0018	0.50	43.22	1.17	31.64	9.48	4.50	2.37
64	64	0.15100	96.7	0.27000	1434	0.67000	3532	0.0160	21	0.40	0.05	3.34	0.0018	0.52	144.93	1.50	106.66	33.29	16.56	10.12
65	65	0.17200	110.0	0.52000	2772	0.89000	4708	0.0180	29	0.40	0.05	3.63	0.0018	0.54	145.74	1.32	107.86	35.76	20.59	13.04
66	66	0.12300	78.4	0.26000	1379	0.86000	4542	0.0170	17	0.40	0.05	3.00	0.0018	0.50	100.05	1.28	73.27	22.08	10.48	5.52
67	67	0.12900	82.4	0.41000	2166	0.69000	3659	0.0180	20	0.40	0.05	3.00	0.0018	0.50	102.87	1.25	75.70	23.80	12.09	6.71
68	68	0.31900	204.4	0.44000	2309	0.99000	5216	0.0180	26	0.40	0.05	3.09	0.0018	0.51	300.86	1.47	223.94	76.55	42.89	25.83
69	69	0.03900	24.7	0.33000	1765	0.49000	2597	0.0090	13	0.40	0.05	3.04	0.0018	0.50	20.48	0.83	14.44	3.98	1.73	0.83
70	70	0.08400	53.6	0.48000	2545	0.86000	4565	0.0090	18	0.40	0.05	3.52	0.0018	0.53	42.12	0.79	29.70	8.27	3.94	2.31
71	71	0.26800	171.5	0.32000	1692	0.72000	3807	0.0130	27	0.40	0.05	3.18	0.0018	0.51	289.13	1.69	215.48	73.71	41.58	25.68
72	72	0.17100	109.5	0.27000	1417	0.55000	2895	0.0080	29	0.40	0.05	3.19	0.0018	0.51	189.70	1.73	142.22	50.08	28.87	17.81
73	73	0.26200	167.4	0.31000	1627	0.78000	4093	0.0150	12	0.40	0.05	4.07	0.0018	0.57	228.81	1.37	163.69	37.91	15.01	8.12
74	74	0.25800	165.2	0.42000	2230	0.88000	4634	0.0180	12	0.40	0.05	3.79	0.0018	0.55	204.20	1.24	146.40	35.43	13.56	7.47
75	75	0.11000	70.5	0.29000	1514	0.49000	2581	0.0160	12	0.40	0.05	4.44	0.0018	0.60	90.51	1.28	64.30	13.83	5.82	3.10
76	76	0.21400	136.9	0.55000	2909	0.92000	4874	0.0140	12	0.40	0.05	4.68	0.0014	0.75	116.35	0.85	77.14	9.93	6.43	2.92
77	77	0.09100	58.2	0.34000	1802	0.72000	3782	0.0160	20	0.40	0.05	4.16	0.0016	0.63	60.79	1.04	43.46	10.47	6.18	3.65
77.1	77.1	0.10400	66.3	0.24000	1291	0.58000	3042	0.0200	12	0.40	0.05	3.00	0.0018	0.50	92.48	1.39	67.16	18.95	7.79	3.63
78	78	0.08100	51.7	0.18000	956	0.44000	2300	0.0160	12	0.40	0.05	4.51	0.0016	0.65	69.85	1.35	49.06	8.73	4.37	2.21
79	79	0.17700	113.3	0.34000	1792	0.72000	3783	0.0170	12	0.40	0.05	4.52	0.0016	0.67	133.96	1.18	93.02	14.98	8.10	4.02
80	80	0.07500	48.0	0.20000	1031	0.43000	2250	0.0200	12	0.40	0.05	4.50	0.0018	0.60	66.84	1.39	47.61	10.24	4.34	2.30
81	81	0.02200	14.2	0.06000	291	0.18000	937	0.0360	12	0.40	0.05	4.49	0.0018	0.60	29.97	2.11	21.75	4.90	2.07	1.07
82	82	0.01600	10.5	0.07000	392	0.20000	1061	0.0150	12	0.40	0.05	3.05	0.0018	0.50	16.39	1.56	12.01	3.40	1.38	0.65
83	83	0.13200	84.3	0.16000	839	0.48000	2536	0.0130	12	0.40	0.05	4.12	0.0018	0.57	138.21	1.64	100.03	23.43	9.29	5.01
84	84	0.05800	36.9	0.15000	772	0.32000	1708	0.0070	80	0.40	0.05	4.11	0.0018	0.57	128.09	3.47	103.03	56.15	44.41	32.11
85	85	0.02400	15.2	0.15000	818	0.29000	1557	0.0060	67	0.40	0.05	4.34	0.0018	0.59	36.05	2.37	28.71	14.03	10.74	7.59
86	86	0.07200	46.1	0.18000	960	0.39000	2044	0.0130	76	0.40	0.05	4.22	0.0018	0.58	159.82	3.47	127.89	67.90	53.19	38.09
87	87	0.22400	143.5	0.42000	2205	0.64000	3370	0.0150	78	0.40	0.05	4.17	0.0018	0.58	473.70	3.30	381.28	203.74	160.43	115.55
89	89	0.19000	121.8	0.40000	2087	0.72000	3776	0.0180	33	0.40	0.05	4.25	0.0018	0.58	212.03	1.74	158.67	54.10	34.19	21.81
90	90	0.29900	191.1	0.43000	2295	1.01000	5314	0.0150	31	0.40	0.05	3.90	0.0018	0.56	296.57	1.55	220.50	74.51	45.01	28.68
91	91	0.19800	126.9	0.37000	1960	0.85000	4493	0.0130	25	0.40	0.05	3.65	0.0018	0.54	169.09	1.33	124.56	39.29	21.32	13.52
92	92	0.12800	81.9	0.19000	986	0.54000	2838	0.0250	26	0.40	0.05	3.37	0.0018	0.53	162.95	1.99	122.14	41.77	22.77	14.47
93	93	0.16000	102.4	0.42000	2200	0.86000	4553	0.0150	30	0.40	0.05	3.28	0.0018	0.52	145.60	1.42	108.34	37.49	21.66	13.52
94	94	0.14900	95.1	0.25000	1295	0.75000	3965	0.0170	36	0.40	0.05	3.22	0.0018	0.51	193.62	2.04	147.77	56.66	34.99	22.48
95	95	0.03100	19.8	0.16000	863	0.26000	1378	0.0140	33	0.40	0.05	3.46	0.0018	0.53	35.55	1.80	26.94	9.76	5.81	3.77
96	96	0.04100	26.0	0.19000	1016	0.29000	1541	0.0270	40	0.40	0.05	3.00	0.0018	0.50	61.25	2.36	47.27	19.51	12.57	8.12
97	97	0.03800	24.2	0.21000	1093	0.36000	1913	0.0230	42	0.40	0.05	3.23	0.0018	0.52	50.73	2.10	39.23	16.06	10.51	6.95
98	98	0.12200	77.9	0.28000	1482	0.49000	2570	0.0190	29	0.40	0.05	3.82	0.0018	0.55	140.29	1.80	105.04	35.22	20.61	12.99
99	99	0.13300	84.9	0.35000	1847	0.72000	3823	0.0210	28	0.40	0.05	3.86	0.0018	0.56	124.98	1.47	92.13	29.71	17.11	10.95
100	100	0.09300	59.8	0.19000	1013	0.48000	2536	0.0170	43	0.40	0.05	3.37	0.0018	0.52	149.23	2.50	114.97	47.73	31.27	20.82
101	101	0.48700	311.6	0.53000	2779	1.16000	6125	0.0210	28	0.40	0.05	3.31	0.0018	0.52	486.32	1.56	361.46	122.96	69.27	43.35
102	102	0.14600	93.7	0.53000	2783	0.99000	5204	0.0250	25	0.40	0.05	3.00	0.0018	0.50	111.99	1.20	83.10	28.08	15.77	9.28
103	103	0.14500	92.5	0.33000	1746	0.75000	3942	0.0170	38	0.40	0.05	3.02	0.0018	0.50	178.60	1.93	136.75	53.97	34.33	21.86
104	104	0.21000	134.1	0.35000	1851	0.75000	3948	0.0150	30	0.40	0.05	3.02	0.0018	0.50	232.45	1.73	174.82	63.20	37.31	22.64
105	105	0.15800	101.0	0.19000	1008	0.44000	2305	0.0230	34	0.40	0.05	3.00	0.0018	0.50	272.70	2.70	207.38	81.29	48.72	30.71
106	106	0.05700	36.6	0.33000	1720	0.47000	2485	0.0100	30	0.40	0.05	3.00	0.0018	0.50	46.65	1.27	34.84	12.31	7.28	4.38
107	107	0.06600	42.3	0.19000	1027	0.52000	2748	0.0300	34	0.40	0.05	3.00	0.0018	0.50	86.76	2.05	66.36	25.43	15.63	7.82
108	108	0.22800	145.8	0.55000	2914	0.99000	5220	0.0220	34	0.40	0.05	3.00	0.0018	0.50	236.40	1.62	178.49	67.38	41.74	19.01
109	109	0.09300	59.2	0.34000	1789	0.52000	2734	0.0200	30	0.40	0.05	3.58	0.0018	0.54	93.23	1.57	69.38	23.76	13.74	8.79
110	110	0.02600	16.6	0.20000	1043	0.37000	1968	0.0230	27	0.40	0.05	3.81	0.0018	0.55	21.26	1.28	15.57	4.97	2.83	1.81
111	111	0.10800	68.9	0.27000	1405	0.50000	2662	0.0260	29	0.40	0.05	3.00	0.0018	0.50	128.03	1.86	96.66	34.50	19.94	10.91
112	112	0.07000	44.8	0.15000	809	0.39000	2076	0.0170	37	0.40	0.05	3.00	0.0018	0.50	106.75	2.38	81.94	32.86	20.58	6.91
113	113	0.27400	175.2	0.29000	1517	0.75000	3959	0.0140	47	0.40	0.05	3.25	0.0018	0.52	467.85	2.67	363.31	157.99	106.78	71.97
114	114	0.17400	111.1	0.35000	1825	0.59000	3091	0.0170	46	0.40	0.05	3.63	0.0018	0.54	272.91	2.46	211.08	88.57	60.08	40.38
115	115	0.03500	22.6	0.11000	607	0.19000	998	0.0180	40	0.40	0.05	3.36	0.0018	0.52	63.06	2.79	48.18	19.75	12.59	8.28
116	116	0.09500	60.6	0.31000	1630	0.65000	3454	0.0250	36	0.40	0.05	3.00	0.0018	0.50	111.44	1.84	84.99	32.87	20.60	7.93
117	117	0.07200	46.1	0.27000	1421	0.53000	2816	0.0270	43	0.40	0.05	3.00	0.0018	0.50	100.11	2.17	77.60	32.40	21.44	6.57
118	118	0.07900	50.4	0.23000	1226	0.56000	2943	0.0230	47	0.40	0.05	3.01	0.0018	0.50	120.56	2.39	93.85	40.86	27.65	6.57
119	119	0.13000	83.1	0.30000	1581	0.54000	2827	0.0190	50	0.40	0.05	3.14	0.0018	0.51	219.12	2.64	170.75	76.18	52.30	18.57
120	120	0.40400	258.6	0.47000	2458	0.94000	4964	0.0160	46	0.40	0.05	3.45	0.0018	0.53	598.98	2.32	464.05	195.62	132.25	87.99
121	121	0.09700	61.9	0.25000	1301	0.49000	2579	0.0150	49	0.40	0.05	3.43	0.0018	0.53	154.88	2.50	120.50	52.68	36.21	24.59
122	122	0.11900	76.3	0.14000	765	0.46000	2428	0.0190	31	0.40	0.05	3.05	0.0018	0.50	183.42	2.40	139.01	51.82	30.09	18.59

TABLE G.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
LITTLE DRY CREEK																				
123	123	0.02200	14.1	0.14000	735	0.29000	1557	0.0050	15	0.40	0.05	3.46	0.0018	0.54	14.15	1.01	10.22	2.72	1.12	0.65
124	124	0.28900	185.0	0.50000	2661	0.81000	4276	0.0110	43	0.40	0.05	3.22	0.0018	0.51	367.46	1.99	282.64	115.89	76.47	50.72
125	125	0.04700	30.2	0.20000	1038	0.29000	1542	0.0210	50	0.40	0.05	3.85	0.0018	0.56	80.73	2.67	62.62	27.55	19.43	13.18
126	126	0.12300	78.6	0.28000	1503	0.58000	3060	0.0150	38	0.40	0.05	3.10	0.0018	0.51	160.75	2.05	123.31	48.67	30.83	19.77
127	127	0.02700	17.3	0.17000	893	0.34000	1801	0.0200	33	0.40	0.05	3.31	0.0018	0.52	28.68	1.66	21.61	7.86	4.71	3.01
128	128	0.12900	82.3	0.38000	2003	0.61000	3246	0.0180	39	0.40	0.05	3.35	0.0018	0.52	160.59	1.95	123.02	48.45	30.92	20.42
129	129	0.01400	8.8	0.08000	415	0.14000	747	0.0150	25	0.40	0.05	3.00	0.0018	0.50	16.32	1.85	12.34	4.30	2.39	1.41
130	130	0.13600	87.1	0.10000	549	0.38000	2013	0.0200	80	0.40	0.05	3.27	0.0018	0.52	430.41	4.94	355.01	194.29	152.34	108.08
131	131	0.26700	170.8	0.31000	1629	0.76000	4025	0.0160	80	0.40	0.05	3.43	0.0018	0.53	617.44	3.61	498.66	272.03	213.40	154.07
132	132	0.04400	28.0	0.13000	687	0.25000	1327	0.0130	79	0.40	0.05	3.51	0.0018	0.53	107.09	3.82	86.07	47.35	37.19	26.88
133	133	0.18800	120.1	0.28000	1472	0.53000	2783	0.0140	80	0.40	0.05	3.02	0.0018	0.50	459.48	3.83	371.53	205.21	160.61	116.10
134	134	0.04500	28.7	0.09000	489	0.47000	2463	0.0160	80	0.40	0.05	3.43	0.0018	0.53	105.96	3.69	85.27	46.93	36.87	26.73
135	135	0.01300	8.5	0.12000	649	0.18000	976	0.0180	80	0.40	0.05	3.00	0.0018	0.50	27.85	3.28	22.42	12.31	9.64	6.99
136	136	0.02100	13.3	0.15000	784	0.27000	1445	0.0090	80	0.40	0.05	3.01	0.0018	0.50	37.63	2.83	30.42	16.54	12.97	9.39
137	137	0.02800	18.1	0.11000	585	0.24000	1245	0.0100	78	0.40	0.05	3.00	0.0018	0.50	64.03	3.54	51.46	28.16	21.92	15.86
138	138	0.10500	67.2	0.14000	765	0.44000	2324	0.0150	80	0.40	0.05	3.00	0.0018	0.50	275.17	4.10	222.59	123.19	96.32	69.79
139	139	0.17900	114.3	0.28000	1474	0.77000	4054	0.0080	80	0.40	0.05	3.00	0.0018	0.50	364.92	3.19	295.37	160.88	125.99	91.04
140	140	0.03900	25.0	0.13000	701	0.35000	1868	0.0200	80	0.40	0.05	3.00	0.0018	0.50	90.82	3.63	73.12	40.35	31.55	22.90
141	141	0.09300	59.2	0.15000	794	0.37000	1951	0.0160	80	0.40	0.05	3.00	0.0018	0.50	244.79	4.13	198.24	109.52	85.63	62.13
142	142	0.00600	3.8	0.07000	353	0.15000	791	0.0210	80	0.40	0.05	3.41	0.0018	0.53	12.93	3.40	10.41	5.73	4.51	3.27
143	143	0.00600	3.9	0.09000	468	0.12000	649	0.0120	14	0.40	0.05	3.01	0.0018	0.50	4.81	1.23	3.51	1.01	0.45	0.22
144	144	0.08200	52.4	0.12000	648	0.36000	1878	0.0300	34	0.40	0.05	3.63	0.0018	0.54	143.27	2.73	108.02	40.50	24.65	15.79
145	145	0.16400	105.2	0.24000	1267	0.53000	2809	0.0180	50	0.40	0.05	3.72	0.0018	0.55	313.19	2.98	242.90	107.11	75.16	50.79
146	146	0.03400	21.7	0.18000	945	0.28000	1503	0.0190	80	0.40	0.05	3.35	0.0018	0.52	73.44	3.38	59.10	32.37	25.38	18.40
147	147	0.03500	22.6	0.15000	769	0.33000	1734	0.0150	53	0.40	0.05	3.02	0.0018	0.50	59.23	2.62	46.39	21.49	15.10	10.26
148	148	0.01400	8.7	0.10000	503	0.16000	828	0.0210	43	0.40	0.05	3.77	0.0018	0.55	21.82	2.51	16.74	6.88	4.62	3.06
149	149	0.20700	132.2	0.41000	2159	0.75000	3985	0.0170	66	0.40	0.05	3.02	0.0018	0.50	386.93	2.93	308.46	155.20	116.07	81.43
150	150	0.03800	24.1	0.17000	884	0.35000	1848	0.0160	54	0.40	0.05	4.19	0.0018	0.58	59.86	2.48	46.71	20.81	15.14	10.35
151	151	0.25200	161.1	0.30000	1570	0.83000	4373	0.0100	81	0.40	0.05	3.00	0.0018	0.50	546.83	3.39	442.71	243.58	191.46	138.83
152	152	0.03500	22.2	0.05000	250	0.20000	1050	0.0100	59	0.40	0.05	3.00	0.0018	0.50	89.97	4.05	70.75	34.82	24.80	17.18
153	153	0.07500	48.1	0.15000	771	0.32000	1685	0.0080	79	0.40	0.05	3.00	0.0014	0.50	180.72	3.76	145.24	79.14	62.40	45.07
154	154	0.09300	59.8	0.16000	852	0.45000	2374	0.0100	50	0.40	0.05	3.00	0.0018	0.50	166.39	2.78	129.72	58.92	40.63	27.36
155	155	0.03800	24.1	0.13000	700	0.30000	1580	0.0090	63	0.40	0.05	3.00	0.0018	0.50	70.22	2.91	55.59	27.64	20.36	14.17
156	156	0.05300	34.1	0.17000	906	0.34000	1783	0.0120	74	0.40	0.05	3.00	0.0018	0.50	113.01	3.31	90.63	48.29	37.07	26.47
157	157	0.33700	215.7	0.35000	1852	0.87000	4580	0.0150	85	0.40	0.05	3.00	0.0018	0.50	786.71	3.65	640.56	359.89	285.31	207.74
158	158	0.07100	45.3	0.19000	1002	0.29000	1545	0.0170	85	0.40	0.05	3.00	0.0018	0.50	183.36	4.05	148.78	84.50	67.07	49.09
159	159	0.09200	59.1	0.29000	1532	0.52000	2763	0.0110	81	0.40	0.05	3.00	0.0018	0.50	180.03	3.05	145.67	79.49	62.45	45.28
160	160	0.14400	92.1	0.36000	1885	0.61000	3201	0.0130	59	0.40	0.05	3.02	0.0018	0.50	243.86	2.65	192.84	92.37	67.13	46.31
161	161	0.12800	82.2	0.39000	2085	0.59000	3105	0.0170	41	0.40	0.05	3.01	0.0018	0.50	167.74	2.04	129.46	53.14	34.84	22.56
162	162	0.00900	5.8	0.02000	115	0.35000	1865	0.0220	48	0.40	0.05	3.00	0.0018	0.50	17.58	3.03	13.62	6.15	4.16	2.78
173	173	0.26200	167.5	0.71000	3774	1.22000	6442	0.0130	76	0.40	0.05	3.00	0.0018	0.50	395.47	2.36	318.26	165.75	128.73	92.62
Totals/Averages			**10849.3**						**32**						**129.79**	**1.96**	**98.95**	**39.72**	**26.94**	**17.86**

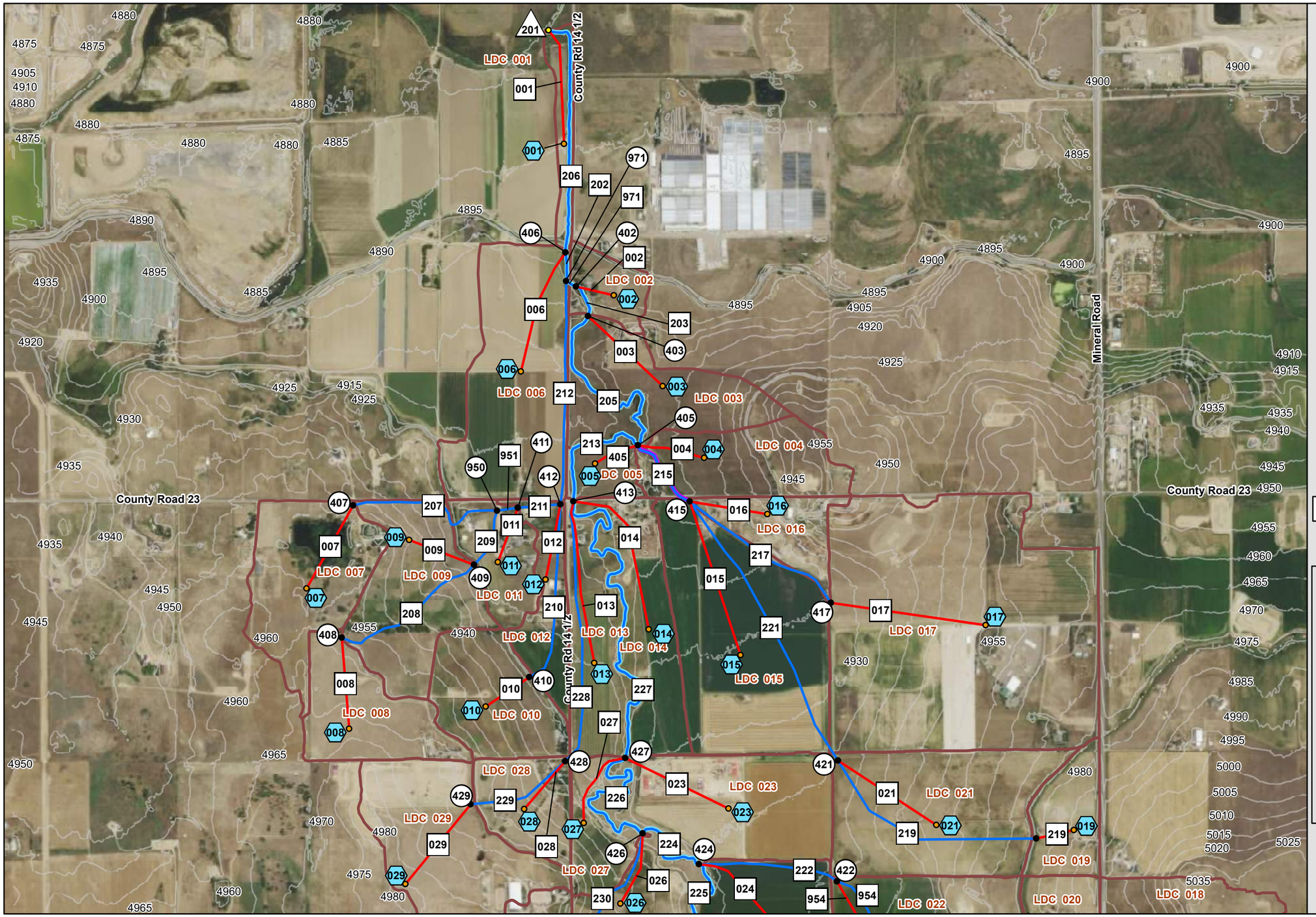
[1]From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2]Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Comparison of Basin Runoff, Pond Outflow and Pond Detention: Existing Conditions and Future Conditions								
Basin	10YR Existing	10Y0R Future	10YR Pond Outflow (cfs)	Approximate 10YR Detention (Ac-ft)	100YR Existing	100YR Future	100YR Pond Outflow (cfs)	Approximate 100YR Detention (Ac-ft)
001	0.7	1.0	0.7	0.1	6.4	6.8	6.4	0.2
002	0.5	1.0	0.5	0.0	10.0	11.0	10.0	0.1
003	1.0	3.6	1.0	0.2	38.4	42.2	38.4	0.6
004	5.6	7.8	5.8	0.2	41.2	43.8	41.2	0.5
005	1.9	2.5	1.9	0.1	15.3	16.0	15.0	0.2
006	1.4	5.5	1.4	0.5	56.6	61.6	56.6	1.1
007	0.5	2.9	0.5	0.2	26.6	32.8	26.6	0.5
008	1.5	3.3	1.5	0.1	34.4	36.9	34.4	0.4
009	0.5	3.7	1.4	0.1	33.4	41.2	34.4	0.5
010	0.8	4.1	0.8	0.2	39.7	45.3	39.7	0.5
011	1.6	1.7	1.6	0.0	19.5	19.7	19.5	0.1
012	1.2	1.5	1.2	0.0	14.4	14.9	14.3	0.2
013	2.5	3.9	2.5	0.2	23.6	25.3	23.5	0.5
014	4.3	5.4	4.2	0.2	27.3	28.7	27.3	0.5
015	14.0	18.6	14.3	0.5	87.4	92.7	87.3	1.2
016	10.8	12.9	10.9	0.2	36.8	40.6	36.8	0.4
017	23.8	59.0	23.7	2.8	222.8	270.8	222.8	5.5
018	12.3	16.5	12.3	0.3	91.6	96.3	91.6	0.8
019	4.1	5.8	4.2	0.1	34.0	35.9	33.9	0.3
020	1.1	2.0	1.1	0.1	17.0	18.2	16.9	0.3
021	2.5	7.6	2.5	0.5	66.2	71.9	66.2	1.1
022	4.1	8.9	4.0	0.5	81.2	80.4	80.4	0.6
023	9.1	12.4	9.3	0.3	58.1	61.8	58.0	0.8
024	10.5	13.8	10.5	0.3	62.1	65.7	62.1	0.6
025	4.9	7.5	4.9	0.2	42.7	45.5	42.7	0.4
026	4.5	6.9	4.7	0.1	38.4	41.0	38.3	0.4
027	0.3	1.4	0.3	0.1	14.9	16.3	14.7	0.3
028	0.4	1.7	0.4	0.1	16.6	19.6	16.5	0.3
029	1.5	5.3	1.5	0.3	55.7	61.5	55.4	0.9
030	5.9	6.4	5.9	0.1	42.3	42.9	42.0	0.2
031	5.3	7.6	5.3	0.2	46.3	49.0	46.2	0.5
032	17.8	33.2	17.8	1.0	222.8	238.4	222.5	2.6
033	4.5	7.4	4.6	0.2	41.6	44.8	41.6	0.4
034	0.7	0.8	0.7	0.0	4.0	4.2	4.0	0.0
035	6.7	11.0	6.7	0.4	67.1	72.0	67.1	0.9
036	6.1	9.7	6.1	0.3	57.7	61.7	57.6	0.7
037	21.8	23.2	21.7	0.4	200.7	202.7	199.7	1.1
038	5.0	5.9	5.1	0.0	17.2	18.7	17.2	0.1
039	5.9	11.5	6.0	0.7	80.4	86.8	80.0	1.7
040	7.7	12.9	8.1	0.4	80.0	85.7	80.0	1.0
041	2.3	3.6	2.3	0.1	20.1	21.6	20.0	0.3
042	7.1	11.3	7.3	0.5	67.6	72.6	67.4	1.2
043	8.3	14.7	8.2	0.5	95.1	102.2	95.1	1.3
044	0.4	0.8	0.4	0.0	6.8	7.5	6.8	0.0
045	8.7	9.9	8.7	0.1	67.8	69.3	67.8	0.3
046	9.7	11.2	9.9	0.2	77.6	79.5	77.3	0.6
046.1	13.3	18.9	13.3	0.4	96.2	102.1	96.2	0.9
047	8.1	10.8	8.4	0.2	52.7	55.8	52.4	1.1
048	2.0	2.7	2.0	0.1	15.4	16.3	15.2	0.2
049	1.1	1.4	1.1	0.1	6.9	7.2	6.8	0.1
050	1.0	1.3	1.0	0.0	6.0	6.4	6.0	0.1
051	0.7	0.8	0.7	0.0	3.6	3.7	3.6	0.0
052	7.6	11.2	7.6	0.5	58.9	63.0	58.5	1.1
053	1.0	1.3	1.0	0.0	5.7	5.9	5.6	0.1
054	0.3	1.3	0.3	0.1	13.0	14.1	13.0	0.2
055	2.4	2.5	2.3	0.0	11.4	11.6	11.2	0.1
056	1.4	3.4	1.3	0.1	25.7	27.8	25.7	0.2
057	3.7	9.8	3.6	0.4	78.0	84.5	77.6	1.0
058	1.5	5.1	1.5	0.4	45.7	49.7	45.7	0.8
059	6.2	12.1	6.1	0.8	101.6	108.5	101.3	1.6
060	17.5	26.3	17.5	1.1	142.8	152.5	142.8	2.2
061	13.2	16.7	13.3	0.4	93.9	98.0	93.9	0.8
062	48.9	110.2	48.8	7.6	335.1	441.6	335.1	11.4
063	6.1	9.5	6.6	0.5	38.8	43.2	38.8	1.0
064	20.6	33.3	20.6	1.2	127.2	144.9	127.2	1.7
065	13.1	35.8	13.1	2.7	106.2	145.7	106.2	5.1
066	14.7	22.1	14.5	1.1	90.5	100.1	90.5	1.7
067	14.1	23.8	14.1	1.2	89.7	102.9	89.7	0.5
068	38.2	76.5	38.0	4.4	245.9	300.9	245.9	6.2
069	2.8	4.0	2.9	0.3	19.0	20.5	18.9	0.5
070	4.6	8.3	4.6	0.8	36.8	42.1	36.8	1.2
071	35.5	73.7	35.2	3.9	229.8	289.1	229.7	7.0

Basin	10YR Existing	10Y0R Future	10YR Pond Outflow (cfs)	Approximate 10YR Detention (Ac-ft)	100YR Existing	100YR Future	100YR Pond Outflow (cfs)	Approximate 100YR Detention (Ac-ft)
072	22.2	50.1	22.0	2.8	141.7	189.7	141.7	5.4
073	26.4	37.9	27.0	1.0	216.3	228.8	216.3	2.5
074	24.0	35.4	24.2	1.1	191.6	204.2	191.6	2.7
075	8.1	13.8	8.0	0.5	84.3	90.5	84.3	1.2
076	3.4	9.9	3.4	0.9	107.7	116.4	107.7	2.2
077	8.5	10.5	8.5	0.5	57.5	60.8	57.4	1.1
077.1	14.6	19.0	14.7	0.4	87.5	92.5	87.1	1.1
078	4.6	8.7	4.8	0.3	65.3	69.8	65.2	0.8
079	5.9	15.0	5.9	0.8	123.9	134.0	123.9	1.9
080	8.2	10.2	8.2	0.3	64.4	66.8	64.4	0.6
081	3.0	4.9	3.1	0.1	28.0	30.0	28.0	0.2
082	2.9	3.4	3.0	0.1	15.8	16.4	15.6	0.2
083	15.0	23.4	15.0	0.5	129.4	138.2	128.9	1.4
084	5.2	56.2	5.3	3.0	45.9	128.1	45.9	4.5
085	1.3	14.0	1.3	1.1	13.5	36.0	13.5	1.8
086	6.3	67.9	6.2	3.5	59.2	159.8	59.2	5.3
087	18.0	203.7	17.9	11.8	169.5	473.7	169.5	19.0
089	14.4	54.1	14.5	3.7	140.2	212.0	140.2	7.5
090	23.6	74.5	23.3	5.5	205.5	296.6	205.5	10.5
091	18.3	39.3	25.0	2.1	139.0	169.1	138.9	4.3
092	20.3	41.8	20.6	1.6	132.3	162.9	132.3	3.1
093	15.1	37.5	14.9	2.7	105.8	145.6	105.7	5.2
094	18.8	56.7	18.5	3.0	123.8	193.6	123.8	5.7
095	3.5	9.8	3.6	0.6	24.0	35.5	23.8	1.2
096	6.1	19.5	6.2	0.9	36.3	61.2	36.3	1.9
097	4.2	16.1	4.1	1.0	28.3	50.7	28.3	2.0
098	13.4	35.2	13.8	1.9	103.7	140.3	103.7	3.2
099	11.4	29.7	11.4	2.0	95.0	125.0	95.0	3.3
100	13.4	47.7	13.3	2.3	84.9	149.2	84.9	4.5
101	54.1	123.0	54.3	7.3	372.5	486.3	372.4	12.2
102	14.5	28.1	14.7	2.0	91.8	112.0	91.8	3.8
103	17.2	54.0	17.2	3.3	109.1	178.6	109.1	6.6
104	28.2	63.2	28.4	3.4	170.0	232.5	170.0	7.0
105	32.2	81.3	32.1	2.7	186.6	272.7	186.6	5.6
106	5.1	12.3	5.3	1.0	33.4	46.7	33.2	2.0
107	9.4	21.9	9.4	1.2	57.5	79.2	57.5	2.3
108	23.8	54.4	23.8	4.6	153.7	207.4	153.7	8.0
109	11.0	23.8	11.1	1.4	69.3	93.2	68.1	3.0
110	2.0	5.0	2.1	0.4	16.7	21.3	16.7	0.7
111	16.2	32.0	16.3	1.6	97.6	121.9	97.1	3.1
112	11.4	21.2	11.3	1.4	67.4	81.1	67.4	2.3
113	44.3	158.0	44.1	7.1	252.3	467.9	252.3	12.1
114	21.4	88.6	21.1	4.6	146.2	272.9	146.2	8.7
115	5.9	19.8	5.9	0.7	37.8	63.1	37.8	1.6
116	14.9	23.0	15.5	1.6	74.9	89.8	74.9	3.0
117	9.1	19.1	9.1	1.6	56.0	72.7	56.0	2.8
118	10.3	19.8	10.5	2.1	63.6	77.3	63.5	3.3
119	17.4	48.2	17.3	3.8	111.1	167.3	111.1	6.4
120	42.5	193.4	42.1	11.9	311.2	595.0	311.2	22.6
121	11.2	52.7	11.1	2.9	78.3	154.9	77.2	5.7
122	22.5	51.8	22.4	1.9	134.1	183.4	134.1	4.4
123	1.8	2.7	1.9	0.2	13.0	14.2	12.8	0.3
124	30.0	115.9	29.9	7.7	201.9	367.5	201.9	13.5
125	5.2	27.6	5.4	1.4	39.9	80.7	39.9	2.5
126	15.7	48.7	15.6	2.7	98.8	160.8	98.8	5.1
127	3.1	7.9	3.2	0.5	19.6	28.7	19.5	1.0
128	13.9	48.4	13.8	3.0	94.4	160.6	94.4	5.5
129	2.3	4.3	2.3	0.2	13.4	16.3	13.2	0.4
130	55.1	194.3	55.9	4.6	218.4	430.4	218.4	8.0
131	98.7	272.0	99.1	7.6	350.7	617.4	350.7	14.5
132	5.8	47.3	5.7	2.1	40.9	107.1	40.9	3.5
133	36.6	205.2	36.4	8.1	185.8	459.5	185.8	13.1
134	5.9	46.9	5.8	2.2	40.0	106.0	40.0	3.7
135	1.9	12.3	1.9	0.6	10.6	27.9	10.5	1.1
136	2.1	16.5	1.9	1.1	13.5	37.6	13.5	1.8
137	11.3	28.2	11.3	0.8	38.0	64.0	38.0	1.5
138	28.1	123.2	28.4	4.0	121.8	275.2	121.8	6.7
139	25.1	160.9	25.1	8.7	138.2	364.9	138.2	13.6
140	6.6	40.4	6.6	1.8	35.6	90.8	35.5	3.1
141	19.2	109.5	20.6	3.9	101.0	244.8	100.9	6.2
142	0.9	5.7	0.9	0.3	5.0	12.9	5.0	0.5
143	0.8	1.0	0.8	0.0	4.5	4.8	4.5	0.1
144	14.0	40.5	13.9	1.4	97.3	143.3	97.2	2.9

Basin	10YR Existing	10Y0R Future	10YR Pond Outflow (cfs)	Approximate 10YR Detention (Ac-ft)	100YR Existing	100YR Future	100YR Pond Outflow (cfs)	Approximate 100YR Detention (Ac-ft)
145	98.2	107.1	99.0	1.7	298.5	313.2	297.2	2.5
146	4.4	32.4	4.3	1.6	27.5	73.4	27.3	2.8
147	5.0	21.5	5.0	1.1	28.9	59.2	28.6	2.2
148	1.6	6.9	1.6	0.3	12.1	21.8	12.1	0.7
149	26.3	155.2	26.3	9.1	161.1	386.9	161.1	15.4
150	3.4	20.8	3.4	1.2	27.8	59.9	27.8	2.4
151	32.4	243.6	32.3	13.0	202.4	546.8	202.4	21.2
152	10.8	34.8	10.8	0.9	48.0	90.0	48.0	1.8
153	9.0	79.1	8.7	3.7	68.3	180.7	68.3	6.0
154	14.2	58.9	14.8	2.6	84.6	166.4	84.6	5.3
155	4.9	27.6	4.8	1.4	30.2	70.2	30.2	2.7
156	8.7	48.3	8.9	2.3	46.0	113.0	46.0	2.7
157	48.8	359.9	48.6	17.3	291.4	786.7	291.4	26.4
158	11.7	84.5	11.5	3.6	70.1	183.4	70.1	5.7
159	44.0	79.5	44.1	2.2	129.0	180.0	129.0	3.6
160	17.4	92.4	17.4	5.4	108.0	243.9	107.8	9.9
161	16.0	53.1	16.1	3.2	96.2	167.7	96.2	6.0
162	2.6	6.2	2.1	0.2	10.7	17.6	10.7	0.4
173	20.9	165.8	20.7	13.8	141.6	395.5	141.5	21.4



Legend

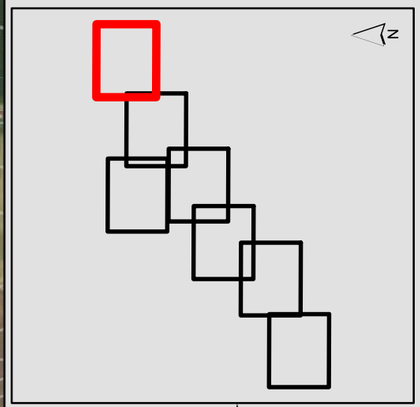
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



0 500 1,000 2,000 Feet

ICON ENGINEERING

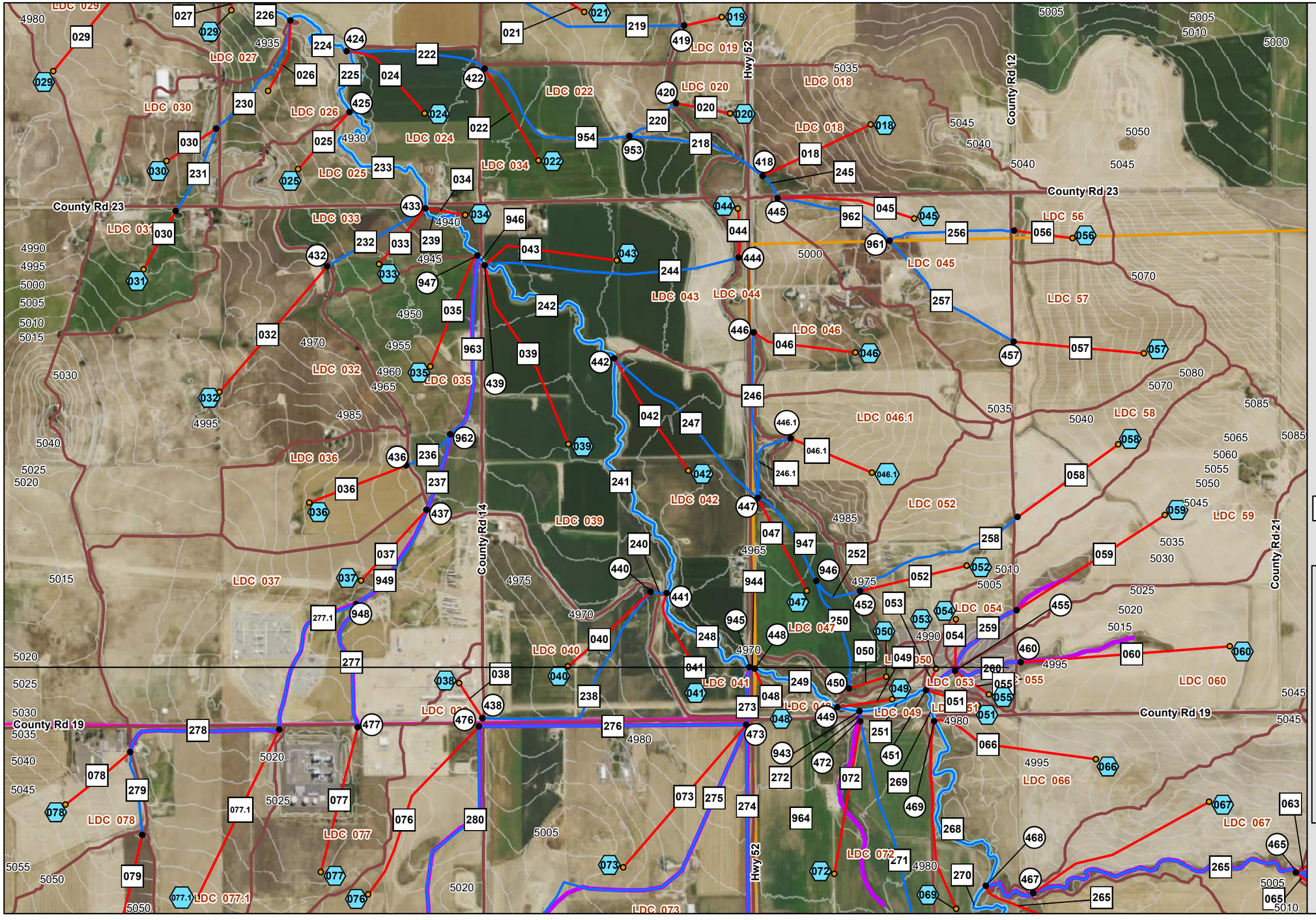
FREDERICK COLORADO

DACONO Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK FUTURE CONDITION SWMM CONVEYANCE ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-1	INDEX: 1 of 7



Legend

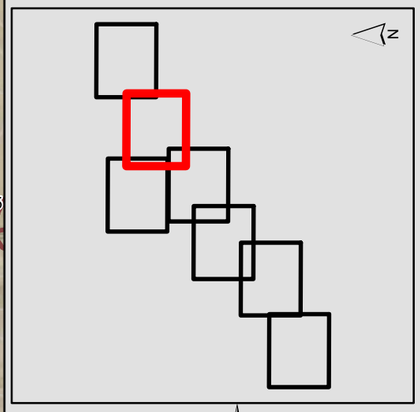
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-2	INDEX: 2 of 7

Legend

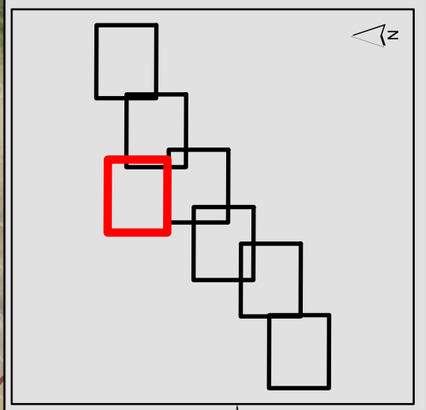
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



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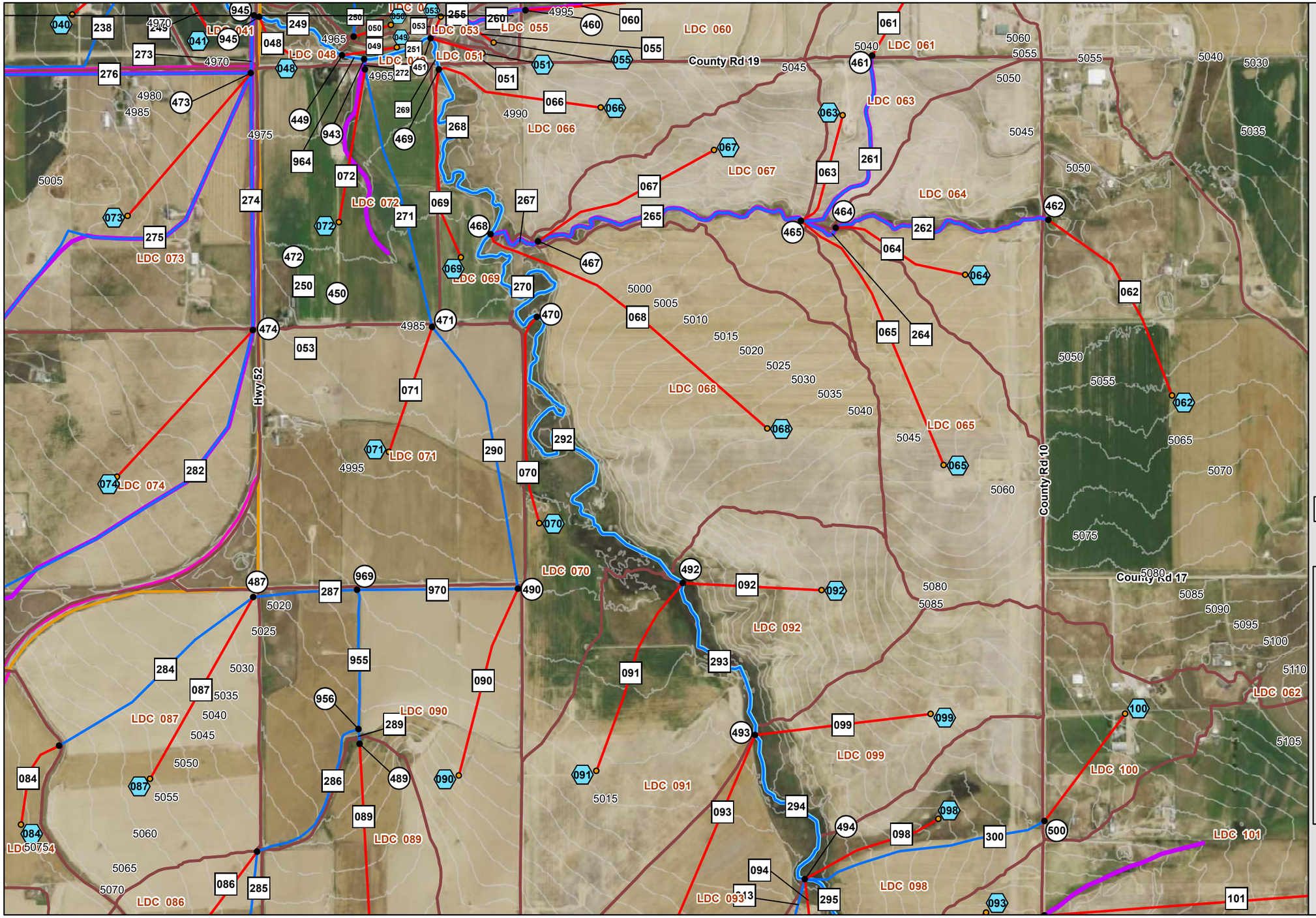
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-3	INDEX: 3 of 7



Legend

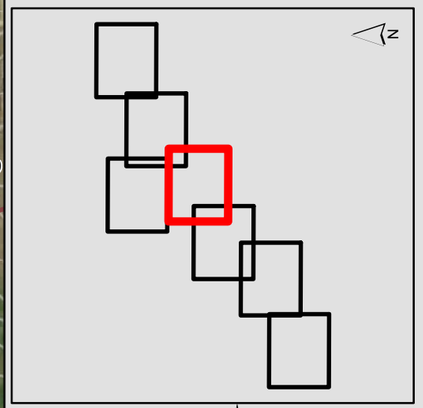
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



0 500 1,000 2,000 Feet

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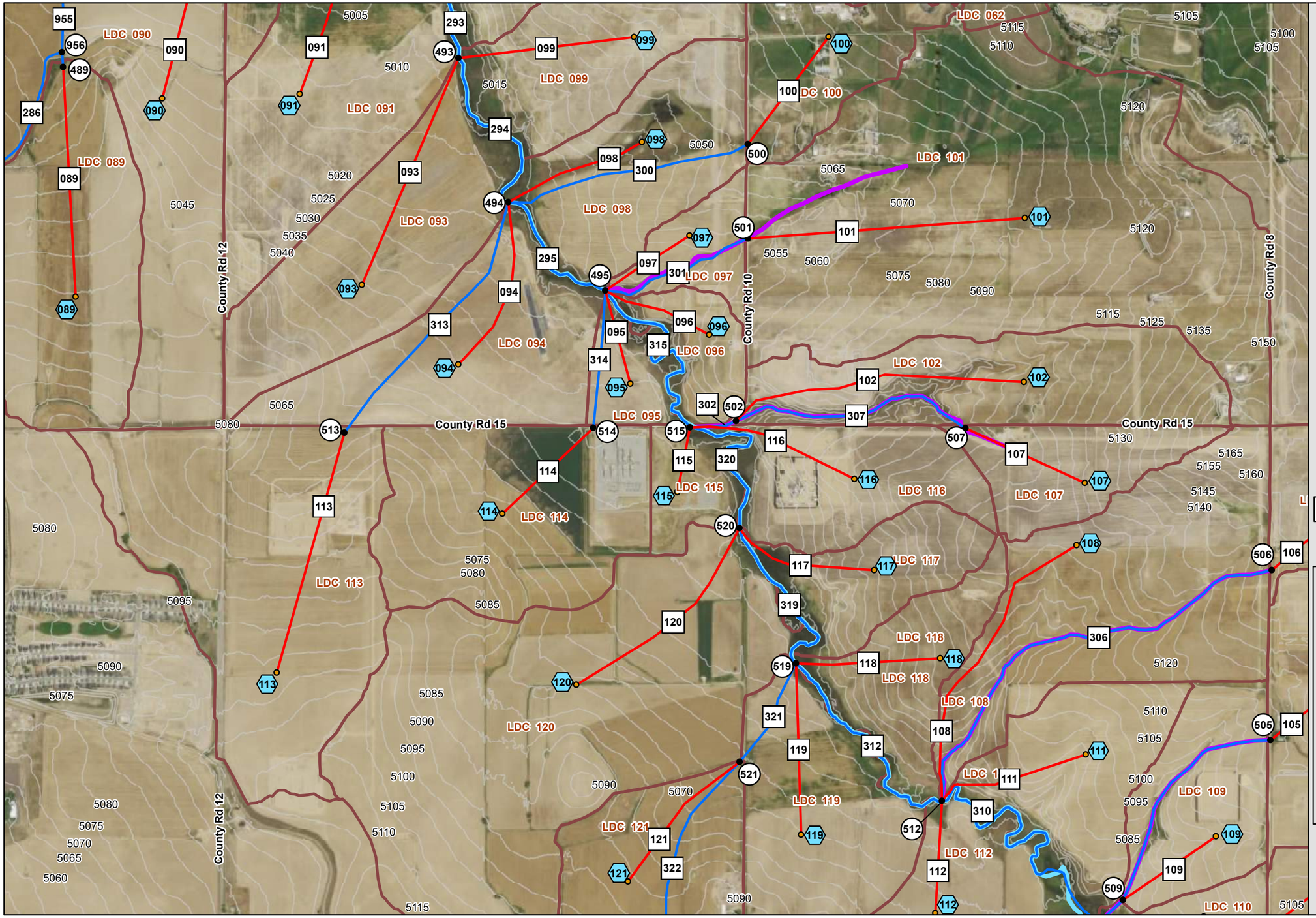
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-4	INDEX: 4 of 7



Legend

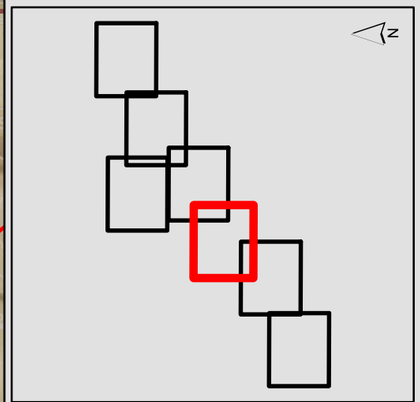
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



N

0 500 1,000 2,000 Feet

ICON ENGINEERING

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FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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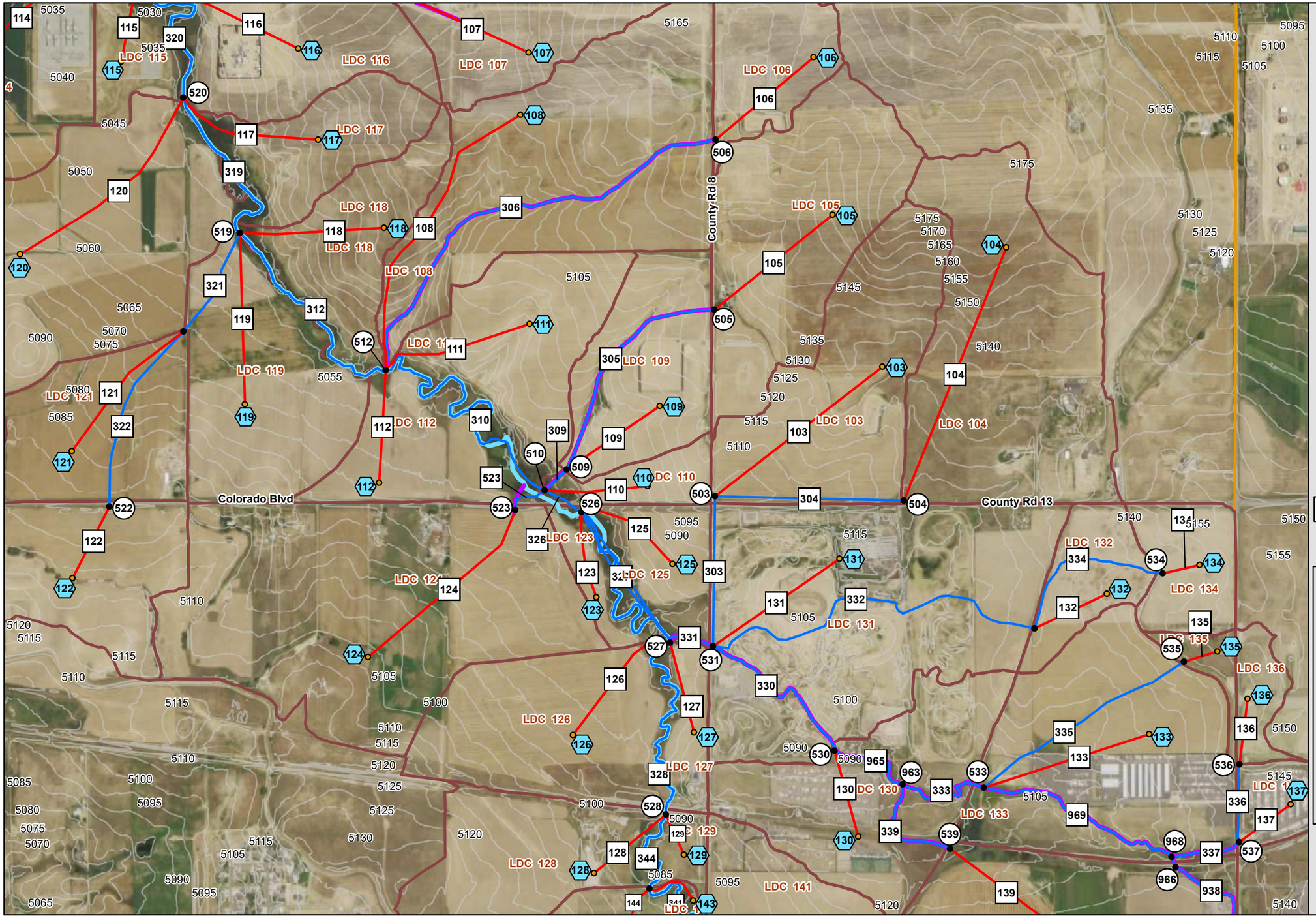
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-5	INDEX: 5 of 7



Legend

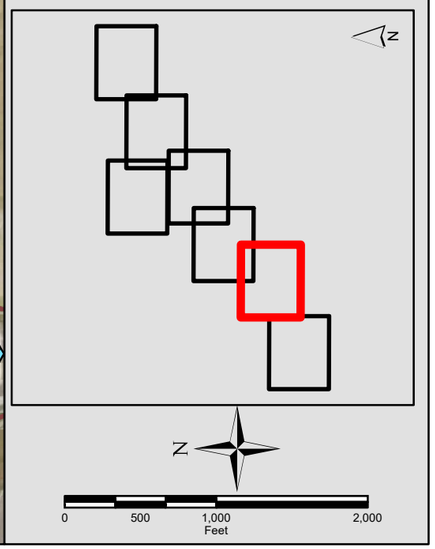
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



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DACONO Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LITTLE DRY CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

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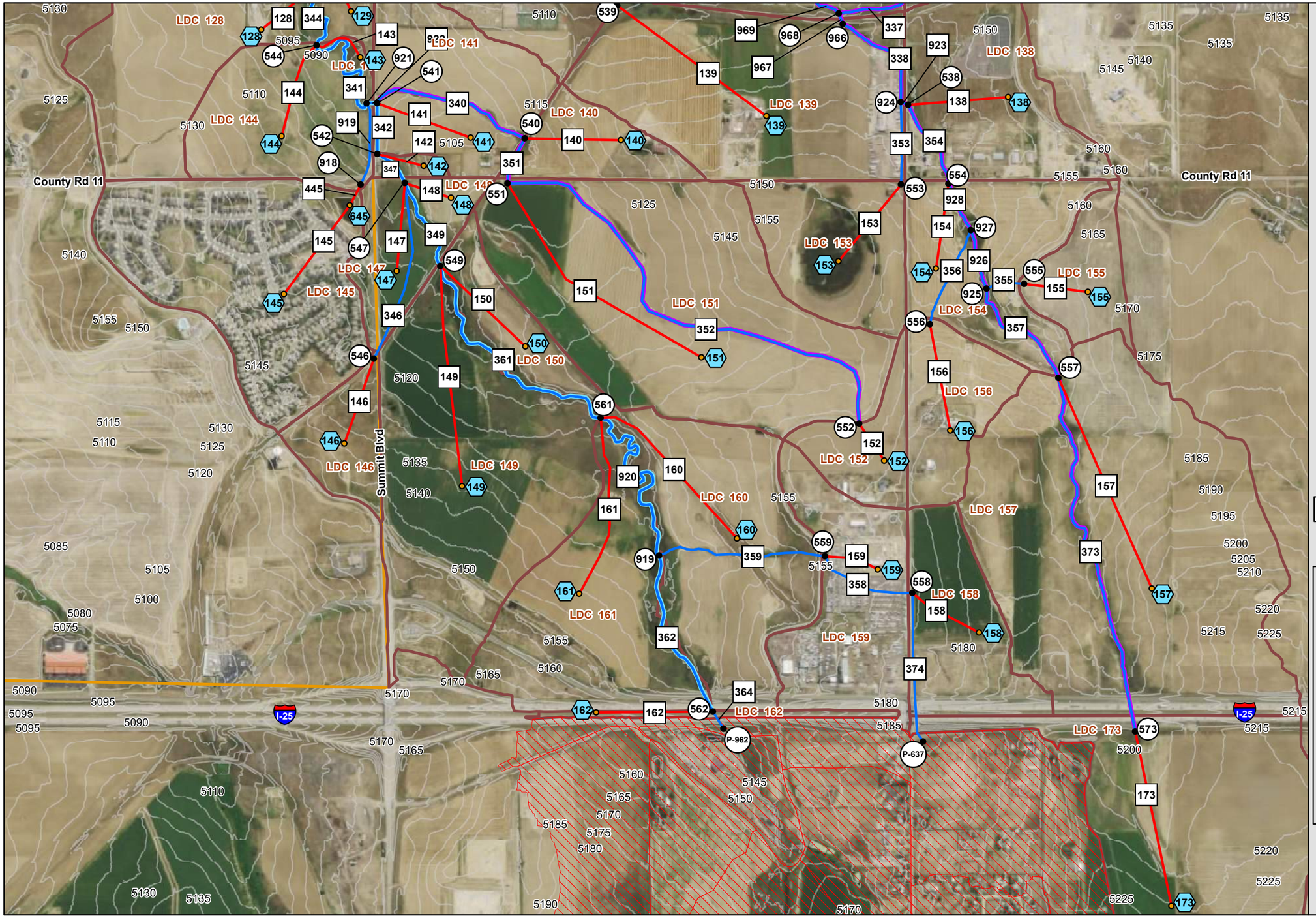
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 10/25/2021	
SHEET: FC-6	INDEX: 6 of 7



Legend

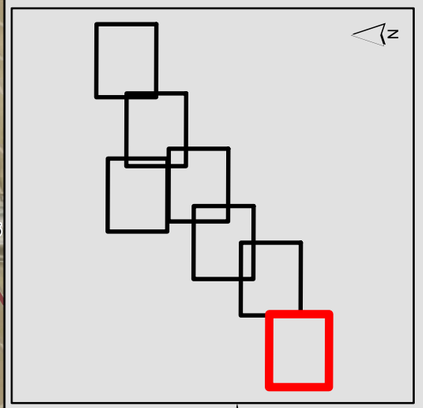
- Junction
- Outfall
- Detention Pond
- Outlet
- Link

Flow Path

- Main Channel
- Tributary
- Erie_LDC_Basins
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



0 500 1,000 2,000 Feet

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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

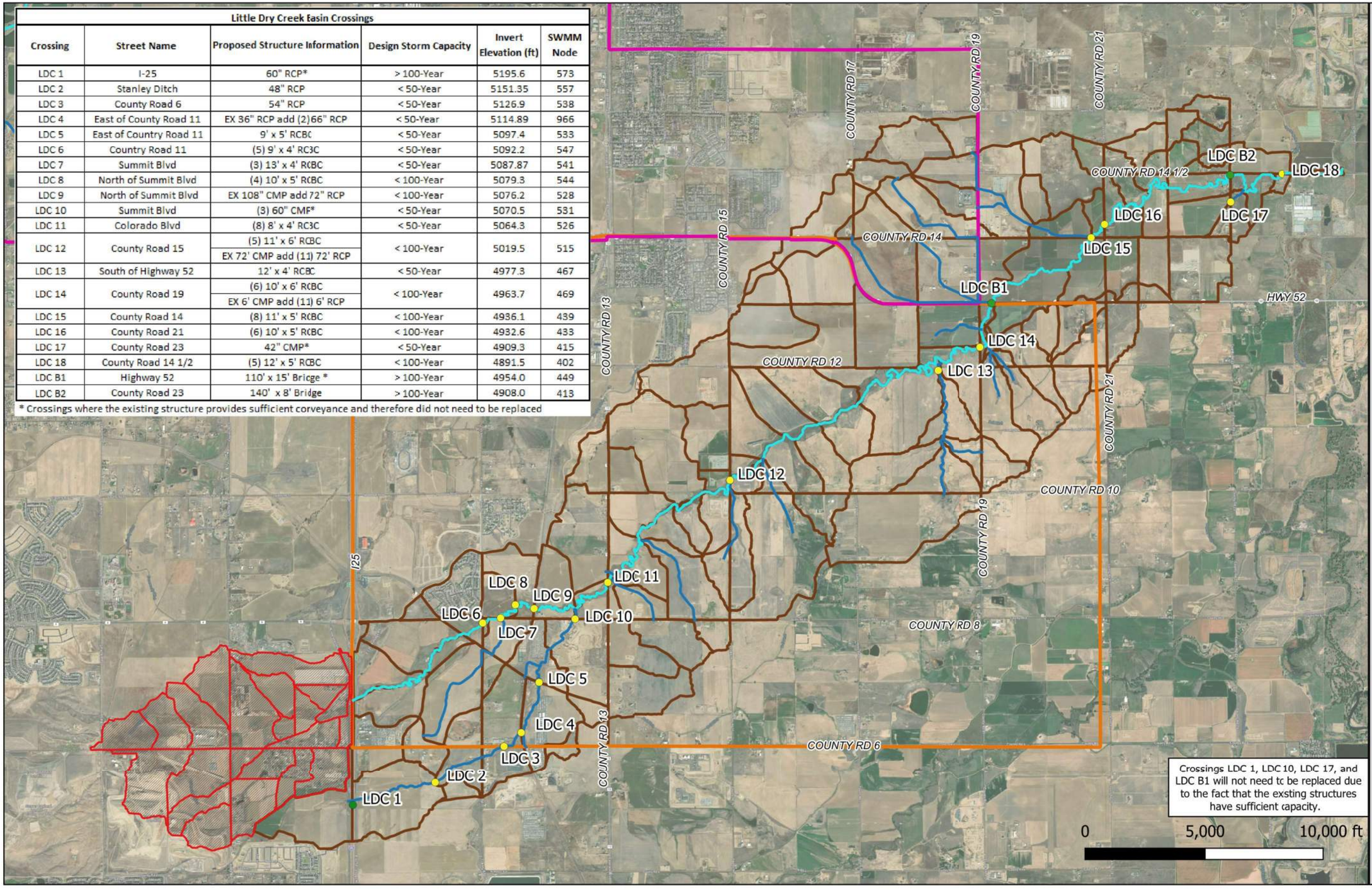
LITTLE DRY CREEK FUTURE CONDITION SWMM CONVEYANCE ELEMENT MAPS

DRAWN BY:	CG
DESIGNED BY:	CG
CHECKED BY:	JD
PROJECT NUMBER:	20-026
DATE:	10/25/2021
SHEET:	FC-7
INDEX:	7 of 7

Little Dry Creek Basin Crossings

Crossing	Street Name	Proposed Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
LDC 1	I-25	60" RCP*	> 100-Year	5195.6	573
LDC 2	Stanley Ditch	48" RCP	< 50-Year	5151.35	557
LDC 3	County Road 6	54" RCP	< 50-Year	5126.9	538
LDC 4	East of County Road 11	EX 36" RCP add (2)66" RCP	< 50-Year	5114.89	966
LDC 5	East of Country Road 11	9' x 5' RCBC	< 50-Year	5097.4	533
LDC 6	Country Road 11	(5) 9' x 4' RCBC	< 50-Year	5092.2	547
LDC 7	Summit Blvd	(3) 13' x 4' RCBC	< 50-Year	5087.87	541
LDC 8	North of Summit Blvd	(4) 10' x 5' RCBC	< 100-Year	5079.3	544
LDC 9	North of Summit Blvd	EX 108" CMP add 72" RCP	< 100-Year	5076.2	528
LDC 10	Summit Blvd	(3) 60" CMP*	< 50-Year	5070.5	531
LDC 11	Colorado Blvd	(8) 8' x 4' RCBC	< 50-Year	5064.3	526
LDC 12	County Road 15	(5) 11' x 6' RCBC EX 72" CMP add (11) 72" RCP	< 100-Year	5019.5	515
LDC 13	South of Highway 52	12' x 4' RCBC	< 50-Year	4977.3	467
LDC 14	County Road 19	(6) 10' x 6' RCBC EX 6' CMP add (11) 6' RCP	< 100-Year	4963.7	469
LDC 15	County Road 14	(8) 11' x 5' RCBC	< 100-Year	4936.1	439
LDC 16	County Road 21	(6) 10' x 5' RCBC	< 100-Year	4932.6	433
LDC 17	County Road 23	42" CMP*	< 50-Year	4909.3	415
LDC 18	County Road 14 1/2	(5) 12' x 5' RCBC	< 100-Year	4891.5	402
LDC B1	Highway 52	110' x 15' Bricge *	> 100-Year	4954.0	449
LDC B2	County Road 23	140' x 8' Bridge	> 100-Year	4908.0	413

* Crossings where the existing structure provides sufficient conveyance and therefore did not need to be replaced



Legend

- Crossing with <10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Little Dry Creek Basin Studied By Erie OSP

Flow Path

- Little Dry Creek
- Tributary

ICON ENGINEERING

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DACONO Colorado

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LITTLE DRY CREEK
FUTURE CONDITION
WITH EXISTING CONDITONS
UPSTREAM IN ERIE OSP
PROPOSED STRUCTURE
CAPACITY

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LDC	INDEX: FC/EC-CROSS

Table G.2.2: Little Dry Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions with Existing Conditions Upstream in Erie OSP

Location	SWMM Node	Drainage Area (acres)	Existing Conditions SWMM Model Peak Discharge (cfs)					Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Difference (Future Conditions with Existing Conditions Upstream in Erie OSP - Existing Conditions) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Country Road 11, South of Summit Blvd	547	1229	50	297	329	1385	2028	67	165	383	1481	2151	17	-132	55	95	124	
Summit Blvd, East of County Road 11	541	1314	59	319	372	1568	2316	85	203	446	1654	2392	26	-116	74	86	77	
East of County Road 11, North of Summit Blvd	544	2272	59	317	370	1572	2327	94	217	469	1707	2476	36	-100	99	135	149	
Colorado Blvd, North of Summit Blvd	526	2363	63	332	472	2249	3399	172	374	733	2468	3715	110	42	260	220	316	
County Road 15, North of County Road 10	515	3344	60	314	485	2520	3883	180	406	824	2708	4113	120	92	339	188	230	
County Road 19, North of County Road 12	469	6403	56	274	484	2769	4363	178	416	847	2836	4274	122	142	363	67	-89	
County Road 14, West of County Road 21	439	8784	47	269	491	2965	4754	170	437	882	2947	4458	123	168	391	-18	-296	
County Road 21, North of County Road 14	433	9524	42	269	492	2996	4821	156	439	885	2960	4484	114	170	393	-35	-337	
County Road 14 1/2, West of County Road 23 1/2	402	10597	12	246	468	3011	4862	24	372	866	2932	4445	12	125	397	-79	-417	
Tributaries to Little Dry Creek																		
I-25 south of Country Road 6	573	168	1	4	21	98	142	1	5	21	101	142	0	1	0	3	0	
County Road 6, East of County Road 11	538	614	7	20	81	376	548	41	68	102	462	578	34	48	21	85	30	
Summit Blvd, West of Colorado Blvd	531	1384	51	82	207	964	1437	105	203	308	1097	1539	54	121	101	133	102	
West of Country Road 19, South of Highway 52	467	702	5	15	86	482	712	10	39	93	552	766	5	24	8	70	54	
County Road 11, south of County Road 6	554	501	4	15	67	321	472	30	53	85	414	540	26	37	19	94	68	
County Road 23, South of County Road 14 1/2	415	326	6	12	40	262	385	6	19	43	277	407	0	6	3	15	21	

Table G.2.2: Little Dry Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions with Existing Conditions Upstream in Erie OSP

Location	SWMM Node	Drainage Area (acres)	Existing Conditions SWMM Model Peak Discharge (cfs)					Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Difference (Future Conditions with Existing Conditions Upstream in Erie OSP - Existing Conditions) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)																		
County Road 11, south of Summit Blvd	551	183	2	8	36	160	225	13	27	40	172	241	11	18	4	12	16	
Colorado Blvd, north of Summit Blvd	523	185	2	5	30	142	225	8	18	30	190	202	7	12	0	48	-23	
County Road 15, south of County Road 10	507	42	0	2	9	41	58	2	6	9	47	58	2	4	0	6	0	
County Road 15, and County Road 10	502	136	1	4	21	101	144	2	12	24	109	149	1	7	3	8	5	
County Road 10, east of County Road 15	501	311	3	8	54	263	372	8	25	54	310	372	5	17	0	47	0	
County Road 10, west of County Road 19	462	319	4	9	49	235	335	6	23	49	317	335	3	13	0	82	0	
County Road 19, north of County Road 10	461	56	2	3	13	67	94	0	2	13	67	94	-1	-1	0	0	0	
County Road 12, east of County Road 19	460	125	1	2	18	100	143	0	3	17	103	143	-1	2	0	3	0	
County Road 12, east of County Road 19	459	92	1	2	6	69	102	0	1	6	46	101	-1	-2	0	-23	0	
County Road 19, south of Highway 52	472	836	2	7	60	493	761	18	46	90	560	805	16	39	30	67	45	
County Road 14, and County Road 17	482	94	1	2	17	102	144	3	7	17	104	144	2	5	0	2	0	
County Road 14, west of County Road 19	475	84	0	1	9	72	105	2	4	10	75	108	1	3	1	3	3	
North of Highway 52, east of County Road 19	474	259	2	3	29	200	297	5	14	37	211	309	3	10	8	11	11	
County Road 19, north of Highway 52	473	251	3	8	52	441	680	7	22	66	463	700	4	14	15	22	20	
County Road 14, west of County Road 19	476	185	1	3	8	94	150	0	3	8	100	156	-1	0	1	6	6	
County Road 19, north of County Road 14	477	58	3	5	8	41	57	1	4	9	40	57	-2	-1	0	0	0	
County Road 19, north of County Road 14	477.1	231	1	4	18	172	258	2	8	20	177	263	1	4	2	5	5	

Table G.2.3.: Little Dry Creek Basin Crossings With Proposed Improvements: Future Condtions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Main Flow Path												
LDC 6-D	Country Road 11, South of Summit Blvd	547	(5) 9' x 4' RCBC	5092.2	1516	< 50 YR	67	165	383	1481	2151	
LDC 7-D	Summit Blvd, East of County Road 11	541	(3) 13' x 4' RCBC	5087.87	1275	< 50 YR	85	203	446	1654	2392	
LDC 8-D*	East of County Road 11, North of Summit Blvd	544	(4) 10' x 5' RCBC	5079.3	2211	< 100 YR	94	217	469	1707	2476	
LDC 9-D*	East of County Road 11, North of Summit Blvd	528	EX 9' CMP add 6' RCP	5076.2	2225	< 100 YR	96	223	481	1742	2545	
LDC 11-D	Colorado Blvd, North of Summit Blvd	526	(8) 8' x 4' RCBC	5064.3	2449	< 50 YR	172	374	733	2468	3715	Proposed raising roadway 3' to facilitate a taller crossing
LDC 12-D	County Road 15, North of County Road 10	515	(5) 11' x 6' RCBC	5019.5	3366	< 100 YR	180	406	824	2708	4113	
			EX 6' CMP add (11) 6' RCP	5019.5	3434	< 100 YR						
LDC 14-D	County Road 19, North of County Road 12	469	(6) 10' x 6' RCBC	4963.7	3506	< 100 YR	178	416	847	2836	4274	
			EX 6' CMP add (11) 6' RCP	5019.5	3563	< 100 YR						
LDC 15	County Road 14, West of County Road 21	439	(8) 11' x 5' RCBC	4936.1	3203	< 100 YR	170	437	882	2947	4458	
LDC 16	County Road 21, North of County Road 14	433	(6) 10' x 5' RCBC	4932.6	3628	< 100 YR	156	439	885	2960	4484	
LDC 18	County Road 14 1/2, West of County Road 23 1/2	402	(5) 12' x 5' RCBC	4891.5	3868	< 100 YR	24	372	866	2932	4445	
LDC 30-D*	Branter Ditch, east of County Road 19	449	(7) 8 x 4' RCBC	4995.39	4007	< 100 YR	187	436	883	2919	4395	
Tributaries to Little Dry Creek												
LDC 1	I-25 south of Country Road 6	573	5' RCP	5195.6	231	> 100 YR	1	5	21	101	142	
LDC 2	Stanley Ditch crossing South of County Road 6	557	4' RCP	5151.35	132	< 50 YR	21	35	62	293	420	
LDC 3	County Road 6, East of County Road 11	538	4.5' RCP	5126.9	115	< 50 YR	41	68	102	462	578	
LDC 4	East of County Road 11, North of County road 6	966	EX 3' RCP add (2) 5.5' RCP	5114.9	757	< 50 YR	43	75	111	507	643	

Table G.2.3.: Little Dry Creek Basin Crossings With Proposed Improvements: Future Condtions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)												
LDC 5	East of Country Road 11, South of Summit Blvd	533	9' x 5' RCBC	5097.4	591	< 50 YR	58	104	150	591	866	
LDC 10-D	Summit Blvd, West of Colorado Blvd	531	(3) 5' CMP	5070.5	733	< 50 YR	105	203	308	1097	1539	
LDC 13-D*	West of Country Road 19, South of Highway 52	467	12' x 4' RCBC	4977.3	429	< 50 YR	10	39	93	552	766	
LDC 19	County Road 11, south of County Road 6	554	3.5' RCP	5135	93	< 50 YR	30	53	85	414	540	
LDC 17	County Road 23, South of County Road 14 1/2	415	3.5' CMP	4909.3	74	< 50 YR	6	19	43	277	407	
LDC 20	County Road 11, south of Summit Blvd	551	3' RCP	5110.2	51	< 50 YR	13	27	40	172	241	
LDC 21-D	Colorado Blvd, north of Summit Blvd	523	3' RCP	5062.0	38	< 50 YR	8	18	30	190	202	
LDC 22-D	County Road 15, south of County Road 10	507	2' RCP	5083.3	19	< 50 YR	2	6	9	47	58	
LDC 23-D	County Road 15, and County Road 10	502	2' RCP	5031.2	25	< 50 YR	2	12	24	109	149	
LDC 24-D	County Road 10, east of County Road 15	501	(2) 2.5' RCP	5045.8	78	< 50 YR	8	25	54	310	372	
LDC 25-D	County Road 10, west of County Road 19	462	(2) 2.5' RCP	5033.5	67	< 50 YR	6	23	49	317	335	
LDC 26-D	County Road 19, north of County Road 10	461	2' RCP	5038.4	24	< 50 YR	0	2	13	67	94	
LDC 27-D	County Road 12, east of County Road 19	460	2' RCP	4992.2	30	< 50 YR	0	3	17	103	143	
LDC 28-D	County Road 12, east of County Road 19	459	2' RCP	5000.2	25	< 50 YR	0	1	6	46	101	
LDC 29-D	County Road 19, south of Highway 52	472	3.5' RCP	4962.0	105	< 50 YR	18	46	90	560	805	
LDC 31-F	County Road 14, and County Road 17	482	(4) 3' RCP	5055.5	174	> 100 YR	3	7	17	104	144	
LDC 32-F	County Road 14, west of County Road 19	475	(2) 2.5' RCP	5023.0	113	> 100 YR	2	4	10	75	108	

Table G.2.3.: Little Dry Creek Basin Crossings With Proposed Improvements: Future Condtions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Conditions SWMM Model Peak Discharge with Existing Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)												
LDC 33-F	North of Highway 52, east of County Road 19	474	(5) 5' x 4' RCBC	4992.0	338	> 100 YR	5	14	37	211	309	
LDC 34-F	County Road 19, north of Highway 52	473	(4) 8' x 5' RCBC	4969.0	706	> 100 YR	7	22	66	463	700	
LDC 35-F	County Road 14, west of County Road 19	476	(3) 3' RCP	4991.0	185	> 100 YR	0	3	8	100	156	
LDC 36-F	County Road 19, north of County Road 14	477	(3) 2' RCP	4998.0	61	> 100 YR	1	4	9	40	57	
LDC 37-F	County Road 19, north of County Road 14	477.1	(2) 7' x 3' RCBC	5001.0	272	> 100 YR	2	8	20	177	263	
Bridges on Main Flow Path												
LDC B1-D	Highway 52, East of County Road 19	449	110' x 15' Bridge	4954.0	--	> 100 YR	187	436	883	2919.3	4394.7	
LDC B2	County Road 23, South of County Road 14 1/2	413	140' x 8' Bridge	4908.0	--	> 100 YR	31	420	867	2936	4450	

* HY-8 program used to evaluate capacities unless noted otherwise

-D Crossings in Dacono Planning Boundary

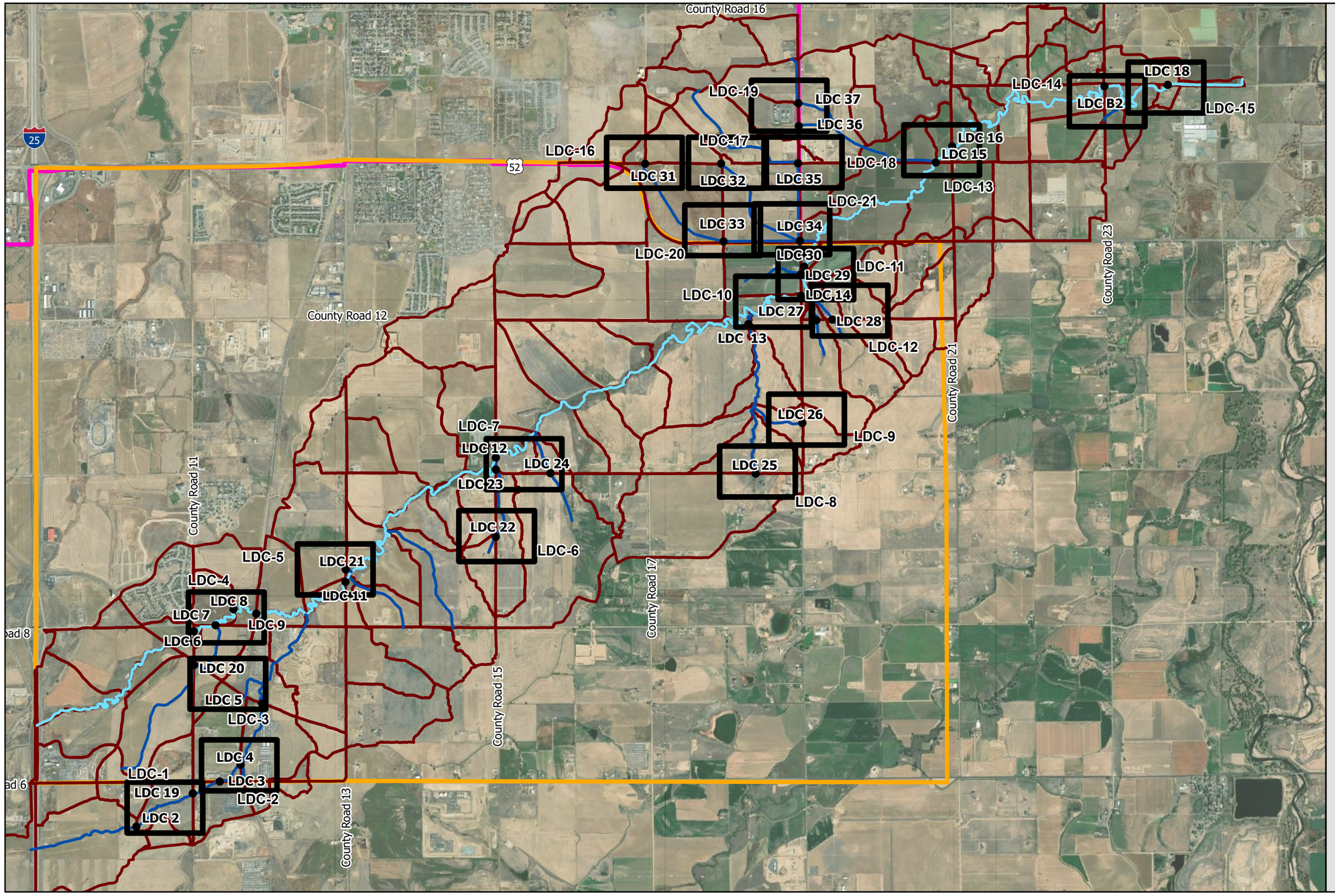
-F Crossings in Frederick Planning Boundary

-D* Crossings not included in cost estimate for City of Dacono

Crossings without notation are located outside of the Dacono and Frederick Planning Boundaries

Indicates revised information for proposed improvements

Appendix G.3. Little Dry Creek Proposed Improvement Documentation



ICON ENGINEERING

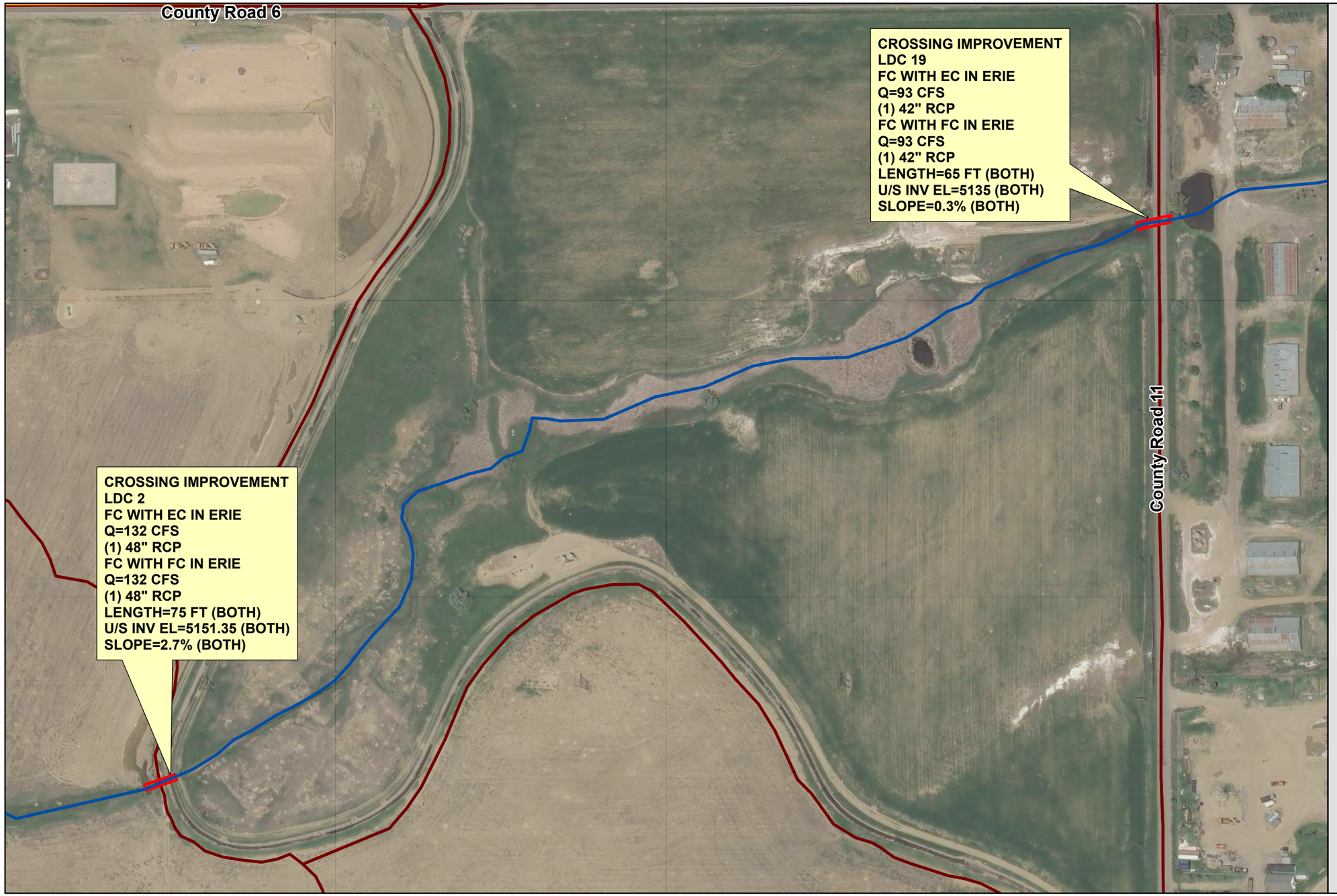
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT INDEX

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: INDEX



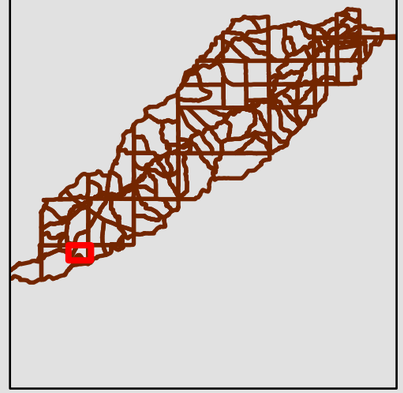
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



N

0 100 200 400 Feet

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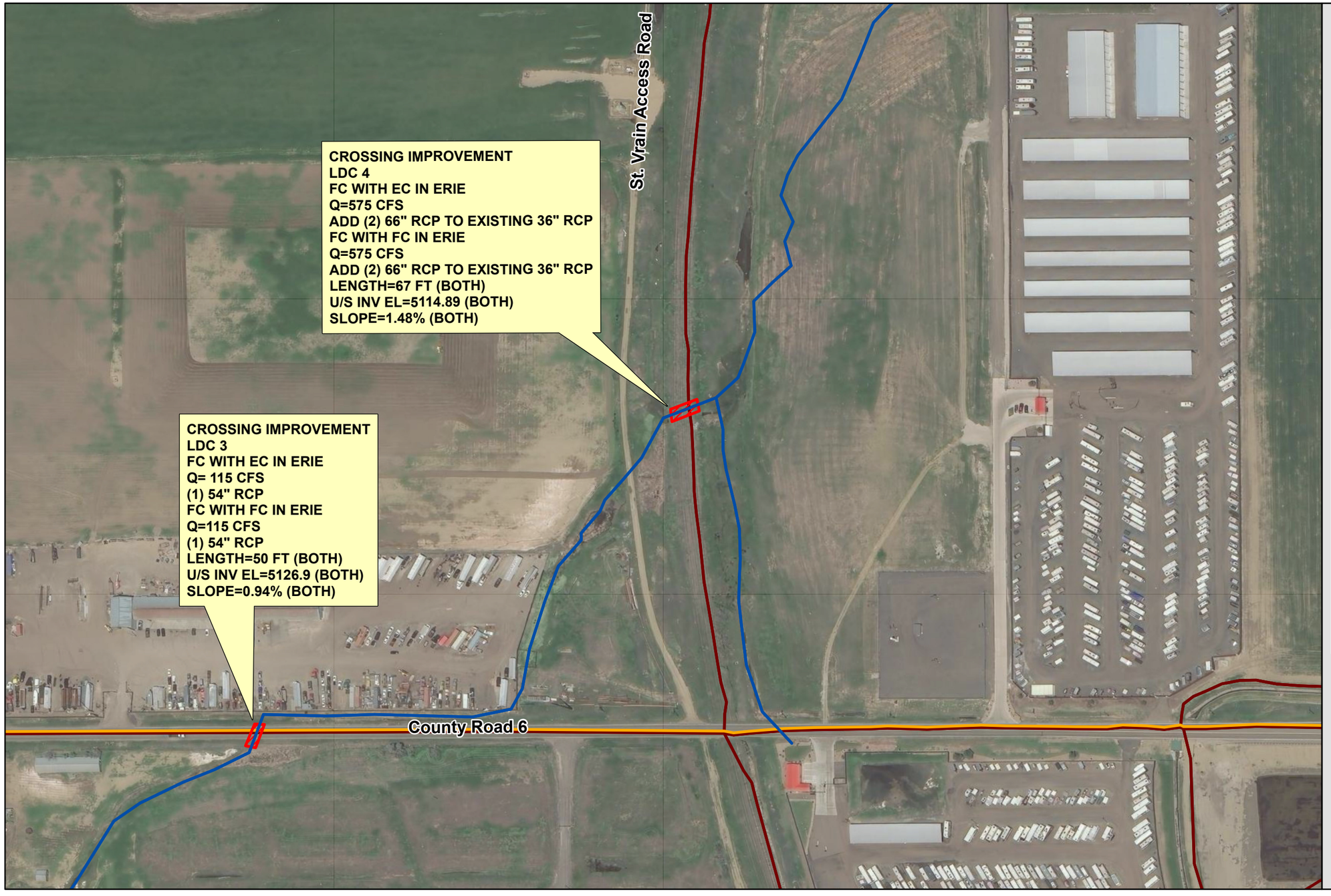
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: LDC-1



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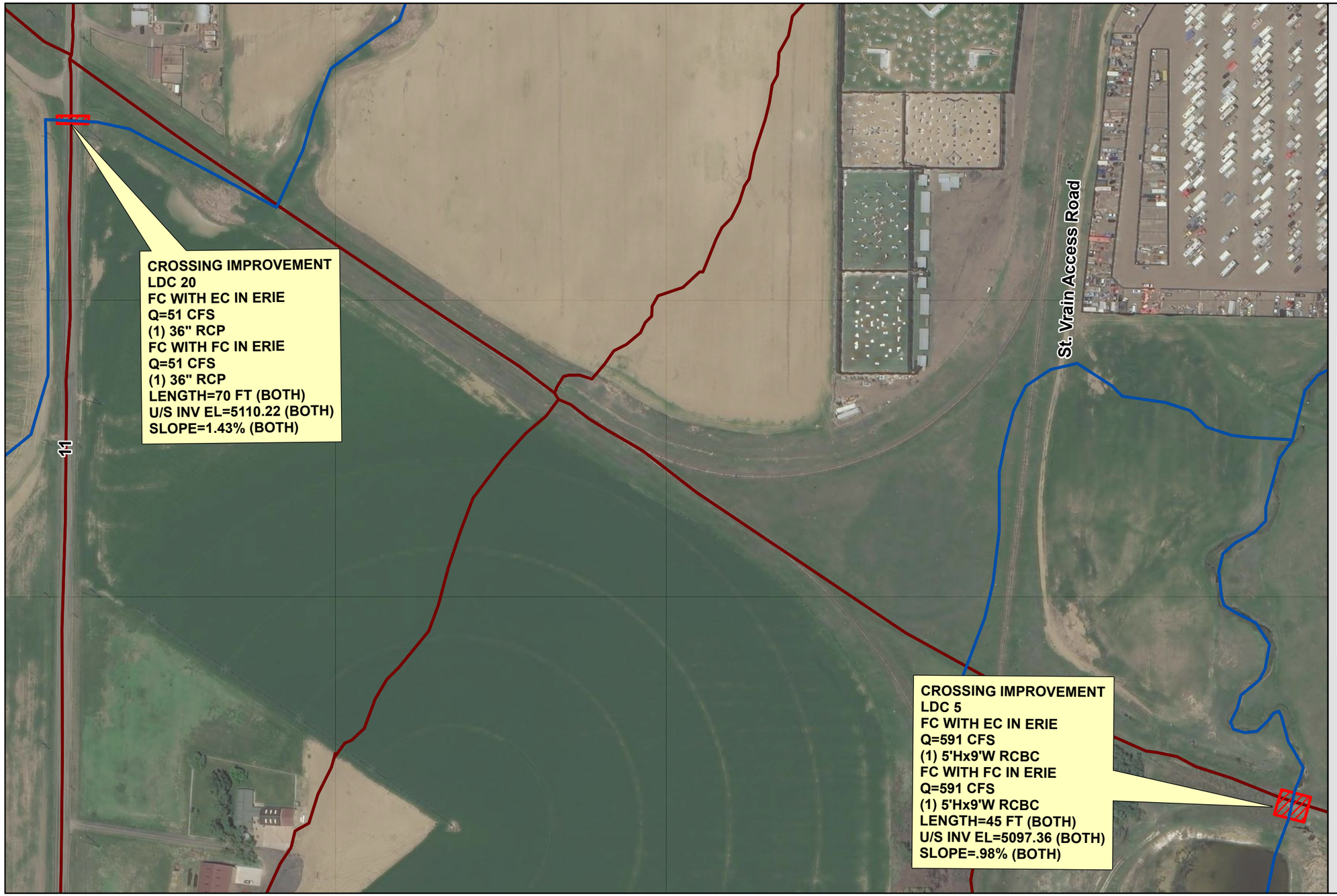
LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 2	INDEX: LDC-2



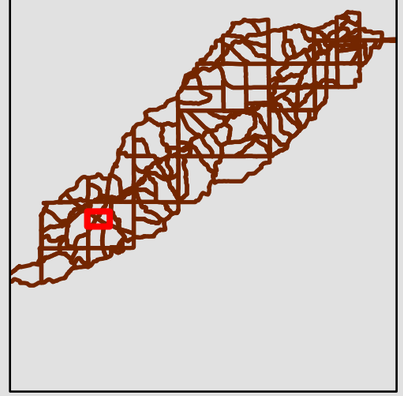
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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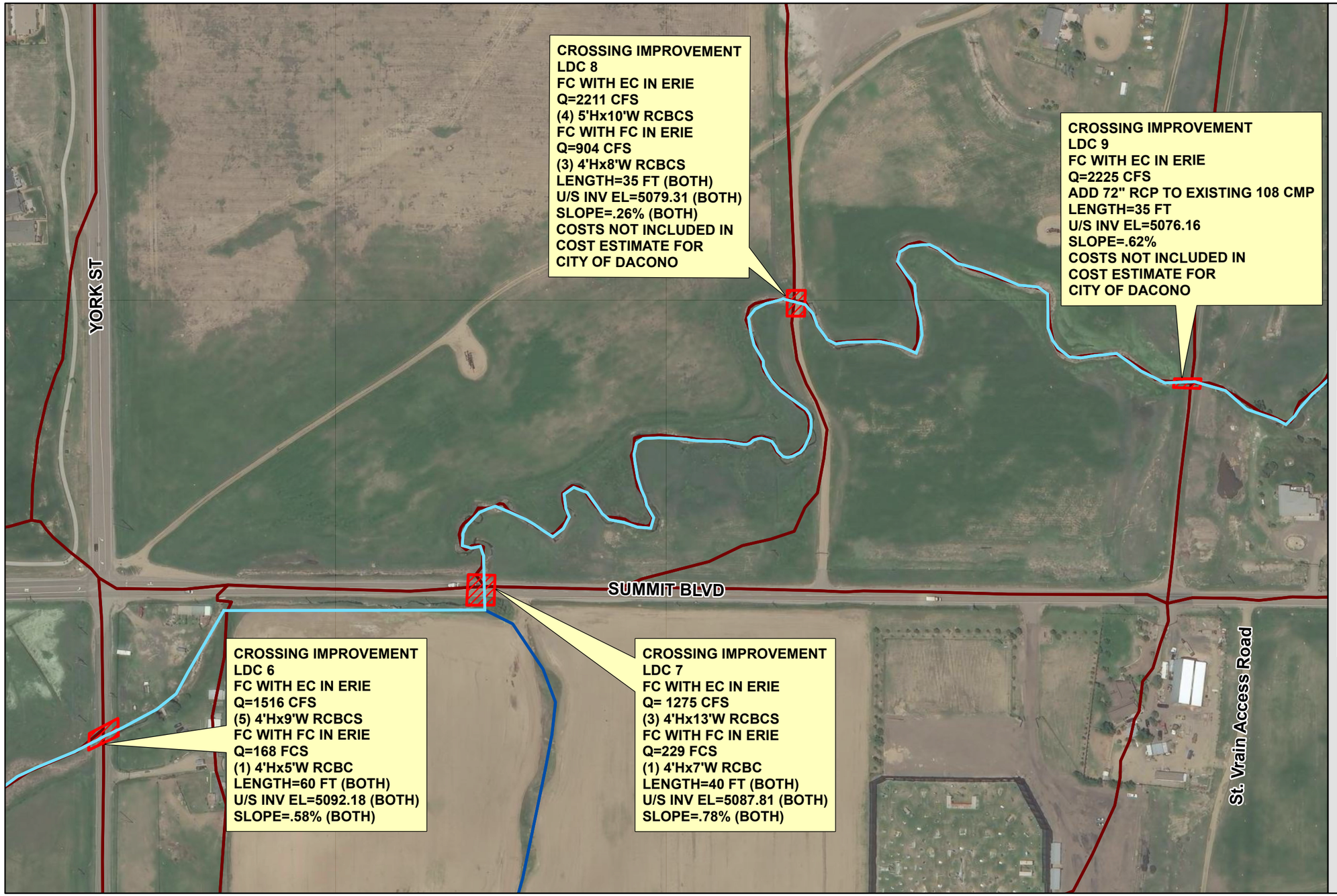
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 3	INDEX: LDC-3



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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
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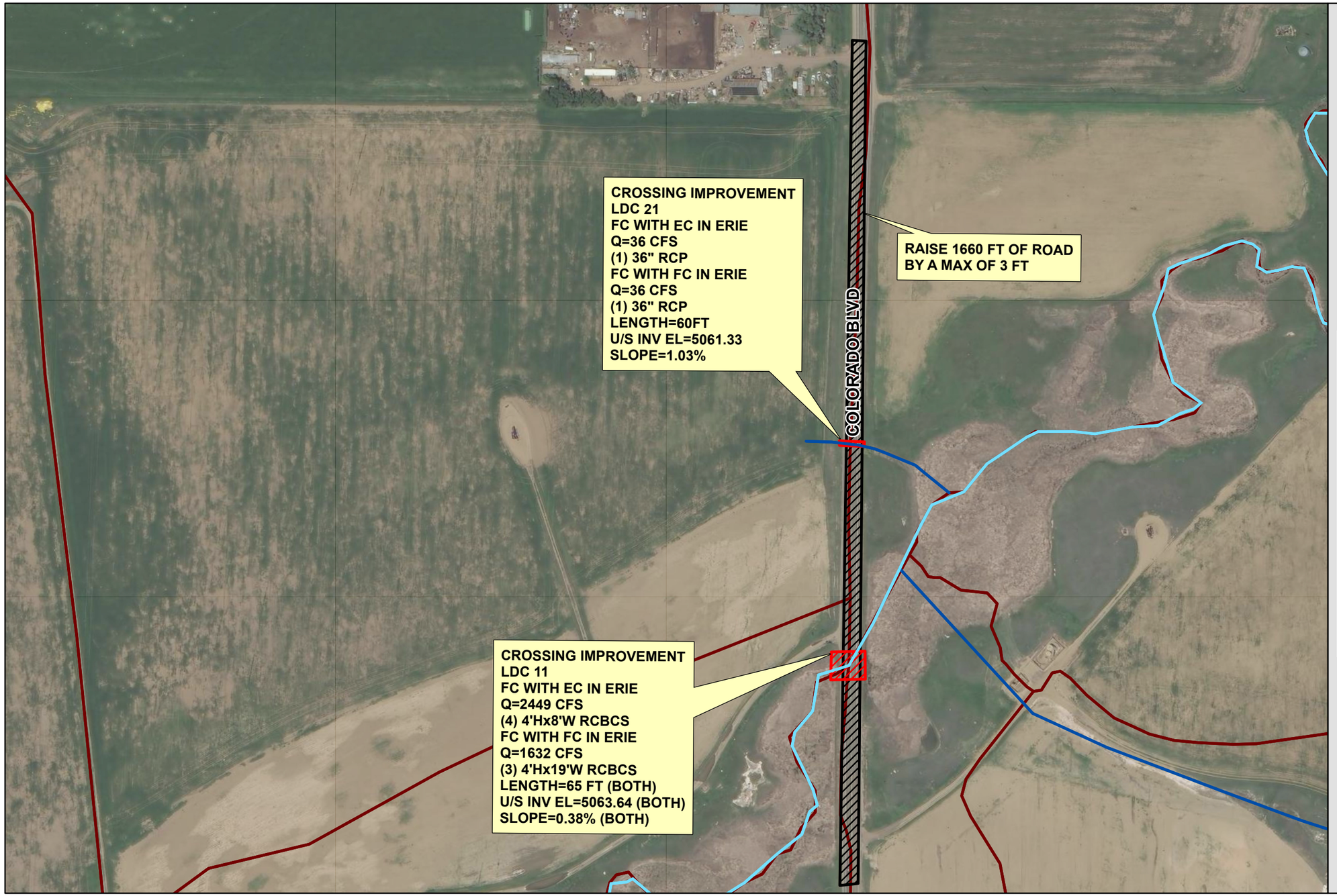


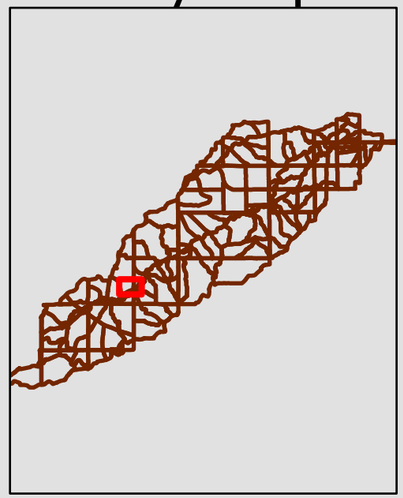
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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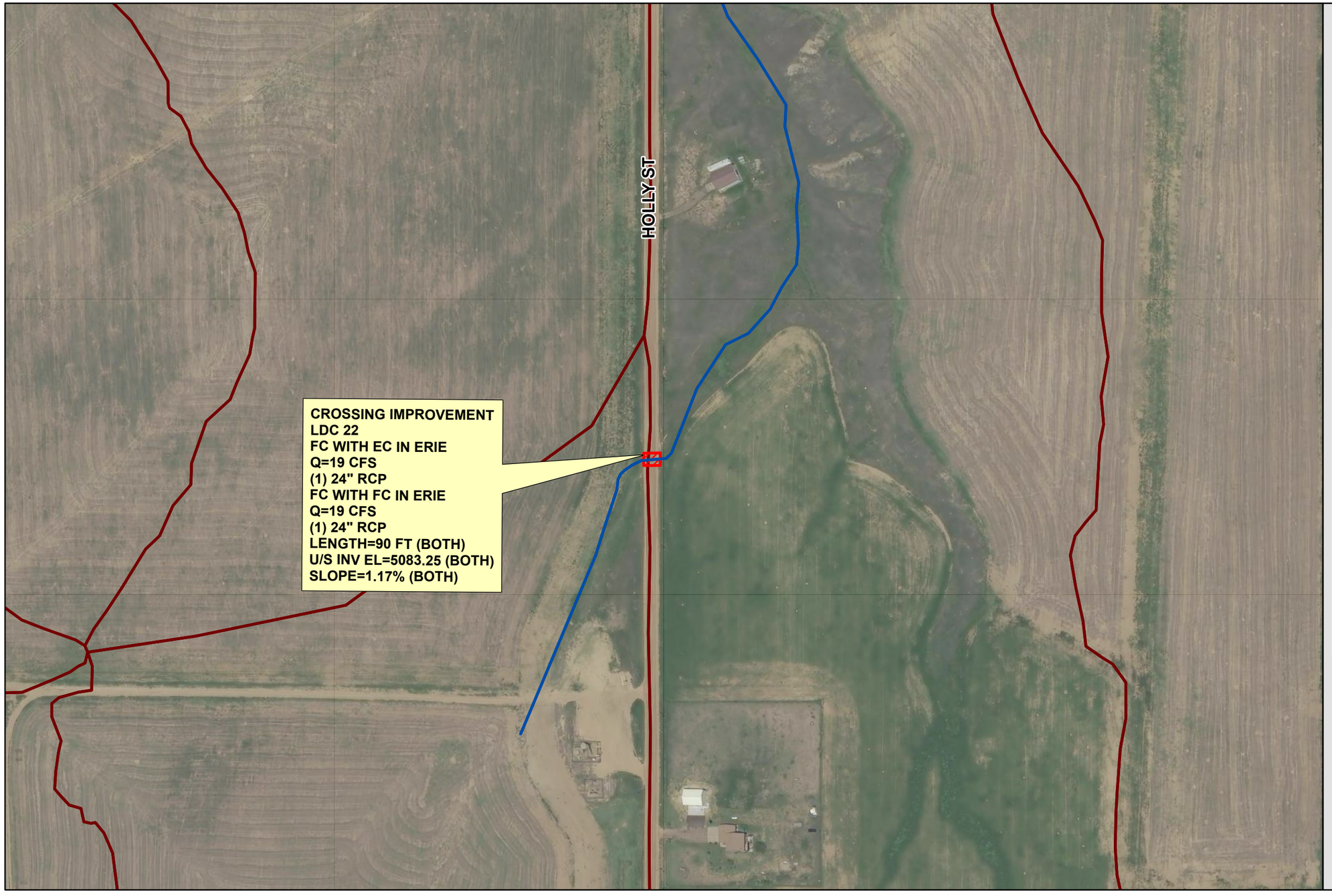
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 5	INDEX: LDC-5



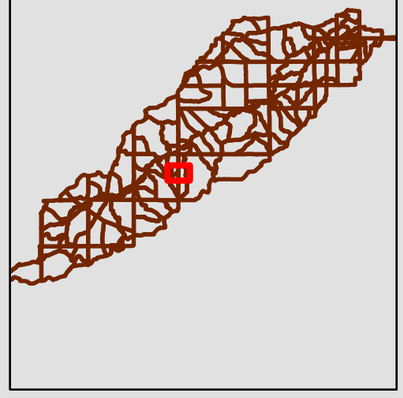
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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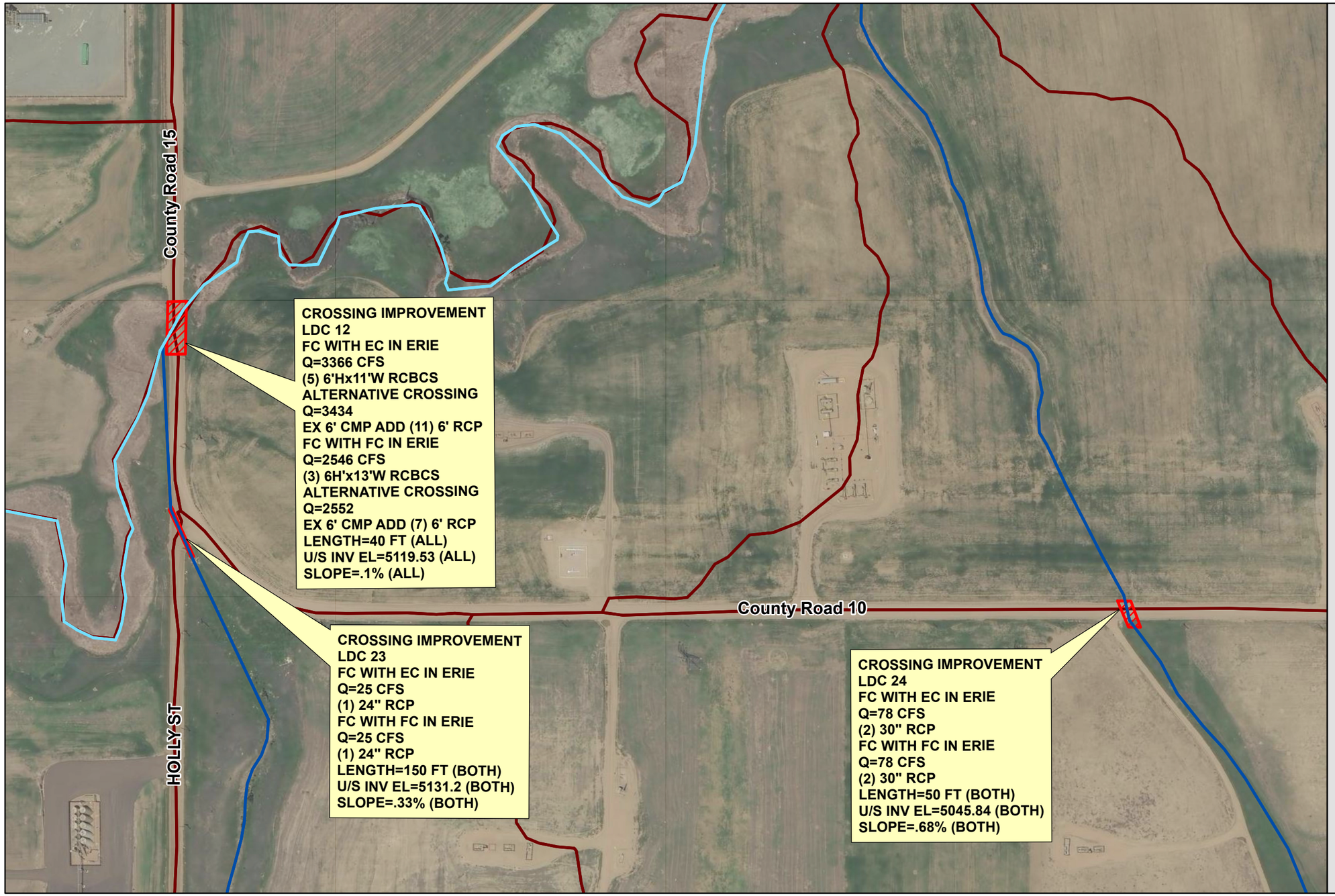
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 6	INDEX: LDC-6



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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 7	INDEX: LDC-7

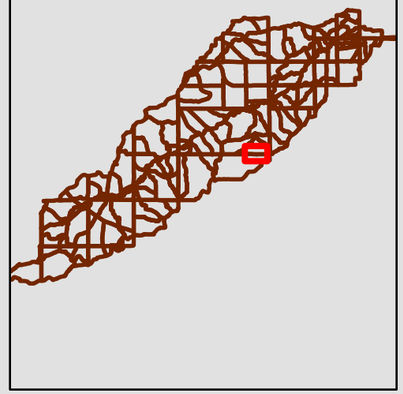
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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0 100 200 400 Feet

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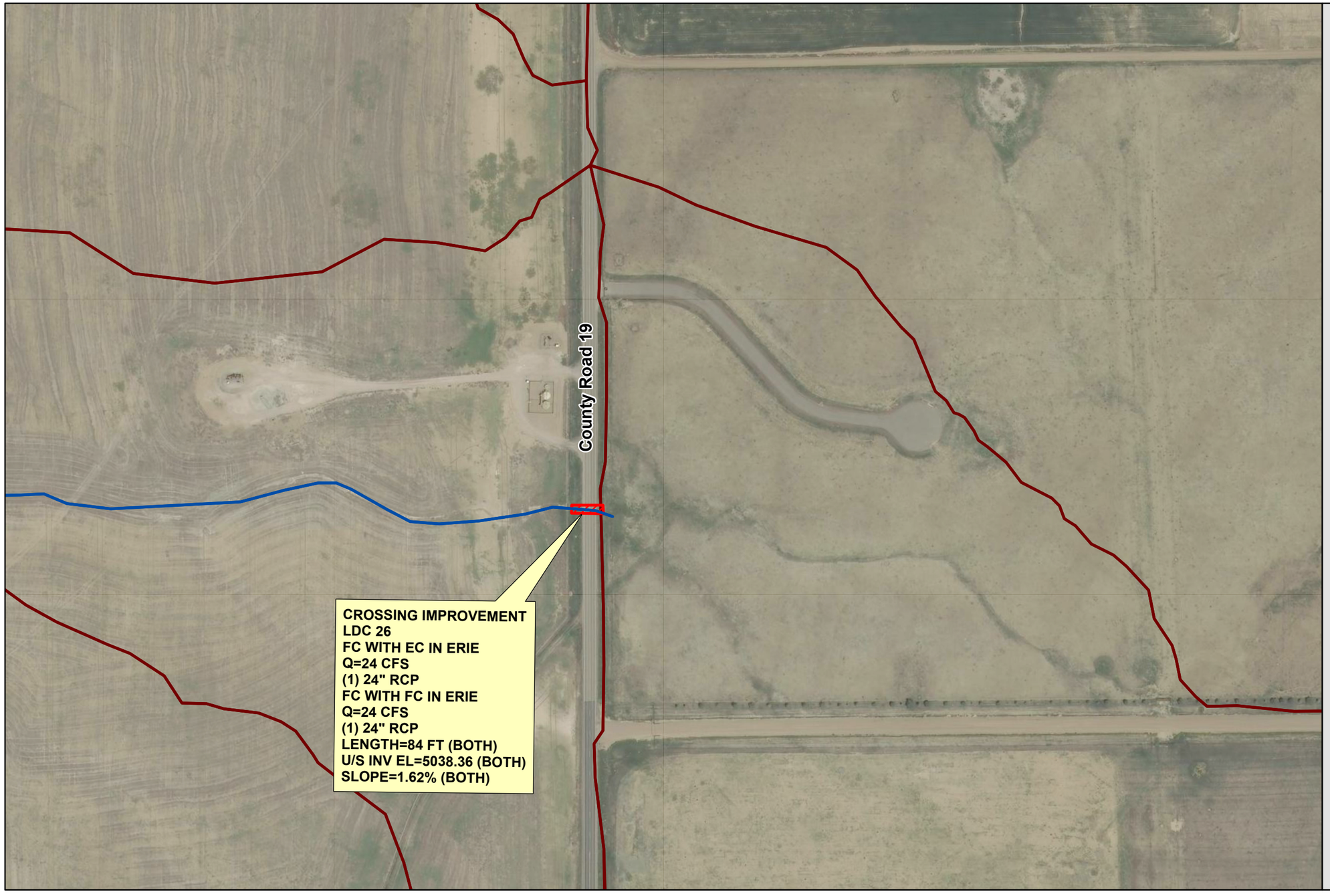
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 8	INDEX: LDC-8



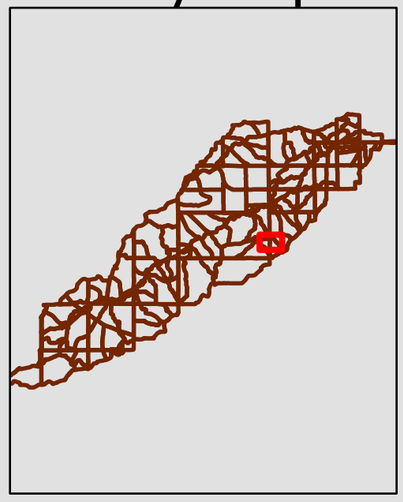
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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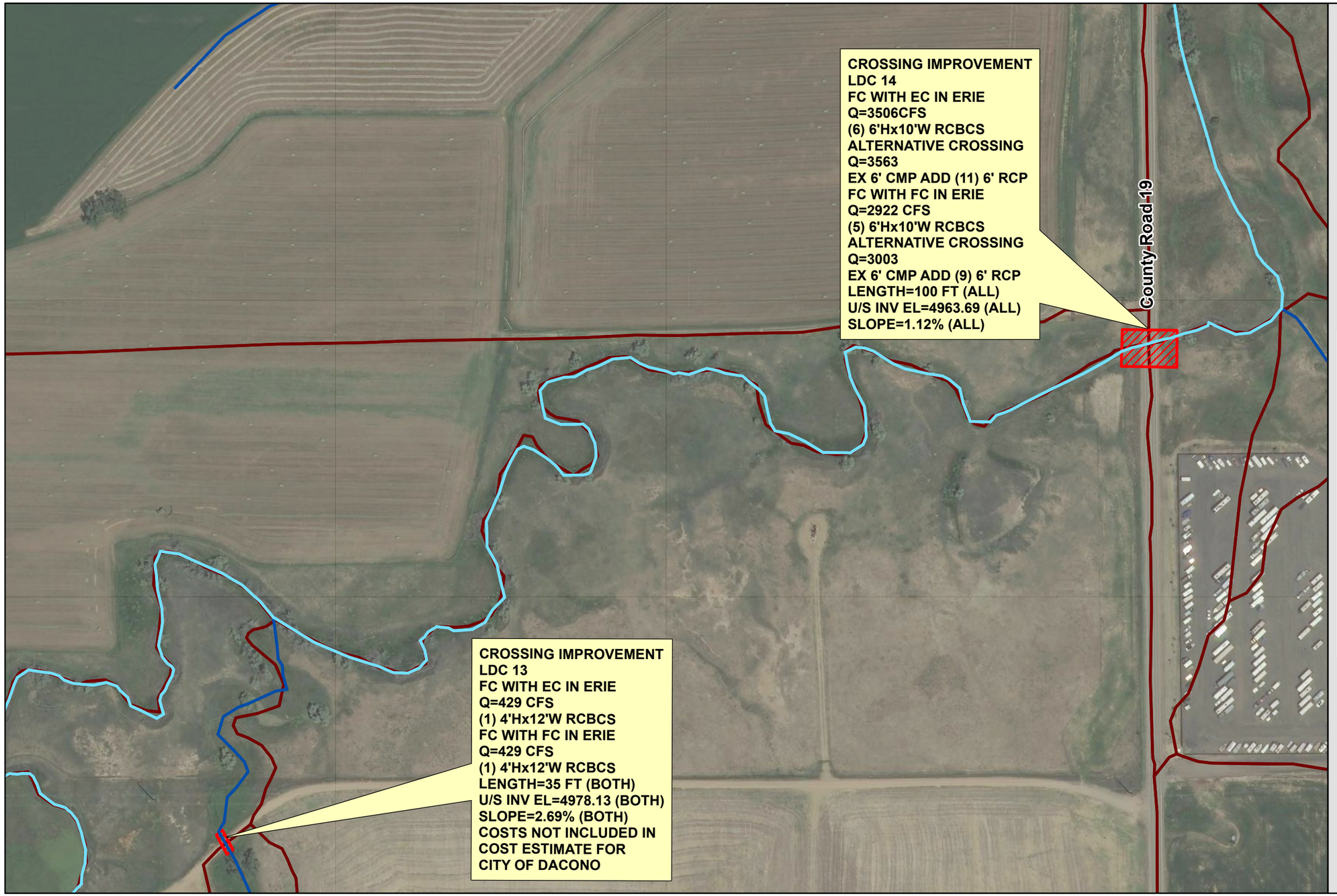
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 9	INDEX: LDC-9



Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

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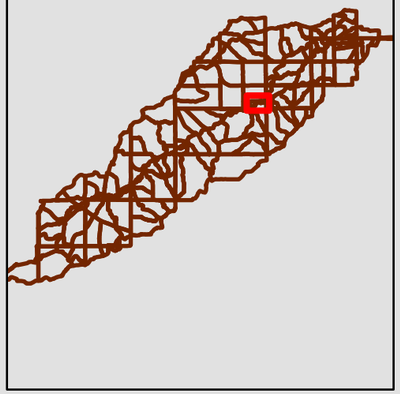
- Tributary

Key Map



N

0 100 200 400 Feet

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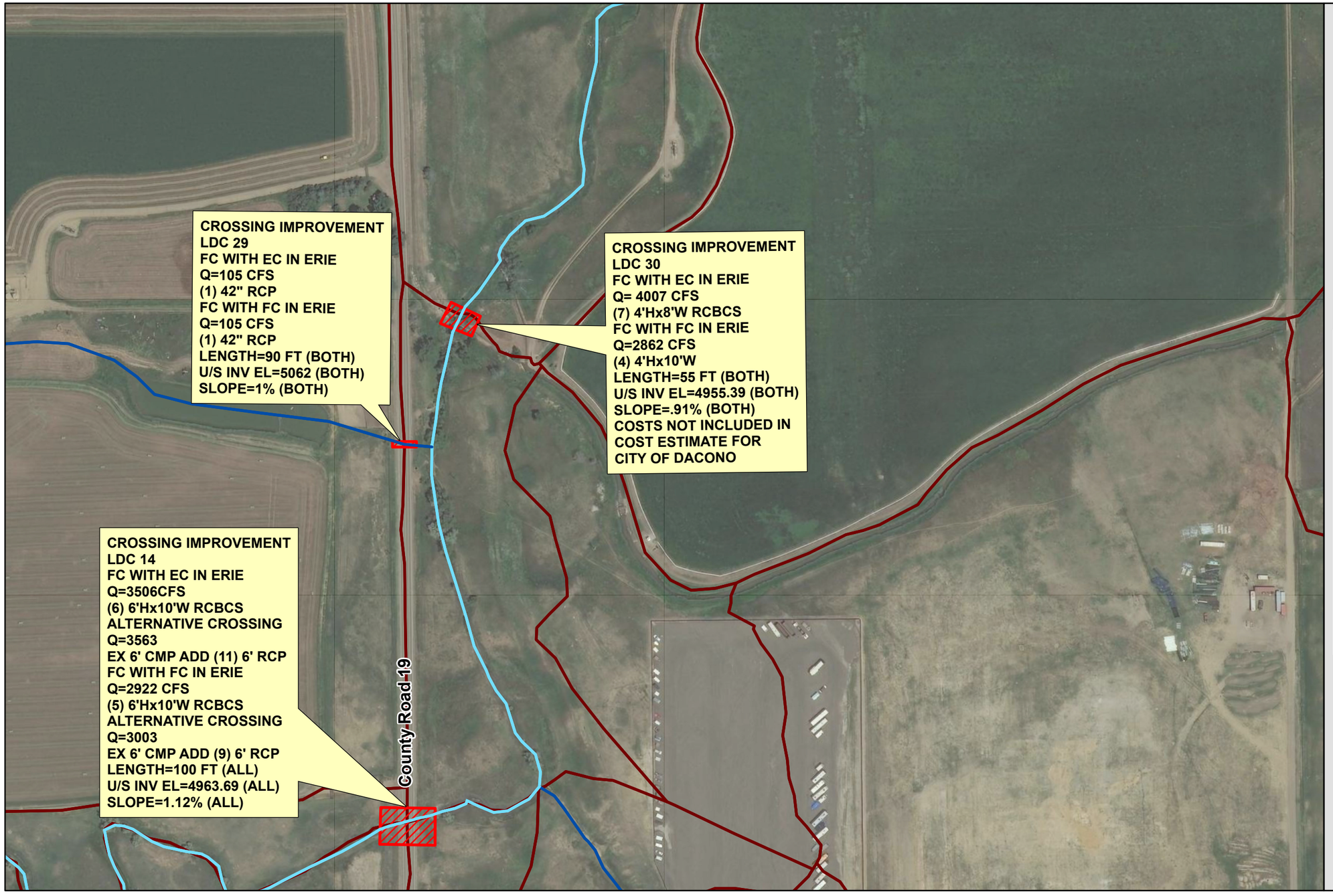
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 10	INDEX: LDC-10



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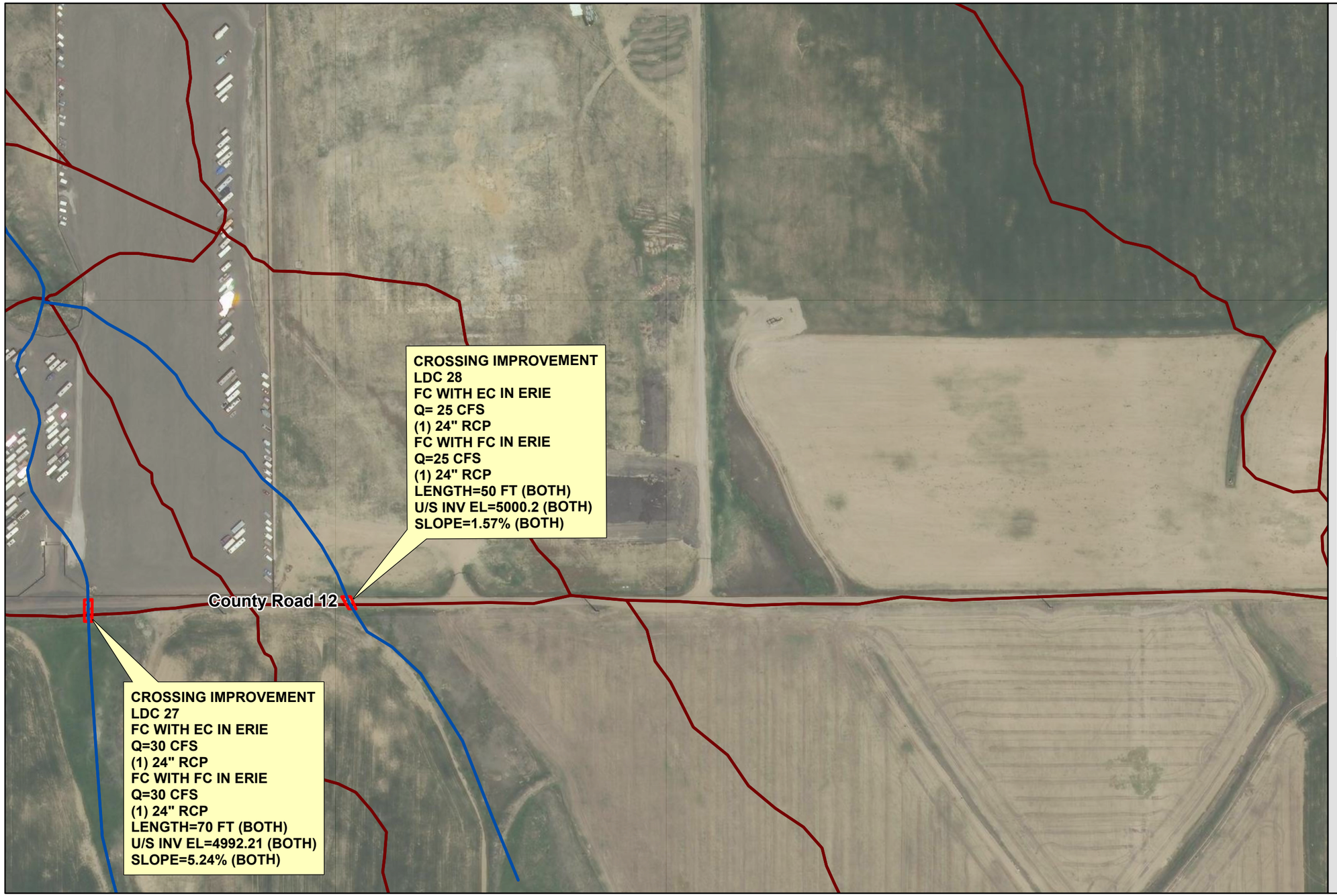
FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 11	INDEX: LDC-11



Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

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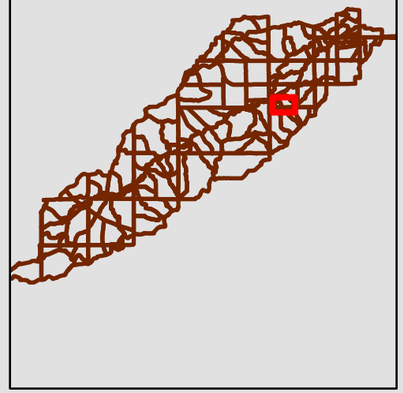
- Tributary

Key Map



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0 100 200 400 Feet

ICON ENGINEERING

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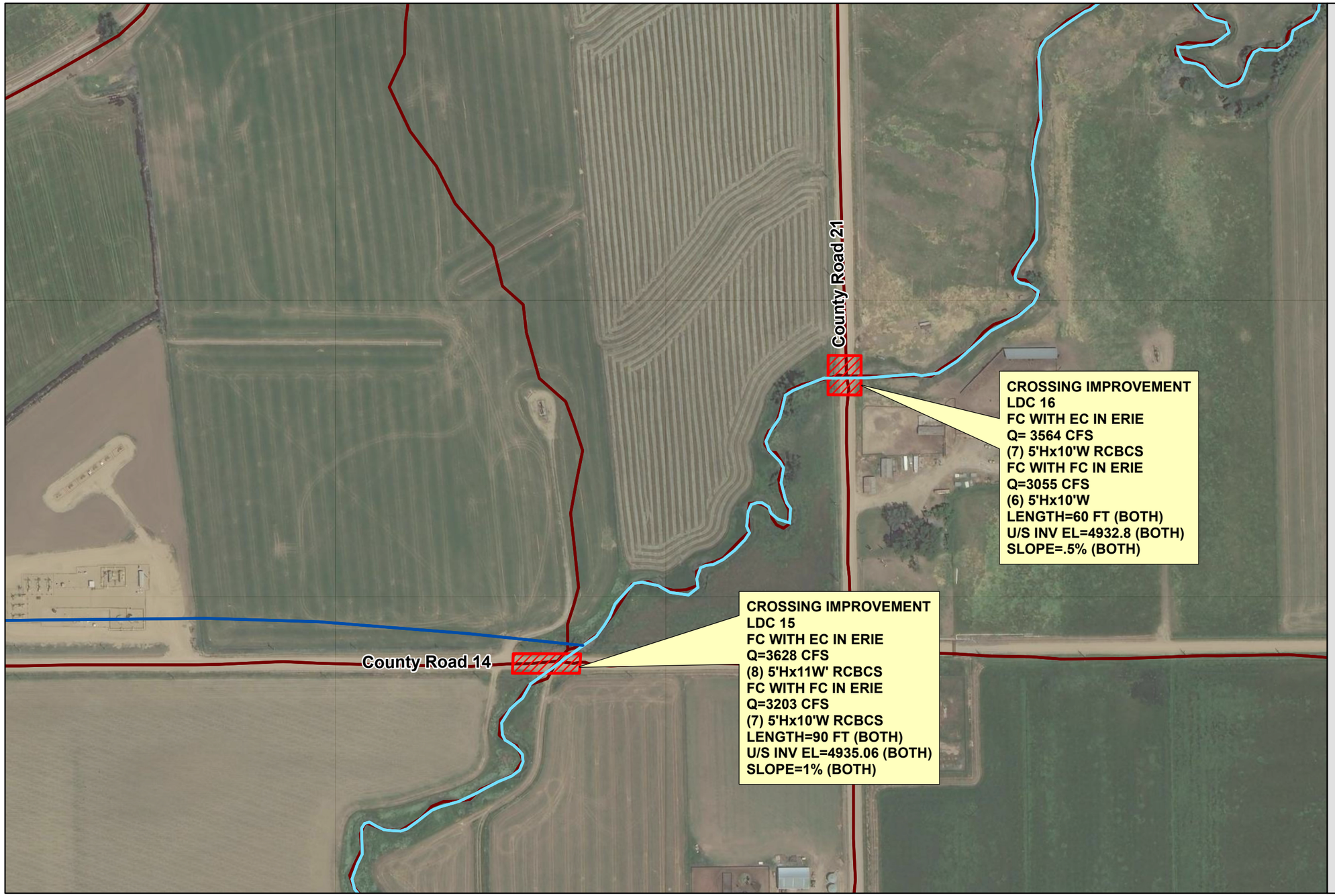
Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 12	INDEX: LDC-12



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FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
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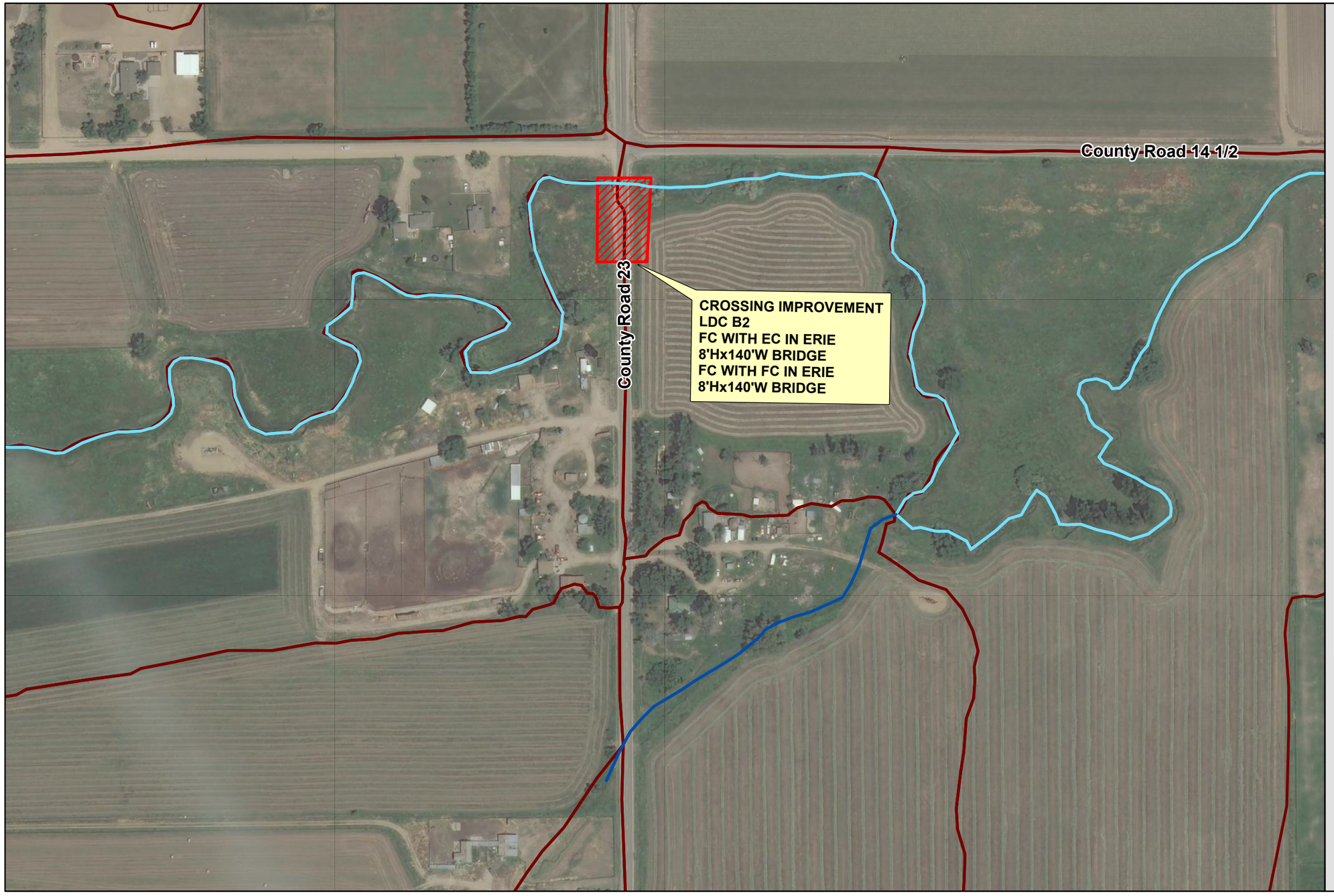

Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
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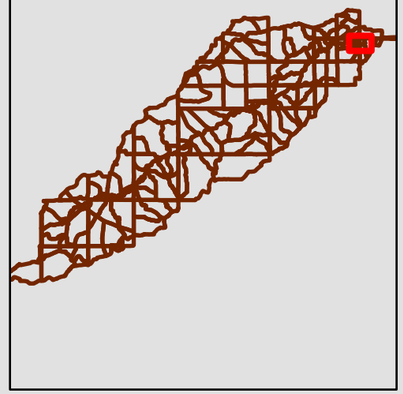
Flow Lines

- Little Dry Creek
- Tributary

Key Map



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0 100 200 400 Feet

ICON ENGINEERING

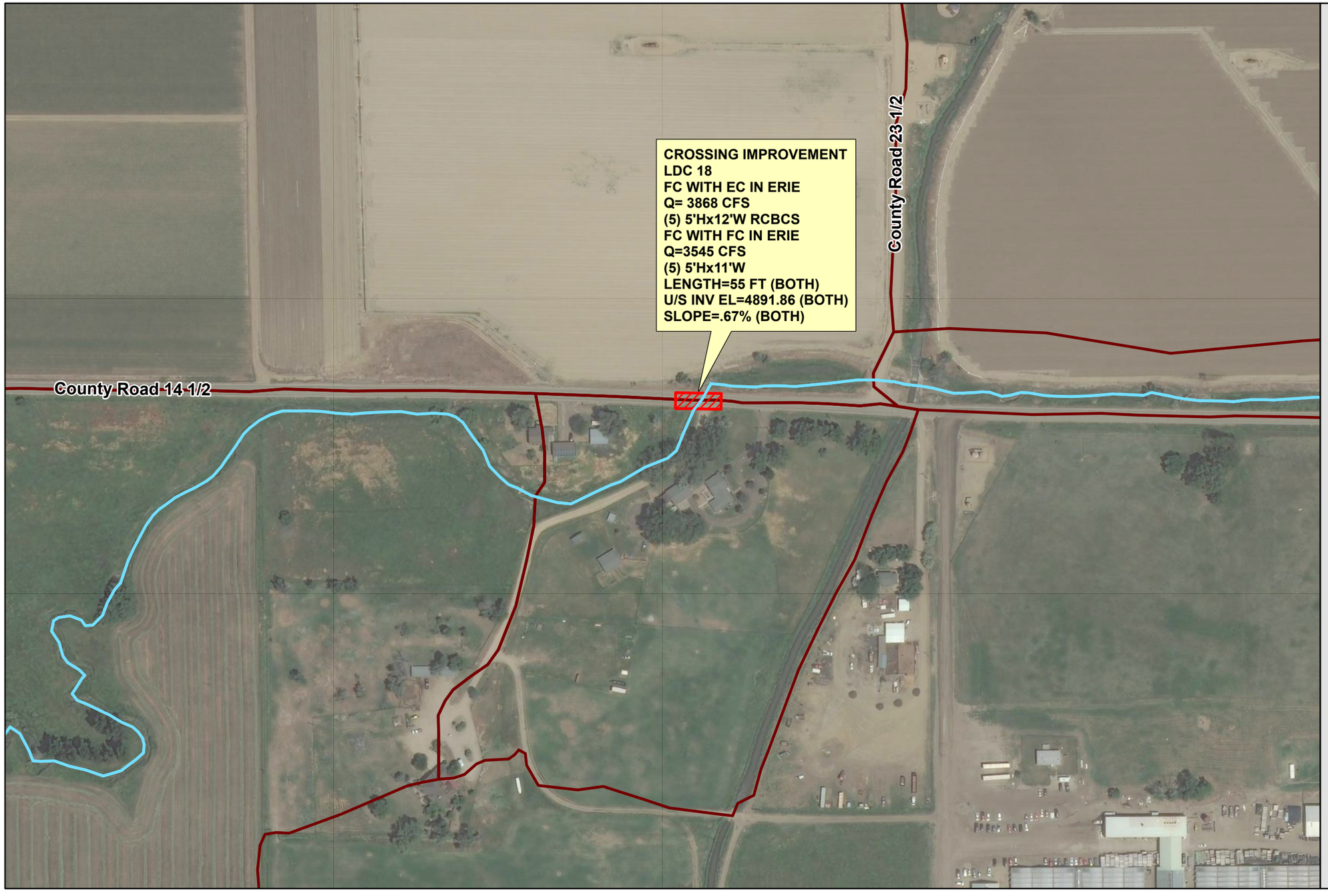
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 14	INDEX: LDC-14



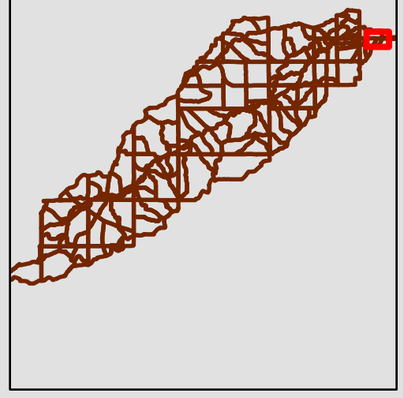
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



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0 100 200 400 Feet

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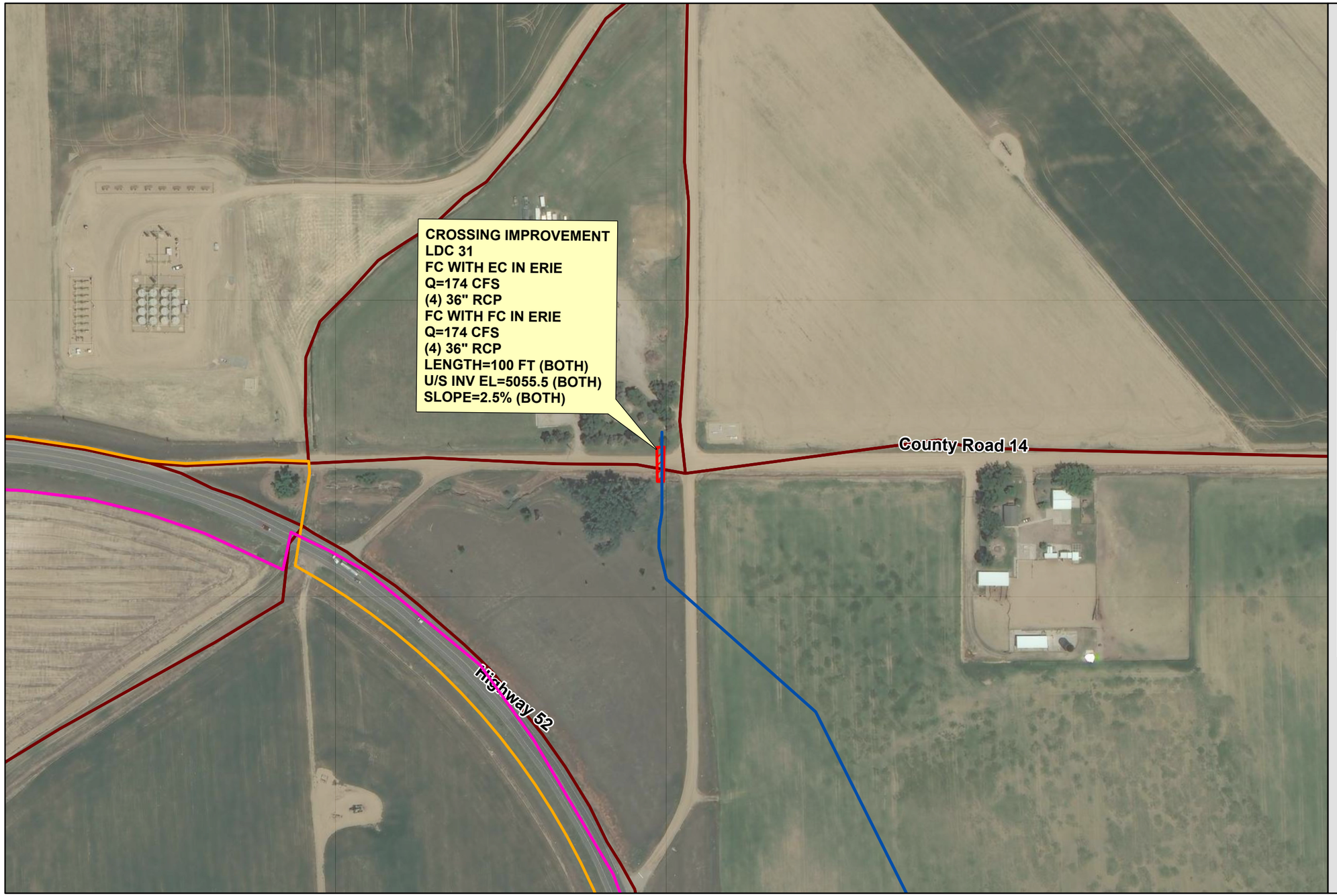
FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 15	INDEX: LDC-15



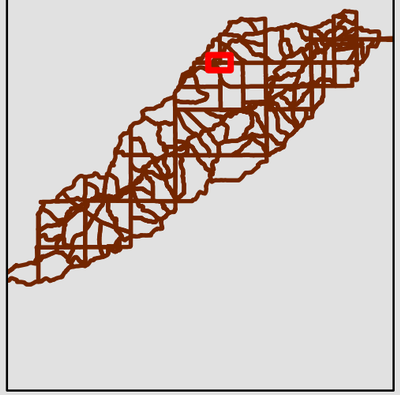
Legend

- Crossing Improvement
- Road Raise
- Dacono Planning Boundary
- Subbasin
- Frederick Planning Boundary

Flow Lines

- Little Dry Creek
- Tributary

Key Map



N

0 100 200 400 Feet

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LITTLE DRY CREEK PROPOSED IMPROVEMENT

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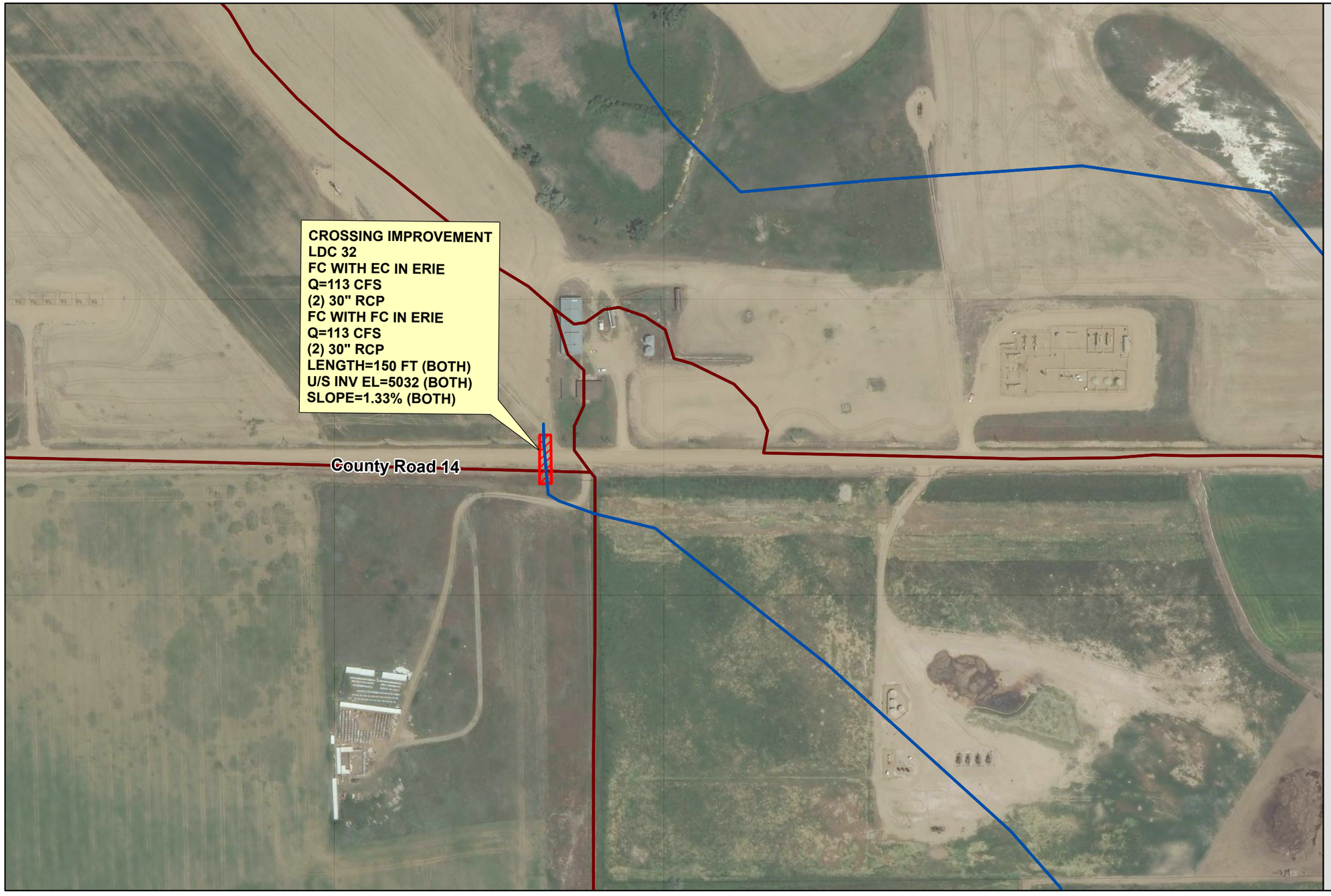
DATE: 11/18/2021	
SHEET: 16	INDEX: LDC-16



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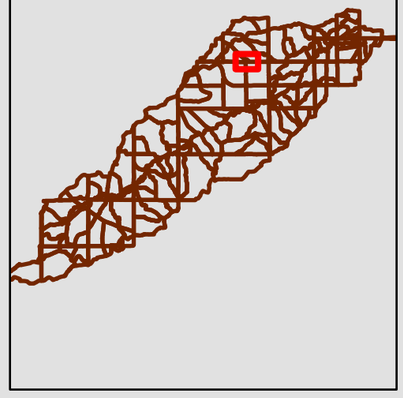

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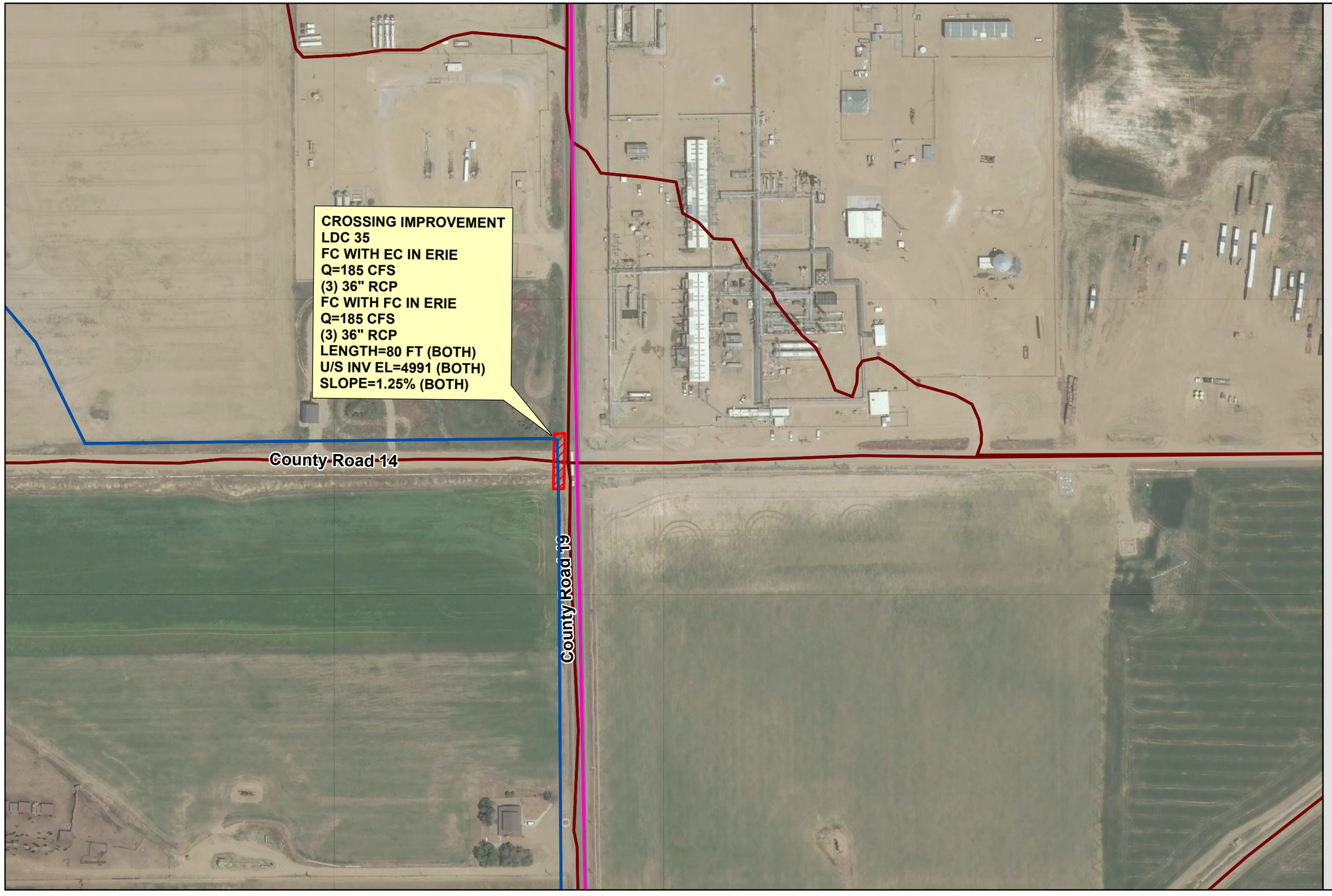
DATE: 11/18/2021	
SHEET: 17	INDEX: LDC-17



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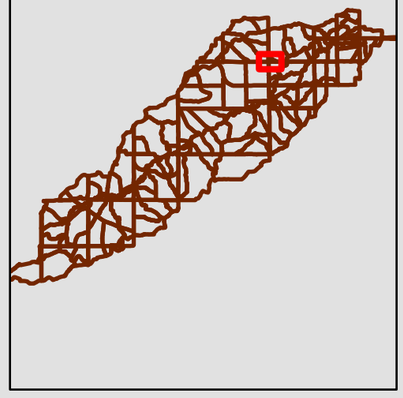

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FREDERICK COLORADO

Dacono Colorado

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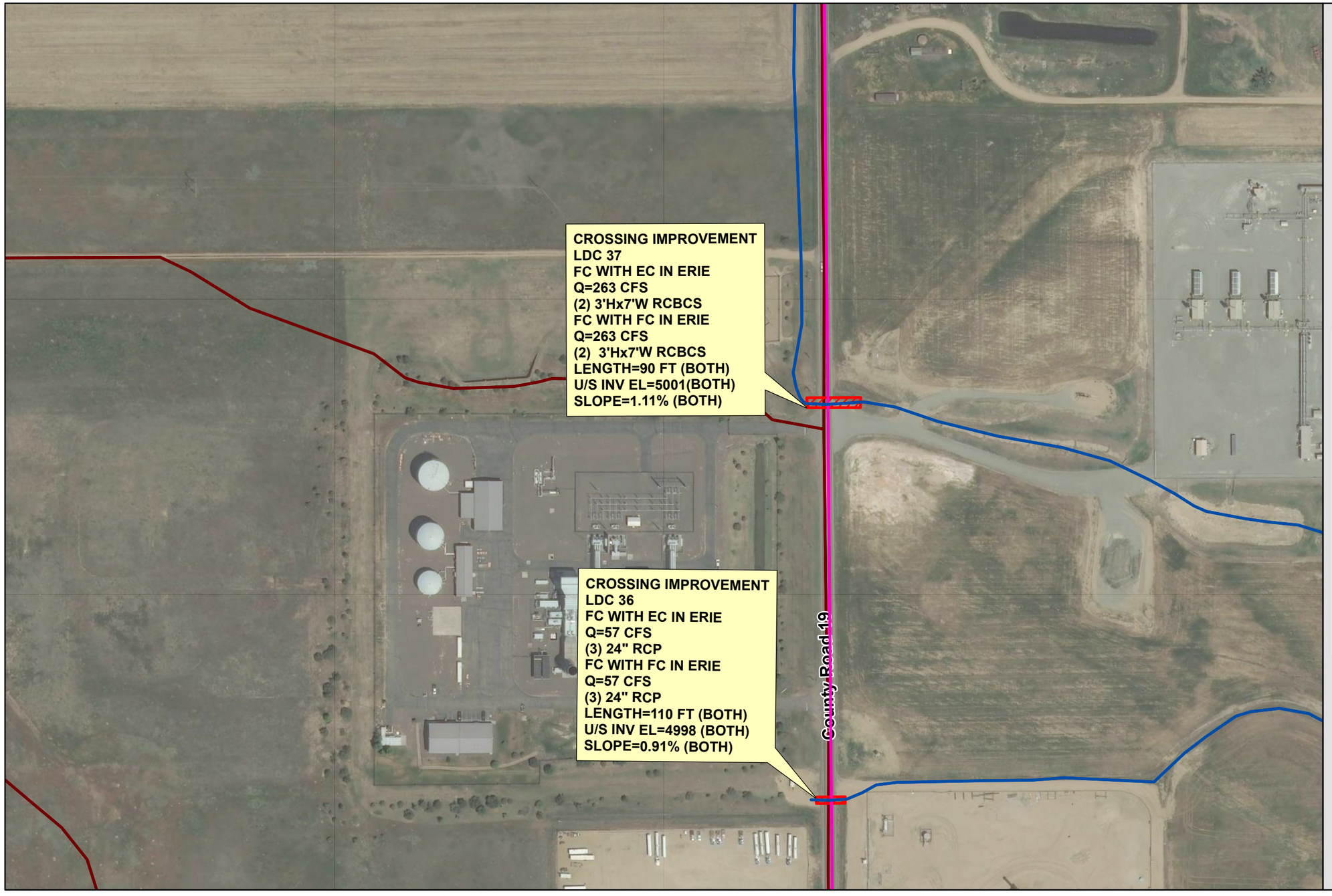
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 18	INDEX: LDC-18



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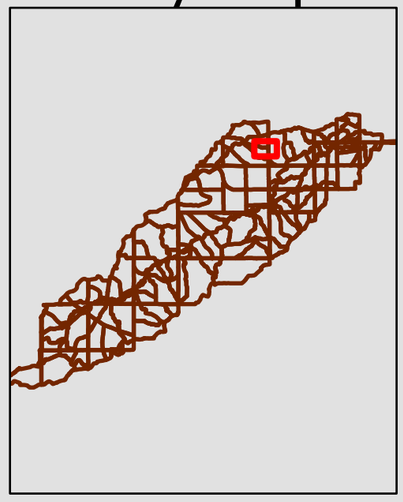

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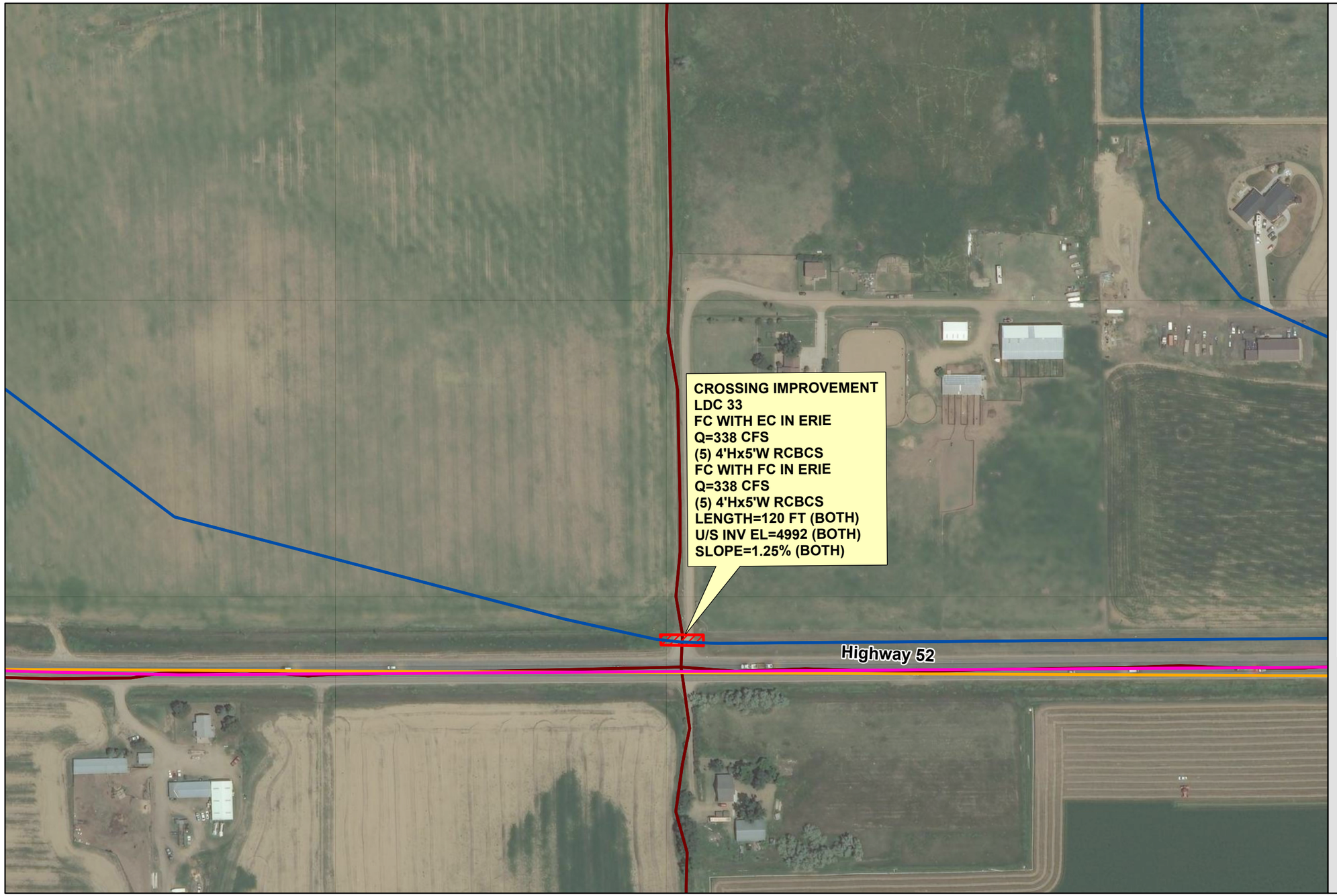
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 19	INDEX: LDC-19



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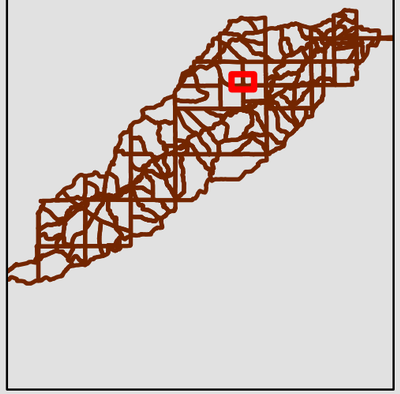

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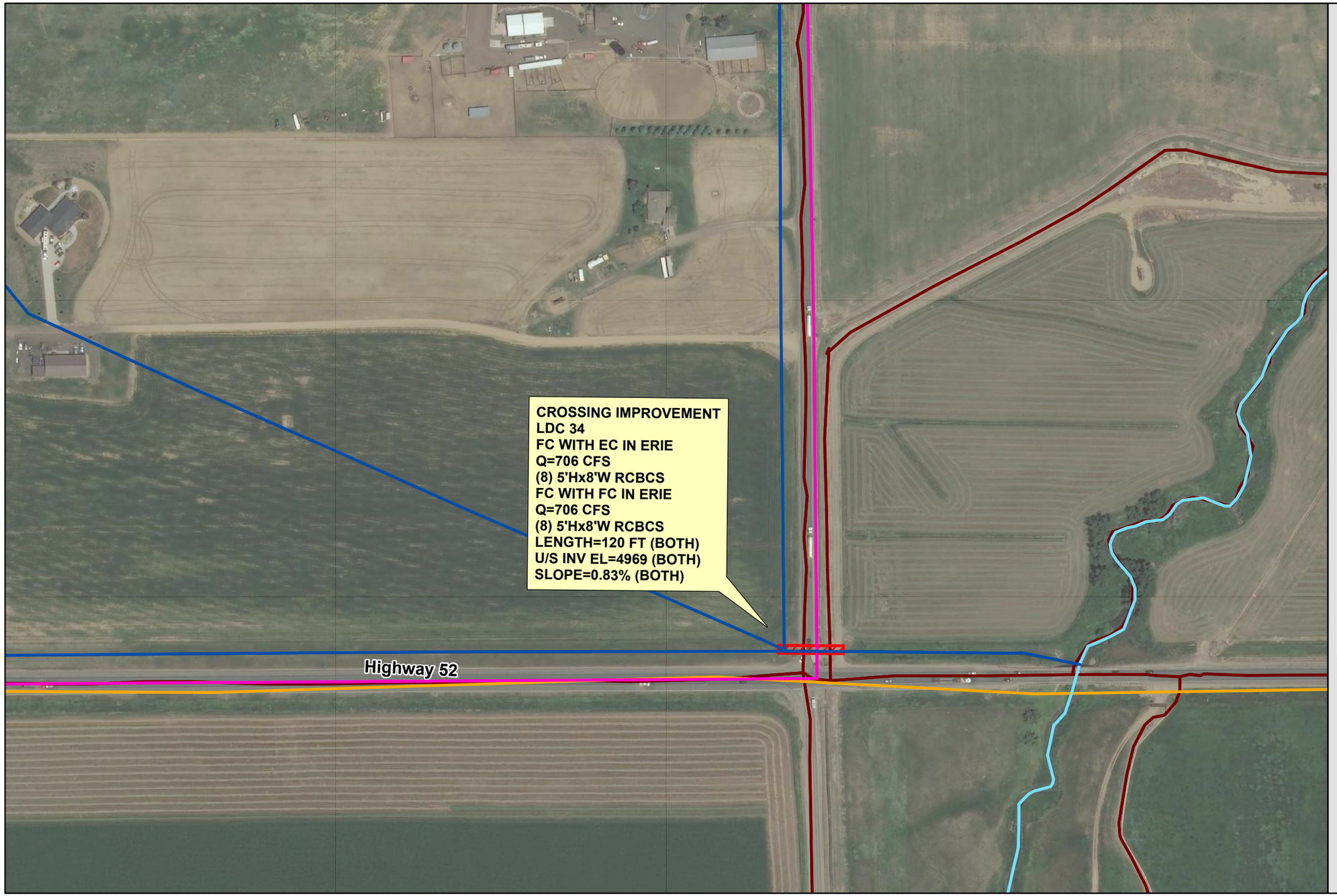
DATE: 11/18/2021	
SHEET: 20	INDEX: LDC-20



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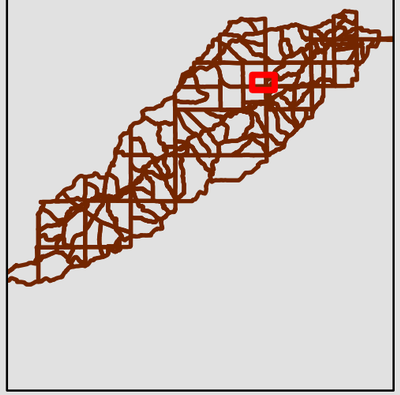

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ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

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DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 21	INDEX: LDC-21

COLORADO BOULEVARD BOX CULVERT

A PORTION OF THE W1/2 OF THE SW1/4 OF SECTION 13, TOWNSHIP 1 NORTH, RANGE 68 W EAST &
A PORTION OF THE E1/2 OF THE SE1/4 OF SECTION 18, TOWNSHIP 1 NORTH, RANGE 67 WEST OF
THE SIXTH PRINCIPAL MERIDIAN, CITY OF DACONO, COUNTY OF WELD, STATE OF COLORADO

PROJECT CONTACTS

OWNER:
JON RABAS
CITY OF DACONO
512 CHERRY AVENUE
PO BOX 186
DACONO, CO 80514
(303) 833-4836

CITY ENGINEER:
GARY ODEHNAL, PE
TAIT & ASSOCIATES, INC.
6163 EAST COUNTY ROAD 16
LOVELAND, CO 80537
(970) 613-1447

GEOTECHNICAL ENGINEER:
GROUND ENGINEERING
2468 EAST 9TH STREET
LOVELAND, CO 80537
(970) 622-0800

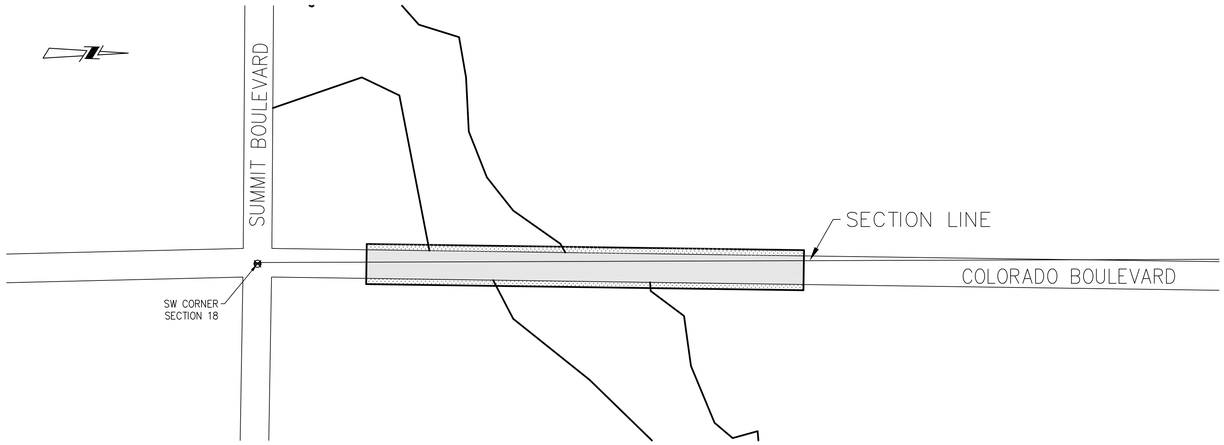
WATER:
JON RABAS
CITY OF DACONO
512 CHERRY AVENUE
PO BOX 186
DACONO, CO 80514
(303) 833-4836

WASTEWATER:
ST. VRAIN SANITATION DISTRICT
11307 BUSINESS PARK CIRCLE
FIRESTONE, CO 80504
(303) 994-7572

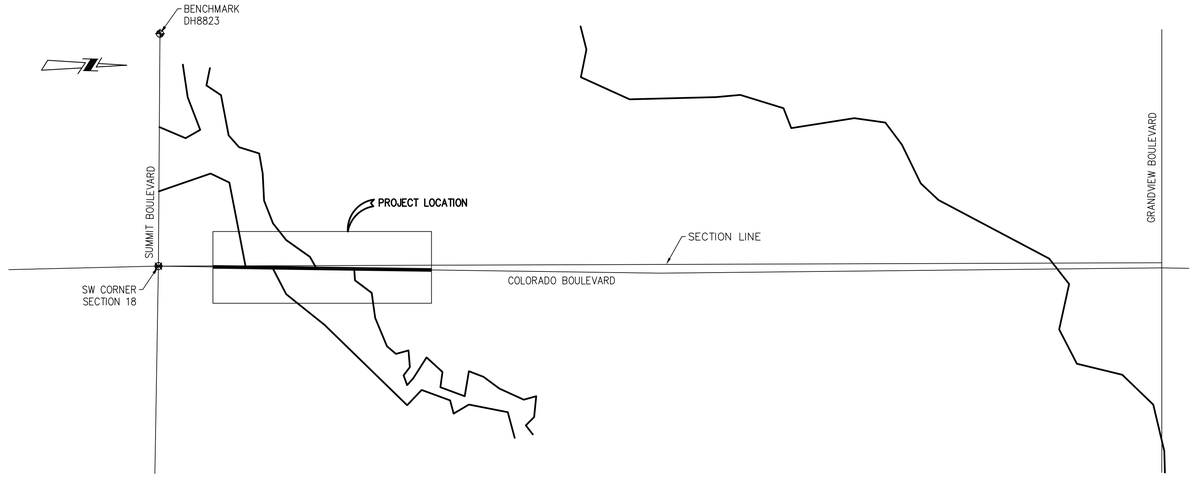
GAS:
PAUL WEINBERG
SOURCE GAS
3766 EUREKA WAY, UNIT1
FREDERICK, CO 80516
(303) 833-3313 EXT. 1935

ELECTRIC:
UNITED POWER
500 COOPERATIVE WAY
BRIGHTON, CO 80603
(303) 637-1300

TELEHONE/CABLE:
COMCAST
(800) 266-2278



PROJECT MAP
NTS



VICINITY MAP
NTS

SHEET INDEX

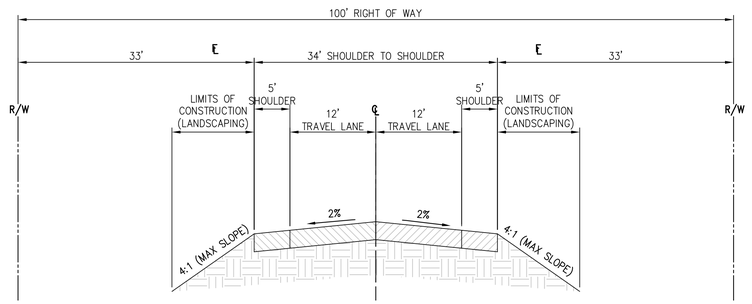
C1 – COVER SHEET
C2 – NOTES SHEET
D1 – EXISTING CONDITIONS & DEMOLITION PLAN
G1 – GRADING PLAN
G2 – BOX CULVERT GRADING DETAIL
R1 – PLAN & PROFILE – STA 20+00 – STA 29+00
R2 – PLAN & PROFILE – STA 29+00 – STA 36+00
S2 – PROJECT DETAILS
S1 – PROJECT DETAILS

SITE LEGEND:

- RIGHT-OF-WAY LINE
- SECTION LINE
- PROPOSED ROADWAY CENTERLINE
- EXTENT OF ROADWAY PAVEMENT REMOVAL
- EXTENT OF DRIVEWAY PAVEMENT REMOVAL
- EXTENT OF GROUND EXCAVATION
- EXISTING FIRE HYDRANT
- EXISTING LIGHT POLE
- EXISTING SIGN
- EXISTING SANITARY MANHOLE
- EXISTING STORM DRAIN MANHOLE
- EXISTING WATER VALVE
- PROPOSED FIRE HYDRANT
- PROPOSED KICKBLOCK
- PROPOSED SIGN
- PROPOSED WATER VALVE
- BENCHMARK
- SECTION CORNER
- 51.15TC / 50.65FS — PROPOSED GRADE
- (59.36)TC / (58.86)FS — EXISTING GRADE
- 2576 — PROPOSED CONTOUR
- (2576) — EXISTING CONTOUR
- 2.0% — PROPOSED SLOPE/FLOW DIRECTION
- (2.0%) — EXISTING SLOPE/FLOW DIRECTION

ABBREVIATIONS:

AC	ASBESTOS CONCRETE
BOE	BOTTOM OF ELECTRIC
BOG	BOTTOM OF GAS
BOT	BOTTOM OF TELEPHONE
BOW	BOTTOM OF WATER
BW	BACK OF WALK
CF	CURB FACE
ELEC/E	ELECTRIC TRENCH
EXIST	EXISTING
FF	FINISHED FLOOR
FG	FINISHED GRADE
FL	FLOW LINE
FS	FINISHED SURFACE
GAS/G	GAS TRENCH
GB	GRADE BREAK
GDC	GLEN DALE CIRCLE
GV	GATE VALVE
HP	HIGH POINT
INV	INVERT
LP	LOW POINT
P.I.P.	PROTECT IN PLACE
PROP	PROPOSED
RCP	REINFORCED CONCRETE PIPE
R/W	RIGHT OF WAY
SAN/S	SANITARY SEWER
SD	STORM DRAIN
S.F.	SQUARE FEET
SSMH	SANITARY SEWER MANHOLE
TC	TOP OF CURB
TELE/T	TELEPHONE
TG	TOP OF GRATE
TOSD	TOP OF STORM DRAIN
TOSS	TOP OF SANITARY SEWER
TOW	TOP OF WATER
TS	TOP OF STEP
TYP	TYPICAL
W/WTR	WATER



TYPICAL STREET SECTION

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

UNAUTHORIZED CHANGES & USES:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES OF THESE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS PRIOR TO CONSTRUCTION. CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

ENGINEERS NOTE TO CONTRACTOR:

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES, PIPES, AND/OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THERE MAYBE EXISTING UTILITIES NOT SHOWN ON THESE PLANS. THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION OF THOSE UNDERGROUND UTILITIES TO BE USED PRIOR TO CONSTRUCTION AND SHALL BE RESPONSIBLE FOR ANY DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON.

BENCH MARK:
USGS NGS MONUMENT, DESIGNATED "RAMONA RESET."
MONUMENT PID IS DH8823
NAVD88 ELEVATION = 5166.66 FEET.

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE WEST LINE OF SECTION 18, T1N, R67W, IN THE CITY OF DACONO. THE BEARING IS N00°11'34"W AND IS SHOWN ON THE PLANS.

ENGINEERING REVIEW
CITY OF DACONO

☐ NO EXCEPTIONS TAKEN
☐ MAKE CORRECTIONS NOTED
☐ REJECTED-SEE CHECKLIST

REVIEW IS FOR GENERAL COMPLIANCE WITH CITY OF DACONO ENGINEERING STANDARDS AND REQUIREMENTS. THE CITY OF DACONO IS NOT RESPONSIBLE FOR THE CORRECTNESS OF DESIGN, DIMENSIONS, DETAILS, QUANTITIES OR DESIGN SAFETY.

CITY ENGINEER DATE

THESE PLANS ARE VALID FOR TWO (2) YEARS AFTER THE DATE OF APPROVAL. RESUBMITTAL TO THE CITY IS REQUIRED AFTER THAT TIME PERIOD.

PREPARED UNDER THE SUPERVISION OF TAIT & ASSOCIATES, INC.

GARY A. ODEHNAL
COLORADO P.E. #28086

NO.	DESCRIPTION	BY	DATE
	REVISIONS		

TAIT
Since 1964
6163 E. Larimer County Road 16
Loveland, CO 80537
p: 970.613.1447 f: 970.613.1897
www.tait.com
Los Angeles
Kansas City/Chicago
Sacramento
Seattle
Boise
Phoenix
Denver
North Dakota

COVER SHEET
COLORADO BOULEVARD BOX CULVERT
CITY OF DACONO
NORTH OF SUMMIT BOULEVARD
DACONO, CO

DRAWN:RM
DATE: 04/18/16
CHK: GAO
DATE: 05/07/2016
REVISION #: —
DATE: —
JOB NO. CO1299D

C1

May 18, 2016 - 8:38am by rmcclellan K:\Drawings\CO\CO1299D Dacono, CO\CO1299D Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\ENG\CO1299D_CS.dwg

COLORADO BOULEVARD BOX CULVERT

STREET & GRADING GENERAL NOTES:

1. ALL WORK WITHIN THE PUBLIC ROW OR EASEMENT SHALL CONFORM TO THE CITY OF DACONO ENGINEERING STANDARDS.
2. CONTRACTOR TO PROVIDE CONSTRUCTION SCHEDULE AND PROPOSED CONSTRUCTION SEQUENCE AS PART OF THE COMPLETE BID PACKAGE.
3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE CITY OF ANY PROBLEM IN CONFORMING TO THE APPROVED PLANS FOR ANY ELEMENT OF THE PROPOSED IMPROVEMENTS PRIOR TO ITS CONSTRUCTION.
4. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR DURING CONSTRUCTION ACTIVITIES TO RESOLVE CONSTRUCTION PROBLEMS DUE TO CHANGED CONDITIONS OR DESIGN ERRORS ENCOUNTERED BY THE CONTRACTOR DURING THE PROGRESS OF ANY PORTION OF THE PROPOSED WORK. IF, IN THE OPINION OF THE CITY INSPECTOR, THE MODIFICATIONS PROPOSED BY THE CONTRACTOR TO THE APPROVED PLANS INVOLVE SIGNIFICANT CHANGES TO THE CHARACTER OF THE WORK OR TO FUTURE CONTIGUOUS PUBLIC OR PRIVATE IMPROVEMENTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING REVISED PLANS TO THE CITY OF DACONO FOR APPROVAL PRIOR TO ANY FURTHER CONSTRUCTION RELATED TO THAT PORTION OF THE WORK. ANY IMPROVEMENTS CONSTRUCTED NOT IN ACCORDANCE WITH THE APPROVED PLANS, OR THE APPROVED REVISED PLANS, SHALL BE REMOVED AT THE CONTRACTOR'S EXPENSE AND THE IMPROVEMENTS SHALL BE RECONSTRUCTED ACCORDING TO THE APPROVED PLANS.
5. UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) – THE UTILITIES CONTRACTOR SHALL CONTACT UNCC FOR LOCATION OF UNDERGROUND GAS, ELECTRIC, AND TELEPHONE UTILITIES AT LEAST FORTY–EIGHT (48) HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. PHONE 811, 800–922–1987 OR 303–232– 1991.
6. WITH NOTIFICATION OF THE RESPECTIVE OWNER, ADJUST RIMS OF ALL CLEANOUTS, MANHOLES, VALVE COVERS AND SURVEY MONUMENTS TO FINISH GRADE PRIOR TO FINAL LIFT PAVING.
7. THE CONTRACTOR SHALL PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FLAGMEN OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY IN ACCORDANCE WITH THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
8. THE CONTRACTOR SHALL PROVIDE INGRESS AND EGRESS TO PRIVATE PROPERTY ADJACENT TO THE WORK THROUGHOUT THE PERIOD OF CONSTRUCTION. THE CONTRACTOR SHALL OBTAIN WRITTEN AGREEMENT FROM THE AFFECTED PROPERTY OWNERS IMPACTED BY THIS ACCESS, PRIOR TO BEGINNING WORK.
9. PRIOR TO FINAL PLACEMENT OF SURFACE PAVEMENT, ALL UNDERGROUND UTILITY MAINS SHALL BE INSTALLED AND SERVICE CONNECTIONS STUBBED OUT BEYOND CURB LINE WHEN ALLOWED BY THE UTILITY. SERVICE FROM PUBLIC UTILITIES AND FROM SANITARY SEWERS SHALL BE MADE AVAILABLE FOR EACH LOT IN SUCH A MANNER THAT WILL NOT BE NECESSARY TO DISTURB THE STREET PAVEMENT, CURB, GUTTER, AND SIDEWALK WHEN CONNECTIONS ARE MADE.
10. MYLAR COPY OF "AS–BUILT" PLANS SHALL BE SUBMITTED TO THE CITY OF DACONO, AS WELL AS AN ELECTRONIC COPY PER SECTION 8 OF THESE STANDARDS PRIOR TO FINAL ACCEPTANCE OF WORK. COORDINATE WITH THE CITY AND ENGINEER OF RECORD FOR THE PREPARATION OF MYLAR "AS–BUILTS."
11. THE CONTRACTOR SHALL NOTIFY THE CITY INSPECTOR AT LEAST TWENTY–FOUR (24) HOURS PRIOR TO DESIRED INSPECTION.
12. SURVEY MONUMENTS MUST BE SET WITHIN SIXTY (60) DAYS OF COMPLETION OF PROJECT.
13. WATER TRUCK, IF CALLED FOR BY THE CITY INSPECTOR, WILL BE PROVIDED BY THE CONTRACTOR TO KEEP WIND EROSION IN CHECK.
14. ANY SETTLEMENT OR SOIL ACCUMULATIONS BEYOND THE PROPERTY LIMITS DUE TO GRADING OR EROSION SHALL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR.
15. ANY CONSTRUCTION DEBRIS OR MUD TRACKING IN THE ADJACENT PUBLIC ROW RESULTING FROM THIS CONSTRUCTION SHALL BE REMOVED IMMEDIATELY BY THE CONTRACTOR. THE CONTRACTOR SHALL IMMEDIATELY FIX ANY EXCAVATIONS OR EXCESSIVE PAVEMENT FAILURES CAUSED BY THE CONSTRUCTION AND SHALL PROPERLY BARRICADE THE SITE UNTIL CONSTRUCTION IS COMPLETE. FAILURE BY THE CONTRACTOR TO CORRECT ANY OF THE ABOVE WITHIN FORTY–EIGHT (48) HOURS OF WRITTEN NOTICE BY THE CITY SHALL CAUSE THE CITY TO ISSUE A STOP WORK ORDER (RED TAG) AND/OR DO THE WORK AND MAKE A CLAIM AGAINST THE LETTER OF CREDIT FOR ANY COST INCURRED BY THE CITY.
16. AREAS BEING DISTURBED BY THE GRADING SHALL BE REPLACED IN KIND.
17. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.
18. THE DUTY OF THE CITY TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON, OR NEAR THE CONSTRUCTION SITE.
19. AT LEAST FIVE (5) DAYS PRIOR TO THE START OF CONSTRUCTION, A PRE–CONSTRUCTION MEETING WILL BE HELD AND ATTENDED BY THE CONTRACTOR AND REPRESENTATIVES OF OTHER APPROVING AGENCIES. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE CITY ENGINEER.

CITY ACCEPTANCE NOTE

1. UPON COMPLETION OF WATER CONSTRUCTION AND TESTING, THE CONTRACTOR SHALL CONTACT THE CITY FOR A PROBATIONARY ACCEPTANCE INSPECTION. A PUNCHLIST WILL BE PROVIDED TO THE CONTRACTOR UPON COMPLETION OF THE INITIAL WALK–THRU AND PROBATIONARY ACCEPTANCE WILL BE ISSUED FOLLOWING COMPLETION AND ACCEPTANCE OF THE WORK OUTLINED IN THE PUNCHLIST.
2. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR THE PROPER FUNCTIONING OF THE IMPROVEMENTS FOR UP TO ONE (1) YEAR FROM THE DATE OF PROBATIONARY ACCEPTANCE OF THE IMPROVEMENTS BY THE CITY. ANY MALFUNCTION DURING THIS PERIOD SHALL BE REMEDIED BY THE CONTRACTOR TO THE SATISFACTION OF THE CITY ENGINEER AT NO EXPENSE TO THE CITY.
3. THE DATE OF FINAL ACCEPTANCE WILL BE INDICATED IN THE CONDITIONS OF THE PROBATIONARY ACCEPTANCE LETTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE CITY FOR A FINAL INSPECTION AND FINAL ACCEPTANCE AFTER THE DATE INDICATED.
4. REFER TO SECTION 2.10 OF CITY OF DACONO STANDARD SPECIFICATIONS FOR ADDITIONAL DETAILS.

GEOTECHNICAL NOTE

1. CONTRACTOR TO INCORPORATE ALL RECOMMENDATIONS DETAILED IN THE "SUBSURFACE EXPLORATION PROGRAM GEOTECHNICAL AND PAVEMENT SECTIONS RECOMMENDATIONS, _____" BY GROUND ENGINEERING JOB NUMBER _____, DATED _____ __, ____.

CALL UTILITY NOTIFICATION CENTER OF COLORADO

1–800–922–1987

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CITY OF DACONO

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COLORADO P.E. #28086

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Since 1944
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www.tait.com
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Kansas City/Lenexa
Sacramento
Seattle
Boise
Phoenix
Denver
North Dakota

NOTES SHEET
COLORADO BOULEVARD BOX CULVERT
CITY OF DACONO
NORTH OF SUMMIT BOULEVARD
DACONO, CO

DRAWN: RM
DATE: 04/18/16
CHECKED: CO
DATE: 05/07/2016
REVISION #: —
DATE: —
JOB NO: CO12990

C2

May 18, 2016 – 8:38am by rmclellan K:\Drawings\CO\CO12990 Dacono, CO\CO12990 Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\ENG\CO12990_NOTE.dwg

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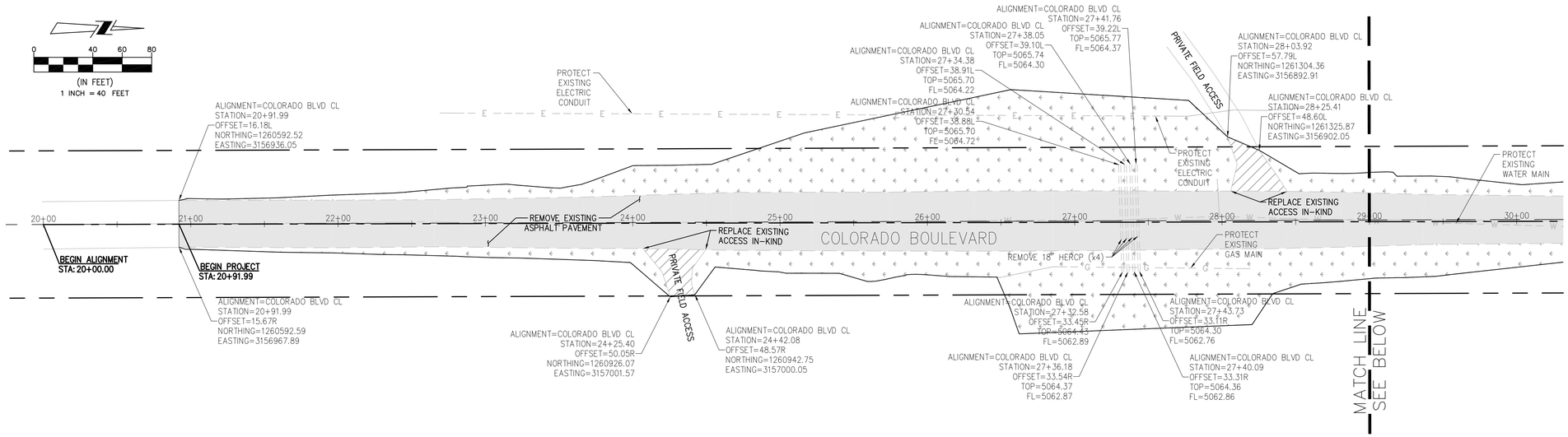

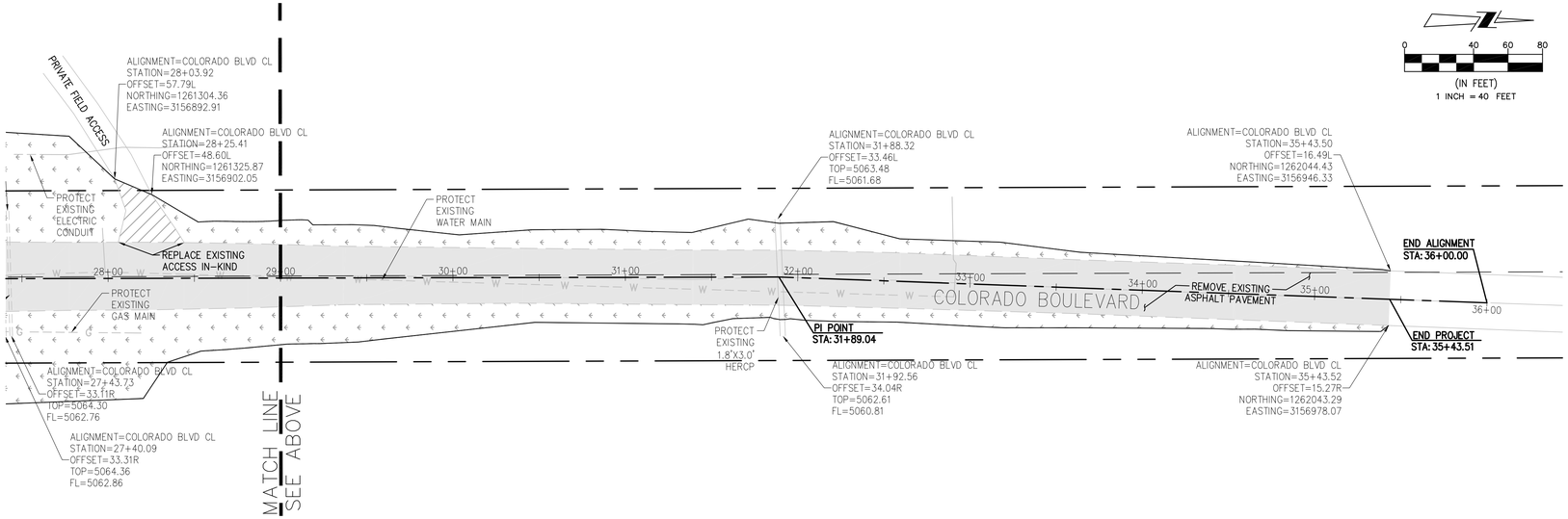

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North Dakota

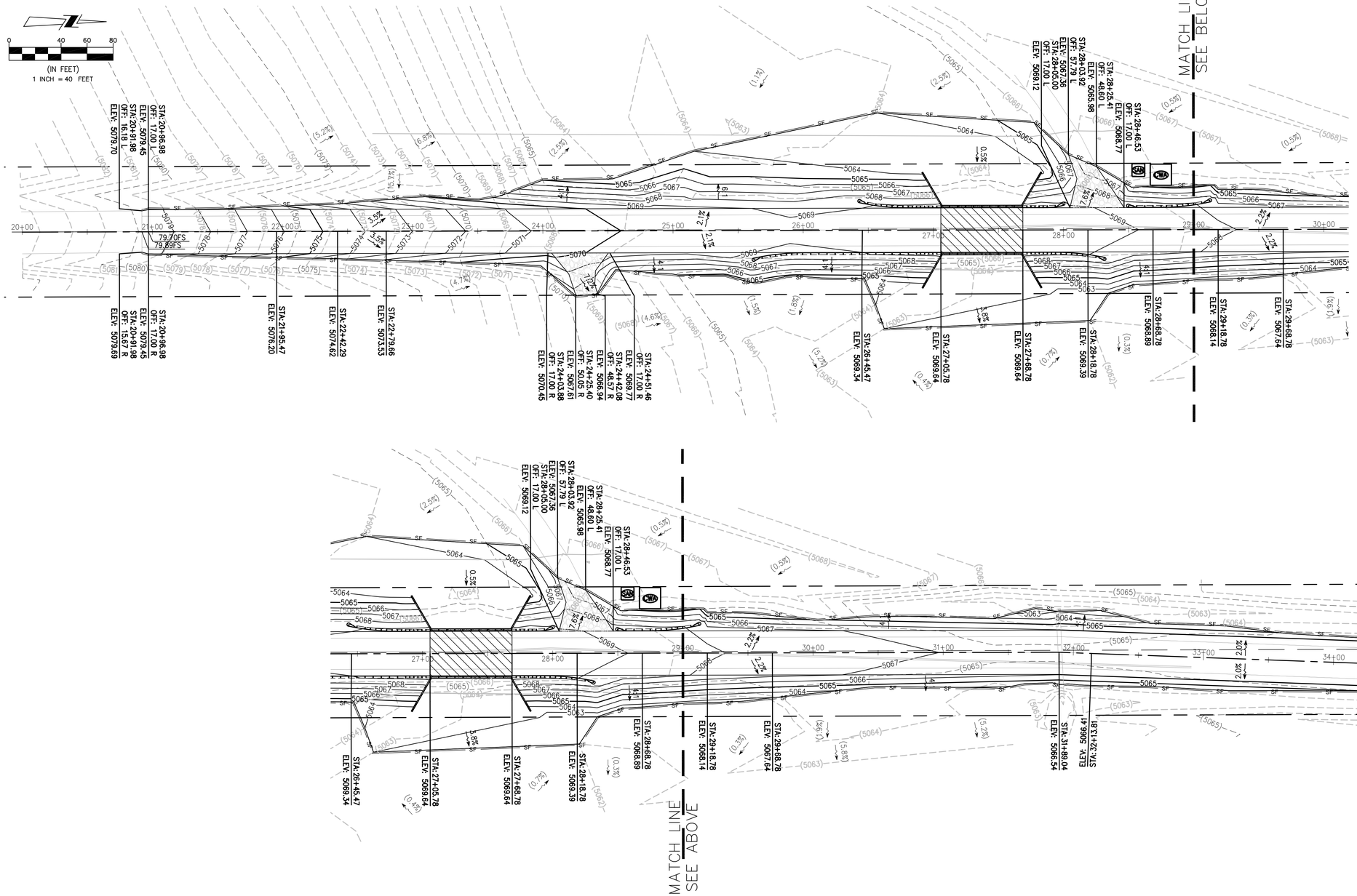
EXISTING CONDITIONS & DEMOLITION PLAN
COLORADO BOULEVARD BOX CULVERT
CITY OF DACONO
NORTH OF SUMMIT BOULEVARD
DACONO, CO

DRAWN:RM
DATE: 04/18/16
CHECKED: CO
DATE: 05/07/2016
REVISION #: —
DATE: —
JOB NO. CO1299D

D1

May 18, 2016 - 8:39am by rmcclellan K:\Drawings\CO\CO1299D Dacono, CO\CO1299D Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\

COLORADO BOULEVARD BOX CULVERT



GRADING LEGEND:

- 2576 — PROPOSED CONTOUR
- (2576) — EXISTING CONTOUR
- 2.0% — PROPOSED SLOPE/FLOW DIRECTION
- (2.0%) — EXISTING SLOPE/FLOW DIRECTION
- 51.15TC / 50.65FS — PROPOSED GRADE
- (59.36)TC / (58.86)FS — EXISTING GRADE

EROSION CONTROL LEGEND:

- SF — SILT FENCE / LIMITS OF DISTURBANCE
- SM — SEEDING AND MULCHING
- CWA — CONCRETE WASHOUT AREA
- SAN — SANITARY FACILITY

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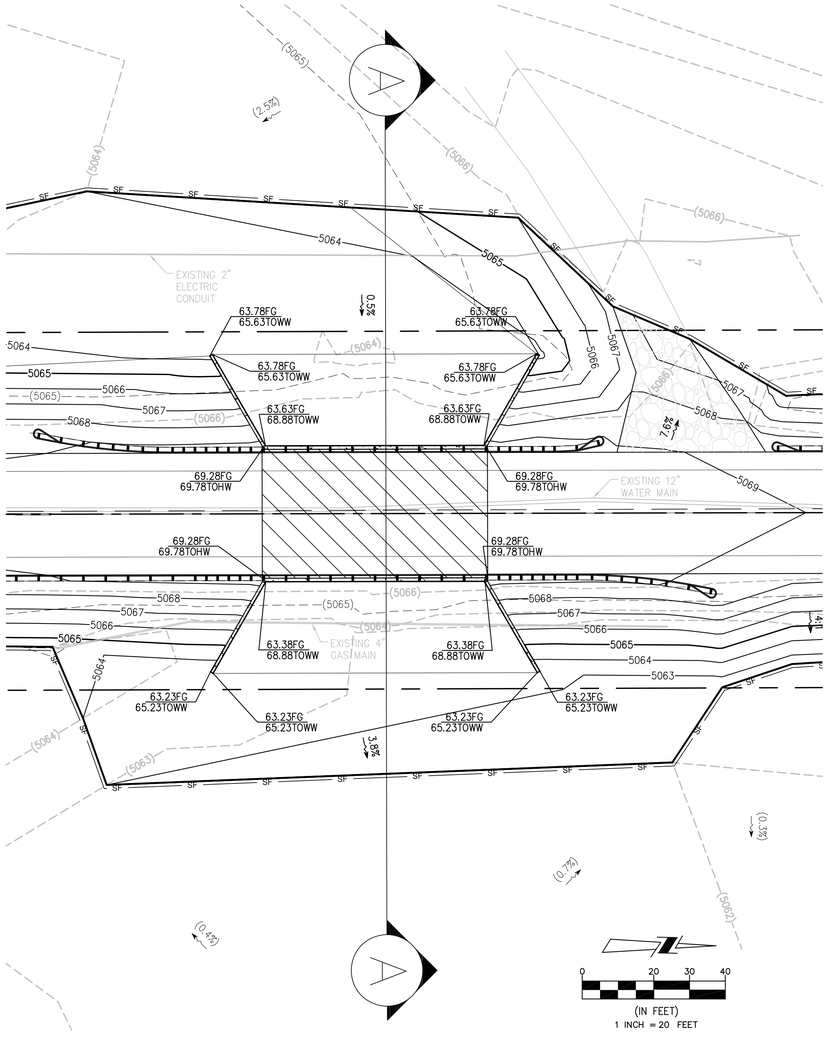
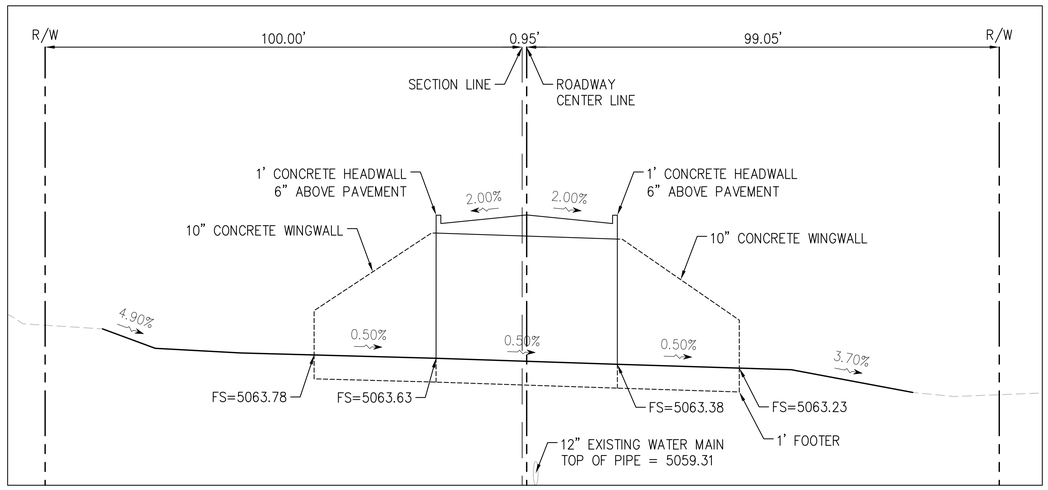
May 18, 2016 - 8:39am by rmcclellan K:\Drawings\CO\CO12990 Dacono, CO\CO12990 Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\ENG\CO12990_GR.dwg

COLORADO BOULEVARD BOX CULVERT



BOX CULVERT GRADING DETAIL



SECTION A–A

HS: 1"=1' VS: 1"=5'

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BOX CULVERT GRADING DETAIL

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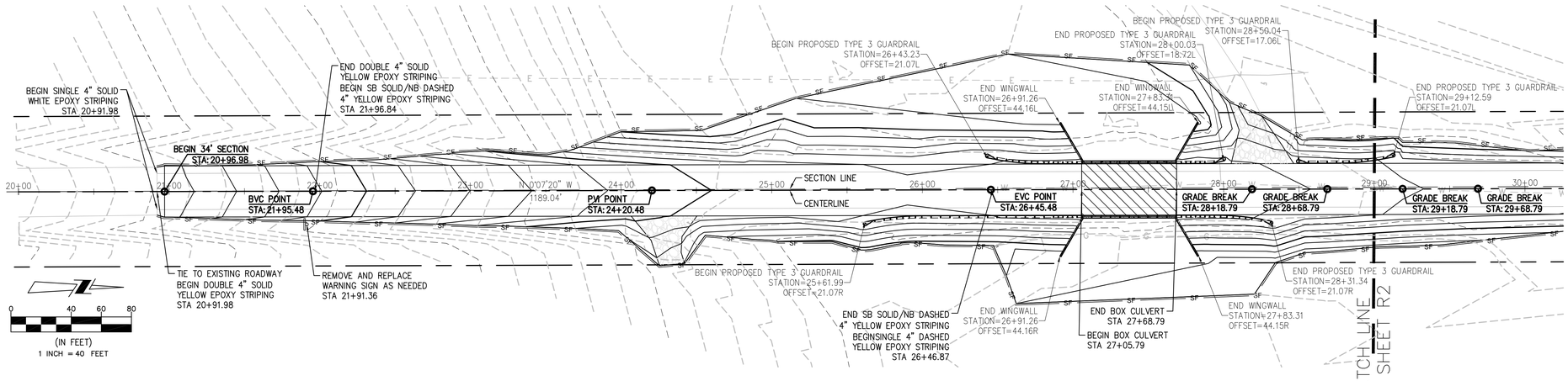

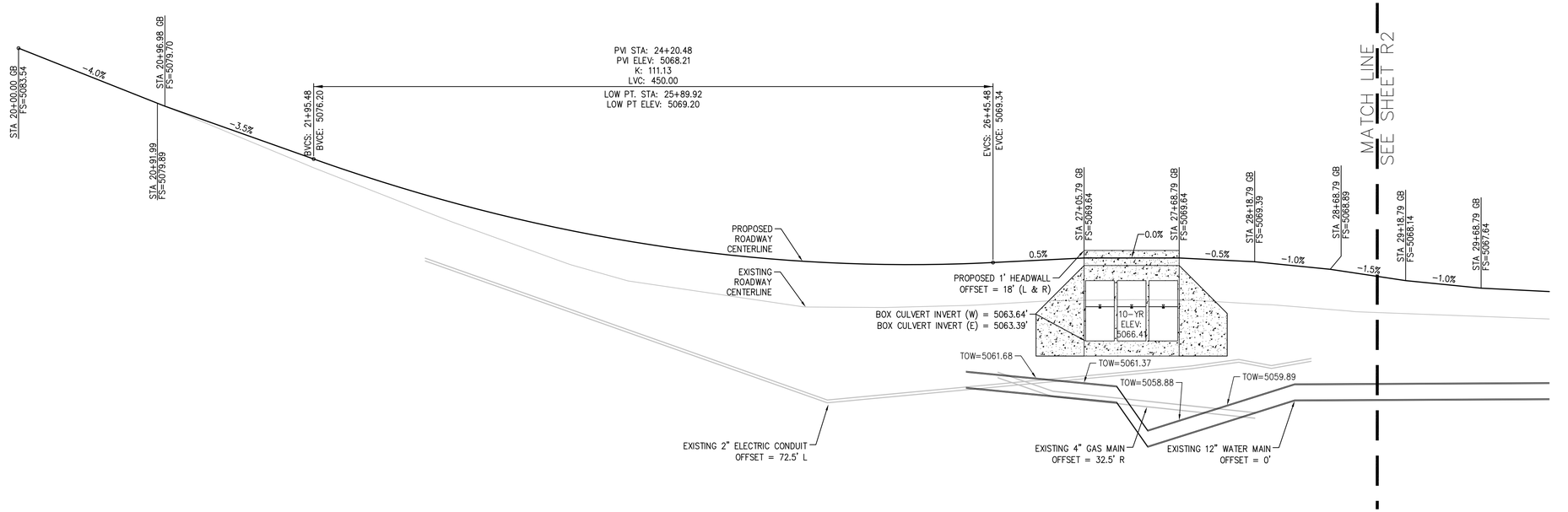

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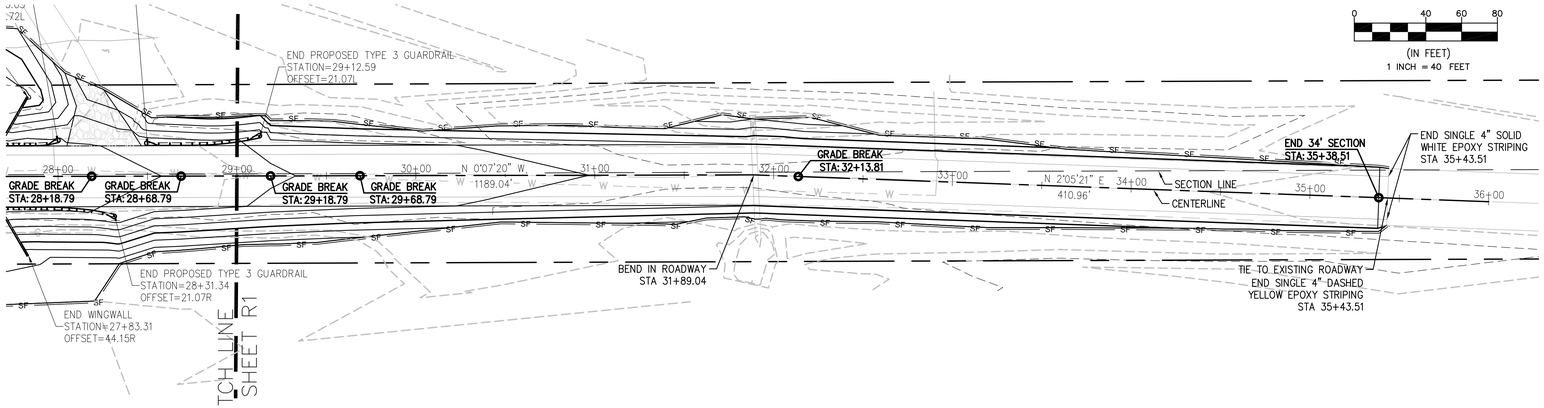

0 40 60 80
(IN FEET)
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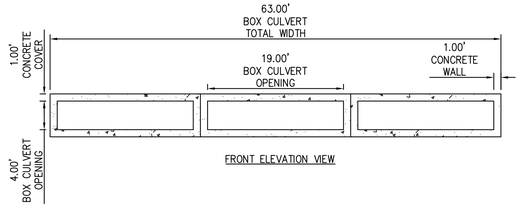
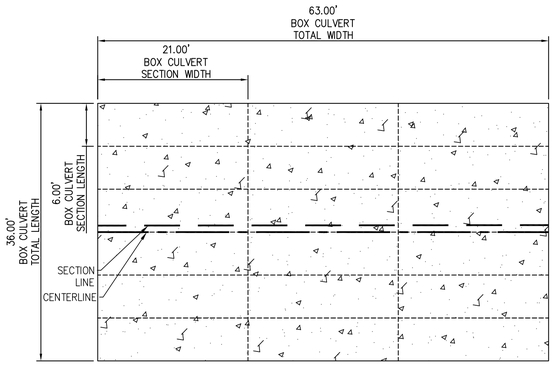
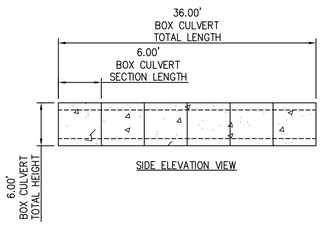


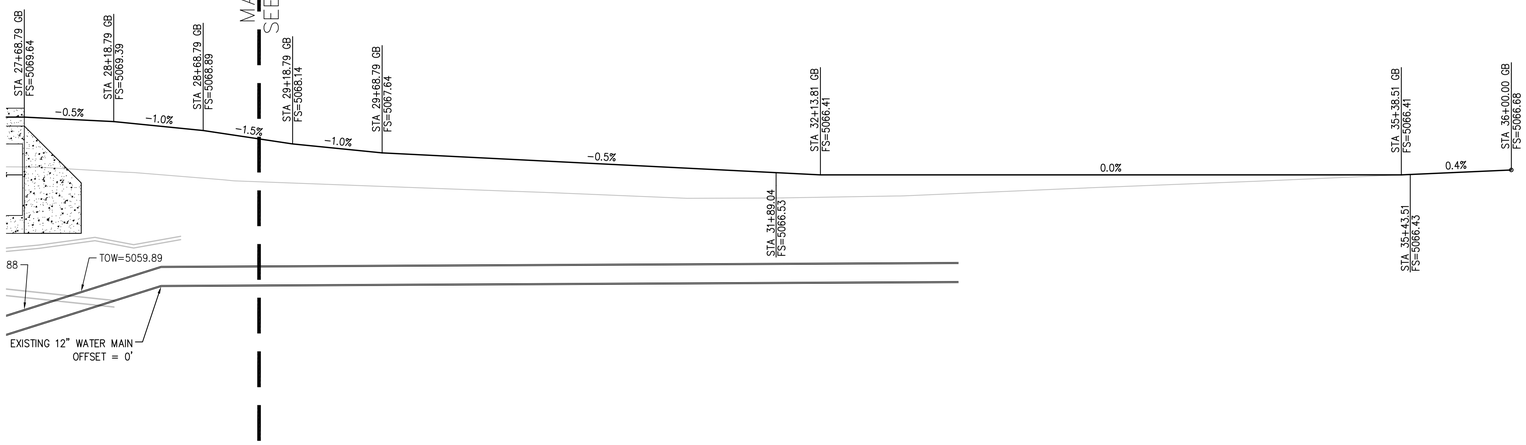
FRONT ELEVATION VIEW



PLAN VIEW



SIDE ELEVATION VIEW



CALL UTILITY NOTIFICATION
CENTER OF COLORADO

1-800-922-1987

CALL 2 BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES

UNAUTHORIZED CHANGES & USES:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES OF THESE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS PRIOR TO CONSTRUCTION. CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

ENGINEERS NOTE TO CONTRACTOR:

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES, PIPES, AND/OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THERE MAYBE EXISTING UTILITIES NOT SHOWN ON THESE PLANS. THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION OF THOSE UNDERGROUND UTILITIES TO BE USED PRIOR TO CONSTRUCTION AND SHALL BE RESPONSIBLE FOR ANY DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON.

BENCH MARK:
USGS NGS MONUMENT, DESIGNATED "RAMONA RESET."
MONUMENT PID IS DH8823
NAVD88 ELEVATION = 5166.66 FEET.

BASIS OF BEARINGS:
BEARINGS ARE BASED ON THE WEST LINE OF SECTION 18, T1N, R67W, IN THE CITY OF DACONO. THE BEARING IS N00°11'34"W AND IS SHOWN ON THE PLANS.

ENGINEERING REVIEW
CITY OF DACONO

☐ NO EXCEPTIONS TAKEN
☐ MAKE CORRECTIONS NOTED
☐ REJECTED-SEE CHECKLIST

REVIEW IS FOR GENERAL COMPLIANCE WITH CITY OF DACONO ENGINEERING STANDARDS AND REQUIREMENTS. THE CITY OF DACONO IS NOT RESPONSIBLE FOR THE CORRECTNESS OF DESIGN, DIMENSIONS, DETAILS, QUANTITIES OR DESIGN SAFETY.

CITY ENGINEER DATE

THESE PLANS ARE VALID FOR TWO (2) YEARS AFTER THE DATE OF APPROVAL. RESUBMITTAL TO THE CITY IS REQUIRED AFTER THAT TIME PERIOD.

PREPARED UNDER THE SUPERVISION OF
TAIT & ASSOCIATES, INC.

GARY A. ODEHNAL
COLORADO P.E. #28086

NO.	DESCRIPTION	REVISIONS	BY	DATE

TAIT
Since 1954
6163 E. Larimer County Road 16
Loveland, CO 80537
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Boise
Dallas
Denver
North Dakota

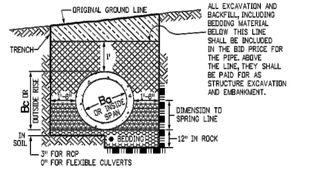
PLAN & PROFILE - STA 29+00 - STA 36+00
COLORADO BOULEVARD BOX CULVERT
CITY OF DACONO
NORTH OF SUMMIT BOULEVARD
DACONO, CO

DRAWN:RM
DATE: 04/18/16
CHECKED:
DATE: 05/07/2016
REVISION #: —
DATE: —
JOB NO. CO1299D

R2

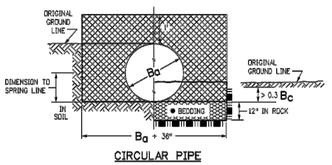
May 18, 2016 - 8:40am by rmcclellan K:\Drawings\CO\CO12990 Dacono, CO\CO1299D Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\ENG\CO12990_P&P.dwg

COLORADO BOULEVARD BOX CULVERT



PIPE IN TRENCH

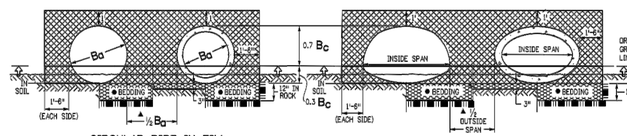
● THE BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.



CIRCULAR PIPE

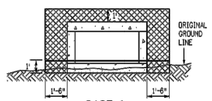
(WHERE ORIGINAL GROUND LINE IS BETWEEN 0.3 Bc AND Bc + 1 FT. ABOVE FLOWLINE)

▲ WHEN TWO OR MORE CONDUITS ARE LAID SIDE-BY-SIDE, THEY SHALL BE PLACED SO THAT THEY ARE ½ OUTSIDE DIAMETER, OR ½ OUTSIDE SPAN, OR 3 FT. APART, WHICHEVER IS LESS. HOWEVER, IF END SECTIONS ARE USED, THE MINIMUM SPACING SHALL BE 1 FT. BETWEEN END SECTIONS.



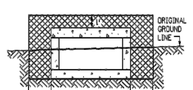
CIRCULAR PIPE IN FILL

ARCH OR ELLIPTICAL PIPE IN FILL



CASE 1

APPLIES WHEN THE ORIGINAL GROUND LINE IS LESS THEN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT. THE EMBANKMENT SHALL BE BUILT UP TO 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT AND THEN EXCAVATED TO THE BOTTOM OF THE BOX CULVERT. THIS EMBANKMENT AND EXCAVATION WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

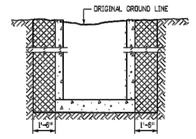


CASE 2

APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

CONCRETE BOX CULVERT

IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



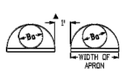
DROP INLETS AND DIVISION BOXES

GENERAL NOTES

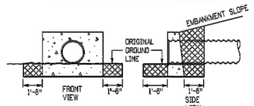
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE TO THE DEPTH REQUIRED FOR THE NEW STRUCTURE AND INCIDENTAL CHANNEL EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
3. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09(b).
4. STRUCTURAL PLATE CULVERTS SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS.
5. B_d EQUALS THE INSIDE DIAMETER OF A PIPE AND B_c EQUALS THE OUTSIDE DIAMETER OF A PIPE. FOR THIN WALLED PIPES, IT IS ASSUMED THAT $B_d = B_c$.
8. APPROXIMATE STRUCTURE EXCAVATION AND BACKFILL QUANTITIES, UP TO 1 FT. OVER THE PIPE WILL BE SHOWN ON THE PLANS, FOR INFORMATION ONLY.

LEGEND

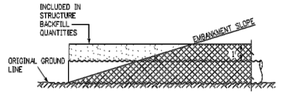
- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- STRUCTURE BACKFILL, CLASS 1
- EMBANKMENT MATERIAL
- EARTH
- ROCK
- BEDDING
- CONCRETE
- = WHEN FLOW LINE OF CULVERT IS LESS THAN 0.3 B_d BELOW THE ORIGINAL GROUND LINE, EMBANKMENT SHALL BE BUILT UP TO 0.3 B_d ABOVE THE FLOW LINE AND TRENCH EXCAVATED TO THE BOTTOM OF PIPE OR AS SHOWN.



CONDUIT WITH END SECTIONS



HEADWALL



END OF PIPE

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Last Modification Date: 07/04/12 Initials: LTA	REV		
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Drawing File Name: 206010102.dgn	REV		
CAD Ver.: MicroStation V8 Scales: Not to Scale Units: English	REV		

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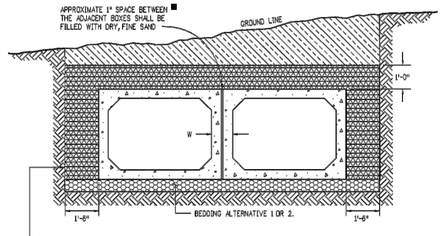
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083
Fax: (303) 757-9820
Project Development Branch DD/LTA

EXCAVATION AND BACKFILL FOR STRUCTURES

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO. M-206-1

Sheet No. 1 of 2

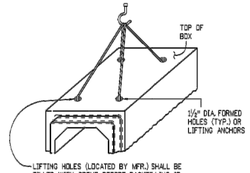


EXCAVATION & BACKFILL WILL BE MEASURED AND PAID FOR TO THIS LINE IN ACCORDANCE WITH SECTION 206.

■ GROUT OR FOAM SEALENT SHALL BE USED WHEN SPECIFIED ON THE PLANS.

EXCAVATION & BACKFILL

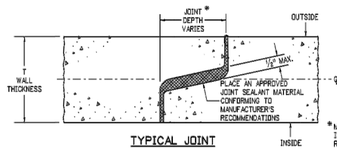
(PARALLEL PRECAST BOX CULVERT INSTALLATION)



LIFTING

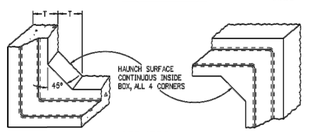
NOSE ANGLE DETAIL

SEE STANDARD PLANS M-601-2, AND 3 TYPICAL AT ADJACENT BOXES DRILL AND GROUT REINFORCING BARS (TYP.)



TYPICAL JOINT

*MINIMUM JOINT DEPTH IS 4" BUT 75%T IS RECOMMENDED.



CORNERS

GENERAL NOTES

1. PRECAST CONCRETE BOX CULVERT SHALL CONFORM TO THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS:

ITEM OR CONDITION	MIN. COVER	AASHTO	EQUIV. ASTM
2 FT. OR MORE COVER	2 FT.	M 259, TABLE 2	C 1433, TABLE 2
LESS THAN 2 FT. COVER	0 FT.	M 273, TABLE 2	C 1433, TABLE 2
PREFORMED JOINT MATERIAL		M 198, 8.1 OR 8.2	C 990, 8.1 OR 8.2
SPAN 20 FT. OR MORE	0 FT.	———	C 1577

THE SPECIFICATIONS LISTED ABOVE SHOW REINFORCING PLACEMENT, EARTH COVER AND OTHER DETAILS NEEDED TO MANUFACTURE THE BOX CULVERTS.

THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THEN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

2. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY, PRIOR TO FABRICATION.
3. BEDDING ALTERNATIVE 1 OR 2 IS REQUIRED:

   BEDDING ALTERNATIVE IS AT THE CONTRACTOR'S OPTION. BEDDING AND EXCAVATION FOR BEDDING WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

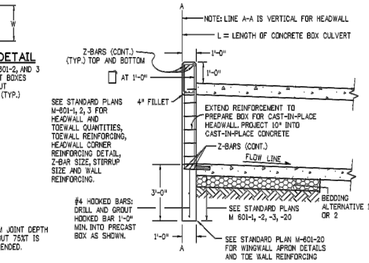
   BEDDING ALTERNATIVE 1 CONSISTS OF 6 IN. OF AGGREGATE BASE COURSE (CLASS 6) COMPACTED TO NOT LESS THAN 95% MAXIMUM DENSITY DETERMINED IN CONFORMANCE WITH AASHTO T 180.

   BEDDING ALTERNATIVE 2 CONSISTS OF AN 3 IN. THICK, MINIMUM, LEAN CONCRETE BASE. CEMENT CONTENT = 250 LBS./CU. YD.

   AGGREGATE GRADATION FOR ALTERNATIVE 2 BEDDING:

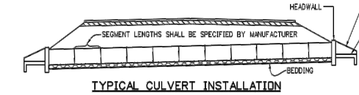
   PASSING 2 IN. SIEVE — 100%
   PASSING NO. 4 SIEVE — 20% TO 70%
   PASSING NO. 200 SIEVE — 5% TO 15%

4. CBC JOINTS USING RUBBER GASKETS SHALL MEET ASTM C1677.
5. CLASS 1 DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE SHALL EXTEND A MINIMUM OF 1 FT. ON EACH SIDE OF JOINTS AND SHALL OVERLAP AND BE SECURELY ATTACHED FOR AT LEAST 1 FT. AT ITS ENDS. THE WRAP SHALL BE A SMOOTH FIT (NOT LOOSE OR STRETCHED) JUST PRIOR TO BACKFILL. THE GEOTEXTILE MATERIAL SHALL MEET THE APPLICABLE REQUIREMENTS OF SECTION 420. COST FOR GEOTEXTILE WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED. A LOAD-AND-RESISTANCE FACTOR DESIGN (LRFD) IS REQUIRED USING ASTM C 1577.
7. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.



CULVERT END

(WITH HEADWALL)



TYPICAL CULVERT INSTALLATION

LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, (CLASS 1)
- EMBANKMENT MATERIAL
- EARTH
- BEDDING
- CONCRETE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	REV		
Full Path:www.coloradodot.info/business/designsupport	REV		
Drawing File Name: 603030101.dgn	REV		
CAD Ver.: MicroStation V8 Scales: Not to Scale Units: English	REV		

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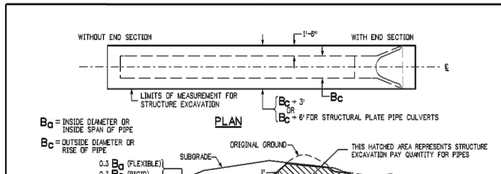
PRECAST CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO. M-603-3

Sheet No. 1 of 1

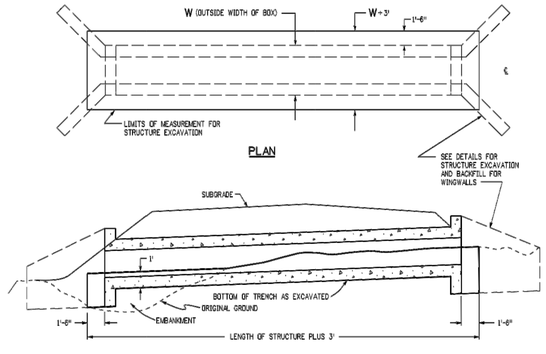


PROFILE

FOR APPLICABLE LIMITS OF STRUCTURE EXCAVATION, SEE BEDDING DETAILS ON SHEET 1 OF THESE DETAILS.

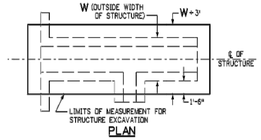
STRUCTURE EXCAVATION UP TO 1 FT. ABOVE THE TOP OF THE PIPE SHALL BE INCLUDED IN THE BID PRICE OF THE PIPE.

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS



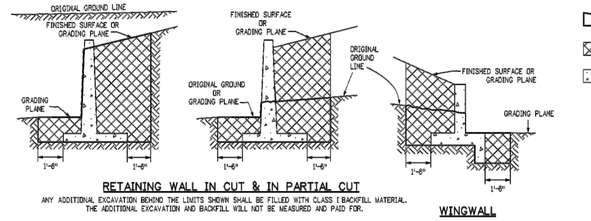
PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES



RETAINING WALL IN CUT & IN PARTIAL CUT

ANY ADDITIONAL EXCAVATION BEHIND THE LIMITS SHOWN SHALL BE FILLED WITH CLASS 1 BACKFILL MATERIAL. THE ADDITIONAL EXCAVATION AND BACKFILL WILL NOT BE MEASURED AND PAID FOR.

WINGWALL

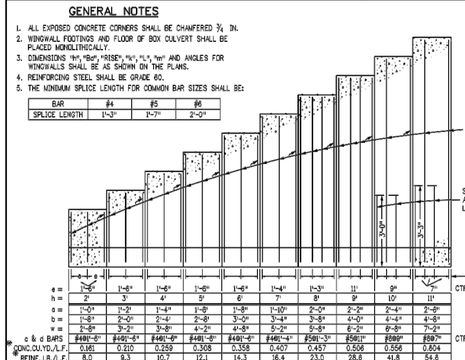
LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- CONCRETE

GENERAL NOTES

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTINGS AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "H", "D", "RISE", "H", "L", "t", "m" AND ANGLES FOR WINGWALLS SHALL BE AS SHOWN ON THE PLANS.
4. REINFORCING STEEL SHALL BE GRADE 60.
5. THE MINIMUM SPLICE LENGTH FOR COMMON BAR SIZES SHALL BE:

BAR	#4	#5	#6
SPLICE LENGTH	1'-3"	1'-7"	2'-0"

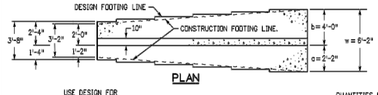


e =	1'-0"	1'-6"	1'-6"	1'-0"	1'-6"	1'-6"	1'-3"	11"	8"	2"
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'
a =	1'-0"	1'-0"	1'-6"	1'-0"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"
b =	1'-8"	2'-0"	2'-6"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"
c & d BARS	#4@12"	#4@6"	#4@6"	#4@6"	#4@6"	#4@6"	#4@6"	#5@12"	#5@9"	#5@7"
CONC. CU.YD./L.F.	0.161	0.210	0.259	0.308	0.358	0.407	0.457	0.506	0.556	0.604
REINF. LB./L.F.	8.0	9.3	10.7	12.1	14.3	16.4	23.0	28.8	41.8	54.8

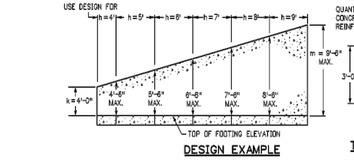
CTRS.

DOES NOT INCLUDE TOE WALL QUANTITIES

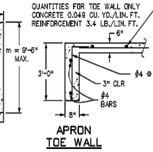
DESIGN TABLE

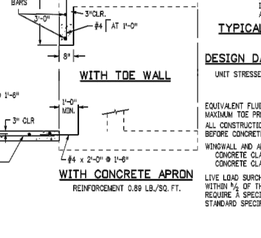


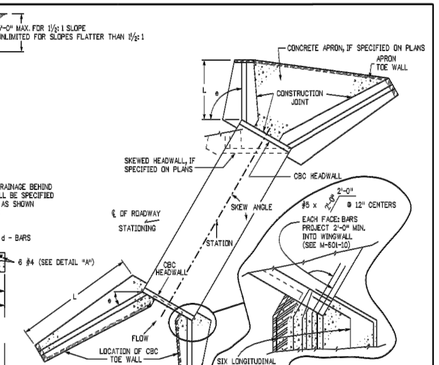
PLAN



DESIGN EXAMPLE







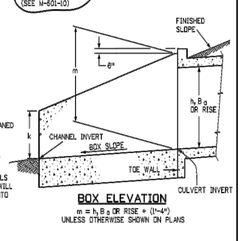
DESIGN DATA:

UNIT STRESSES: $f_s = 24{,}000$ PSI
$f'_c = 4{,}200$ PSI
$n = 9$

EQUIVALENT FLUID PRESSURE = 36 LBS./CU. FT.
MAXIMUM TOE PRESSURE = 1 TON/SQ. FT.
ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE CONCRETE IS POURED.

WINGWALL AND APRON CONCRETE SHALL BE:
CONCRETE CLASS B, OR D (BOX CULVERT) FOR CBC's.
CONCRETE CLASS B, OR D (WALL) FOR PIPES.

LIVE LOAD SURCHARGE HAS NOT BEEN CONSIDERED. WALLS WITHIN ½ OF THE EDGE OF THE ROADWAY SHOULDER WILL REQUIRE A SPECIAL DESIGN IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.



BOX ELEVATION

$m = h, B_d$ OR RISE + (1'-4")
UNLESS OTHERWISE SHOWN ON PLANS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	REV		
Full Path:www.coloradodot.info/business/designsupport	REV		
Drawing File Name: 601020101.dgn	REV		
CAD Ver.: MicroStation V8 Scales: Not to Scale Units: English	REV		

Colorado Department of Transportation
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Project Development Branch DD/LTA

EXCAVATION AND BACKFILL FOR STRUCTURES

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO. M-206-1

Sheet No. 2 of 2

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	REV		
Full Path:www.coloradodot.info/business/designsupport	REV		
Drawing File Name: 601020101.dgn	REV		
CAD Ver.: MicroStation V8 Scales: Not to Scale Units: English	REV		

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WINGWALLS FOR PIPE OR BOX CULVERTS

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO. M-601-20

Sheet No. 1 of 1

NO.	DESCRIPTION	REVISIONS	BY	DATE

TAIT
Since 1964
6163 E. Larimer County Road 16
Loveland, CO 80537
p: 970.613.1447 f: 970.613.1897
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Kansas City/Saratoga
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Seattle
Boise
Phoenix
Denver
North Dakota

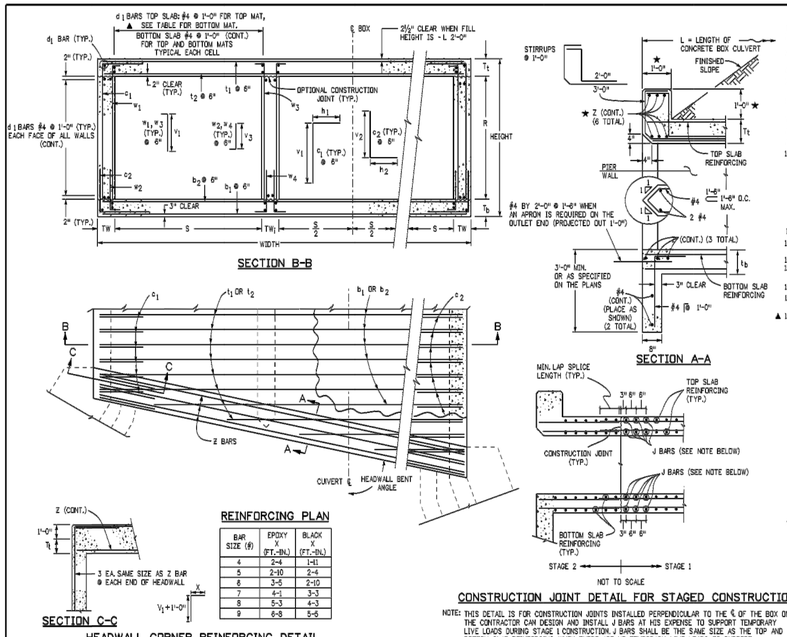
PROJECT DETAILS
COLORADO BOULEVARD BOX CULVERT
CITY OF DACONO
NORTH OF SUMMIT BOULEVARD
DACONO, CO

DRAWN: RM
DATE: 04/18/16
CHECKED: CO
DATE: 05/07/2016
REVISION #: —
DATE: —
JOB NO.: CO12990

S1

May 18, 2016 - 8:40am by rmclellan K:\Drawings\CO\CO12990 Dacono, CO\CO12990 Dacono Dry Creek Box Culvert\Phase 1 Dry Creek Box\ENG\CO12990_DET.dwg

COLORADO BOULEVARD BOX CULVERT



REINFORCING PLAN

BAR SIZE (#)	EPOXY X (FT.-IN.)	BLACK X (FT.-IN.)
4	2-4	1-11
5	2-10	2-4
6	3-5	2-10
7	4-1	3-3
8	5-3	4-3
9	6-8	5-6

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-208-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'_c.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-7"	2'-0"	2'-10"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-0"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
16. FOR FILL HEIGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.
17. ▲ FOR FILL HEIGHTS LESS THAN 2 FT. THE d_1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	8, 9, 10	14, 16, 18	20
BAR SIZE:	#5	#6	#7
SPACING	1'-0"	1'-0"	1'-0"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
RATING DATA: 2ND EDITION, 2015, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION
LOADING DATA: f_y = 60,000 psi, f'_c = 4,500 psi,
LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, ML-93 TANDEM, COLORADO PERMIT TRUCK AND NRL
DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.
DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 130 LBS./CU.FT. HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.
WEARING SURFACE = 12 IN. THICK CONCRETE PAVEMENT.
DEAD LOAD = TYPE 7 BARRIER.
THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.
EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDOT DRAINAGE MANUAL.
EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.
LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19 AND NOTES BELOW):
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY SPECIAL DESIGN FOR STIRRUPS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-4, SHEET 16.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

Computer File Information	
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CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English

Sheet Revisions		
	Date:	Comments
(R-1)	08/27/13	LRFD Design
(R-2)	08/01/15	Analysis Program Updates

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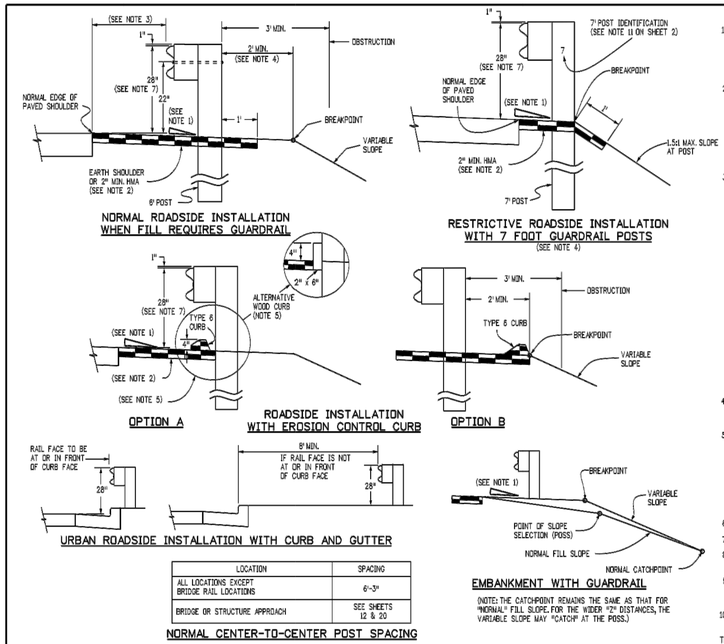
Division of Project Support DDG/Bridge

TRIPLE CONCRETE BOX CULVERT

STANDARD PLAN NO. M-601-3

Issued By: Project Development Branch July 4, 2012

Sheet No. 1 of 2



(NOTE: THE CATCHPOINT REMAINS THE SAME AS THAT FOR "NORMAL" FILL SLOPE FOR THE WIDER "7" DISTANCES, THE VARIABLE SLOPE MAY "CATCH" AT THE POSS.)

LOCATION	SPACING
ALL LOCATIONS EXCEPT BRIDGE RAIL LOCATIONS	6'-3"
BRIDGE OR STRUCTURE APPROACH	SEE SHEETS 12 & 20

NORMAL CENTER-TO-CENTER POST SPACING

GENERAL NOTES

1. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   A. FOR GUARDRAIL FACE 2 FT. OR LESS FROM THE NORMAL EDGE OF PAVED SHOULDER, CONTINUE THE RATE OF SLOPE OF THE NORMAL PAVED SHOULDER TO THE BREAKPOINT.
   B. FOR GUARDRAIL FACE MORE THAN 2 FT. FROM THE NORMAL EDGE OF THE PAVED SHOULDER, THE SLOPE SHALL BE 10:1 OR FLATTER.
2. WHEN SPECIFIED ON THE PLANS, EXTEND A 2 IN. MINIMUM THICKNESS PAVED SURFACE TO 1 FT. BEHIND THE GUARDRAIL POSTS OR TO THE EROSION CONTROL CURB AS SHOWN ON PLANS. ASPHALT CUTTING & PATCHING OR OTHER APPROVED METHOD SHALL BE USED TO MINIMIZE DAMAGE TO ALL PAVED SURFACES UNDER GUARDRAIL INSTALLATIONS. ALL REPAIRS TO THE PAVED AREA WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. A MINIMUM 3 IN. THICK FIBER REINFORCED CONCRETE PAVEMENT MAY ALSO BE USED FOR PAVING BEHIND THE GUARDRAIL. INSTALL THE POST IN A 1½ IN. OVERSIZED FORMED HOLE FOR GUARDRAIL RUNS AND TERMINALS AS DIRECTED. PAYMENT FOR THIS PAVED SURFACE WILL BE MADE UNDER A PAVEMENT OR CONCRETE PAY ITEM WITH QUANTITIES SHOWN ON THE PLANS.
3. THE MINIMUM GUARDRAIL OFFSET FROM PAVED SHOULDER EDGE SHALL BE:
   0 FT. FOR SHOULDERS 8 FT. OR WIDER
   2 FT. FOR SHOULDERS 6 FT. OR LESS
   THE GUARDRAIL OFFSET FROM PAVED INSIDE SHOULDER EDGE OF A DIVIDED HIGHWAY SHALL BE:
   0 FT. MINIMUM FOR SHOULDERS 8 FT. OR WIDER
   2 FT. DESIRABLE FOR 4 FT. SHOULDERS
   THE ABOVE 2 FT. GUARDRAIL TO SHOULDER OFFSET IS DESIRABLE BUT NOT REQUIRED FOR:
   A. FOR AN EXISTING HIGHWAY WITH A DESIGN SPEED LESS THAN 50 MPH, THE MINIMUM OFFSET IS 4 FT. FROM THE TRAVELED WAY.
   B. FOR A ONE-WAY ONE-LANE RAMP, AND WHERE ONE OR MORE OF THE FOLLOWING ARE TRUE:
      (1) THE NON-OFFSET GUARDRAIL BEGINS AT LEAST 100 FT. BEYOND RAMP NOSE.
      (2) THE NON-OFFSET GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.
      (3) THE RAMP SHOULDERS ARE 4 FT. OR WIDER.
   USE OF GREATER THAN MINIMUM OFFSET DIMENSIONS IS ENCOURAGED TO MEET THE DESIRABLE GOAL OF PLACING THE GUARDRAIL AS FAR AS POSSIBLE FROM THE TRAVEL WAY, EVEN FOR SHORT DISTANCES, WHILE PROVIDING A SMOOTH CHANGE IN GUARDRAIL ALIGNMENT.
4. IF 2 FT. CANNOT BE PROVIDED BETWEEN THE BACK OF THE GUARDRAIL POST AND THE BREAKPOINT, USE 7 FT. GUARDRAIL POSTS. REFER TO THE "RESTRICTIVE ROADSIDE INSTALLATION" DETAIL.
5. WHEN SPECIFIED ON THE PLANS, INSTALL 4 IN. HIGH TYPE 6 CURB WITH ITS FACE AT OR BEHIND THE RAIL FACE, AS AN ALTERNATIVE WHEN SPECIFIED ON THE PLANS, INSTALL A 2 IN. x 8 IN. TREATED (AASHTO M 133) WOOD CURB. FASTEN WITH A 4 IN. LAG BOLT AND WASHER AT EACH WOOD POST, OR WITH A ½ IN. DIA. BOLT WITH WASHER AND NUT AT EACH STEEL POST. IF THE 2 IN. x 6 IN. WOOD CURB IS SPECIFIED, IT WILL BE INCLUDED IN THE COST OF THE GUARDRAIL. IF APPROVED BY THE ENGINEER, A 2 IN. x 4 IN. TREATED WOOD CURB MAY BE SUBSTITUTED FOR THE 2 IN. x 8 IN. CURB AND SET ON TOP OF PAVEMENT SURFACE AND ATTACHED AS DESCRIBED ABOVE. NO SPLICING SHALL BE ALLOWED IN WOOD CURBS. ADJACENT BOARDS SHALL BE BUTTED TOGETHER AND BOLTED AT A POST LOCATION. JOINTS SHALL BE LOCATED AT THE POSTS.
6. SEE SHEET 7 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.
7. RESET GUARDRAIL IF THIS DIMENSION WILL BE LESS THAN 25 IN.
8. ALL W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM SHALL BE LAPPED IN THE DIRECTION OF TRAFFIC UNLESS OTHERWISE NOTED.
9. MATERIAL TYPE AND SHAPE OF POSTS AND BLOCKS SHALL BE THE SAME THROUGHOUT THE PROJECT EXCEPT WHEN SPECIFIC POSTS AND BLOCKS ARE SPECIFIED, i.e. AT END ANCHORAGES AND BOX CULVERTS.
10. CONCRETE MAY BE READY-MIXED OR FIELD-MIXED AND SHALL CONSIST OF A MINIMUM OF 1 PART CEMENT TO 6 PARTS AGGREGATE BY VOLUME.

THE GENERAL NOTES ARE CONTINUED ON SHEET 2.

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Last Modification Date: 10/27/14	Initials: LTA
Full Path: www.colorado.gov/cdot/business/designsupport	
Drawing File Name: 601010102.dgn	
CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English

Sheet Revisions		
	Date:	Comments
(R-1)	10/09/14	Added details of the 4 inch curb and combined and revised its details 2 and 3. Removed the curb type and anchorage (anchorage) from sheet 4.
(R-2)	10/27/14	

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GUARDRAIL TYPE 3 W-BEAM

STANDARD PLAN NO. M-606-1

Issued By: Project Development Branch July 4, 2012

Sheet No. 1 of 20

TRIPLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

BOX SIZE S (FT)	BOX SIZE R (FT)	FILL HEIGHT ALLOWED (FT-IN)	WIDTH (FT-IN)	BAR SIZES TYPE(S) & SIZE(S) t_1*	t_2	t_3	b_1	b_2	b_3*	h_1*	h_2	w_1&w_2*	w_3	w_4*	c_1	c_2	DIMENSIONS h_1 (FT-IN)	h_2 (FT-IN)	t_1 (FT-IN)	t_2 (FT-IN)	t_3 (FT-IN)	QUANTITIES CONCRETE (CY/LF)	REBAR STL (LBS/LF)	WATERPROOFING (SY/LF)	RATING FACTORS HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
8	6	7'-2"	10'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	2.830	426	3.370	1.41	1.82	1.90	1.88
		7'-2"	12'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	2.960	426		1.38	1.78	1.87	1.85
		8'-2"	14'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.090	426		1.34	1.74	1.85	1.83
		9'-2"	16'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.220	426		1.30	1.69	1.82	1.80
		10'-2"	18'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.350	426		1.26	1.65	1.80	1.78
		11'-2"	20'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.480	426		1.23	1.61	1.77	1.75
		12'-2"	22'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.610	426		1.19	1.56	1.75	1.73
		13'-2"	24'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.740	426		1.16	1.52	1.72	1.70
		14'-2"	26'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.870	426		1.12	1.47	1.70	1.68
		15'-2"	28'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.000	426		1.09	1.43	1.67	1.65
		16'-2"	30'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.130	426		1.06	1.39	1.65	1.63
		17'-2"	32'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.260	426		1.03	1.35	1.62	1.60
		18'-2"	34'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.390	426		1.00	1.31	1.60	1.58
		19'-2"	36'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.520	426		0.97	1.27	1.57	1.55
		20'-2"	38'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.650	426		0.94	1.23	1.55	1.53
	8	7'-2"	10'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.020	426	3.627	1.33	1.73	1.85	1.83
		7'-2"	12'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.150	426		1.30	1.69	1.82	1.80
		8'-2"	14'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.280	426		1.26	1.64	1.80	1.78
		9'-2"	16'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.410	426		1.22	1.59	1.77	1.75
		10'-2"	18'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.540	426		1.19	1.55	1.75	1.73
		11'-2"	20'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.670	426		1.16	1.51	1.72	1.70
		12'-2"	22'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.800	426		1.12	1.46	1.70	1.68
		13'-2"	24'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.930	426		1.09	1.42	1.67	1.65
		14'-2"	26'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.060	426		1.06	1.38	1.65	1.63
		15'-2"	28'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.190	426		1.03	1.34	1.62	1.60
		16'-2"	30'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.320	426		1.00	1.30	1.60	1.58
		17'-2"	32'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.450	426		0.97	1.26	1.57	1.55
		18'-2"	34'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.580	426		0.94	1.22	1.55	1.53
		19'-2"	36'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.710	426		0.91	1.18	1.52	1.50
		20'-2"	38'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.840	426		0.88	1.14	1.50	1.48
	10	7'-2"	10'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.210	426	4.056	1.25	1.64	1.80	1.78
		7'-2"	12'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.340	426		1.22	1.59	1.77	1.75
		8'-2"	14'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.470	426		1.19	1.55	1.75	1.73
		9'-2"	16'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.600	426		1.15	1.50	1.72	1.70
		10'-2"	18'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.730	426		1.12	1.46	1.70	1.68
		11'-2"	20'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.860	426		1.09	1.42	1.67	1.65
		12'-2"	22'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.990	426		1.06	1.38	1.65	1.63
		13'-2"	24'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.120	426		1.03	1.34	1.62	1.60
		14'-2"	26'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.250	426		1.00	1.30	1.60	1.58
		15'-2"	28'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.380	426		0.97	1.26	1.57	1.55
		16'-2"	30'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.510	426		0.94	1.22	1.55	1.53
		17'-2"	32'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.640	426		0.91	1.18	1.52	1.50
		18'-2"	34'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.770	426		0.88	1.14	1.50	1.48
		19'-2"	36'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.900	426		0.85	1.10	1.47	1.45
		20'-2"	38'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	5.030	426		0.82	1.06	1.45	1.43
	12	7'-2"	10'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.400	426	4.722	1.17	1.54	1.75	1.73
		7'-2"	12'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.530	426		1.14	1.49	1.72	1.70
		8'-2"	14'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.660	426		1.11	1.45	1.70	1.68
		9'-2"	16'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.790	426		1.07	1.41	1.67	1.65
		10'-2"	18'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	3.920	426		1.04	1.37	1.65	1.63
		11'-2"	20'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.050	426		1.01	1.33	1.62	1.60
		12'-2"	22'-3"	1	1	1	16	8	1	3	4	5	3	4	5	3	2'-3"	2'-3"	1'-0"	1'-0"	1'-0"	4.180	426		0.98	1.29	1.60	1.58

Table G.3.1: Little Dry Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions with Future Conditions Upstream in Erie OSP

Location	SWMM Node	Drainage Area (acres)	Existing Conditions SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Difference (Future Conditions with Future Conditions Upstream in Erie OSP - Existing Conditions) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Main Flow Path																		
Country Road 11, South of Summit Blvd	547	1229	50	297	329	1385	2028	37	82	140	481	679	-13	-215	-188	-905	-1348	
Summit Blvd, East of County Road 11	541	1314	59	319	372	1568	2316	55	121	202	665	932	-5	-198	-170	-903	-1384	
East of County Road 11, North of Summit Blvd	544	2272	59	317	370	1572	2327	64	136	226	728	1042	5	-181	-144	-844	-1285	
Colorado Blvd, North of Summit Blvd	526	2363	63	332	472	2249	3399	150	312	510	1749	2585	88	-21	38	-500	-815	
County Road 15, North of County Road 10	515	3344	60	314	485	2520	3883	166	362	615	2210	3284	106	47	129	-310	-600	
County Road 19, North of County Road 12	469	6403	56	274	484	2769	4363	165	381	679	2453	3636	110	107	196	-316	-727	
County Road 14, West of County Road 21	439	8784	47	269	491	2965	4754	170	403	721	2625	3931	122	134	230	-340	-823	
County Road 21, North of County Road 14	433	9524	42	269	492	2996	4821	162	405	725	2646	3974	120	136	233	-349	-847	
County Road 14 1/2, West of County Road 23 1/2	402	10597	12	246	468	3011	4862	29	347	714	2630	3966	17	101	246	-381	-896	
Tributaries to Little Dry Creek																		
I-25 south of Country Road 6	573	168	1	4	21	98	142	1	5	21	99	142	0	0	0	1	0	
County Road 6, East of County Road 11	538	614	7	20	81	376	548	41	71	102	468	578	34	51	21	92	30	
Summit Blvd, West of Colorado Blvd	531	1384	51	82	207	964	1437	118	219	308	1120	1539	67	137	101	156	102	
West of Country Road 19, South of Highway 52	467	702	5	15	86	482	712	10	38	93	552	766	5	23	8	70	54	
County Road 11, south of County Road 6	554	501	4	15	67	321	472	32	54	85	421	540	28	39	19	100	68	
County Road 23, South of County Road 14 1/2	415	326	6	12	40	262	385	6	19	43	277	407	0	6	3	15	21	

Table G.3.1: Little Dry Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions with Future Conditions Upstream in Erie OSP

Location	SWMM Node	Drainage Area (acres)	Existing Conditions SWMM Model Peak Discharge (cfs)					Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Difference (Future Conditions with Future Conditions Upstream in Erie OSP - Existing Conditions) Peak Discharge (cfs)					Notes:
			2	5	10	50	100	2	5	10	50	100	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)																		
County Road 11, south of Summit Blvd	551	183	2	8	36	160	225	13	27	40	175	241	11	18	4	15	16	
Colorado Blvd, north of Summit Blvd	523	185	2	5	30	142	225	8	18	30	190	202	7	12	0	48	-23	
County Road 15, south of County Road 10	507	42	0	2	9	41	58	3	7	9	42	58	2	5	0	1	0	
County Road 15, and County Road 10	502	136	1	4	21	101	144	2	12	24	105	149	1	7	3	5	5	
County Road 10, east of County Road 15	501	311	3	8	54	263	372	8	25	54	310	372	5	17	0	47	0	
County Road 10, west of County Road 19	462	319	4	9	49	235	335	6	23	49	317	335	3	13	0	82	0	
County Road 19, north of County Road 10	461	56	2	3	13	67	94	0	2	13	67	94	-1	-1	0	0	0	
County Road 12, east of County Road 19	460	125	1	2	18	100	143	0	3	17	103	143	-1	2	0	3	0	
County Road 12, east of County Road 19	459	92	1	2	6	69	102	0	1	6	69	101	-1	-2	0	0	0	
County Road 19, south of Highway 52	472	836	2	7	60	493	761	18	46	90	560	805	16	39	30	67	45	
County Road 14, and County Road 17	482	94	1	2	17	102	144	3	7	17	104	144	2	5	0	2	0	
County Road 14, west of County Road 19	475	84	0	1	9	72	105	2	4	10	75	108	1	3	1	3	3	
North of Highway 52, east of County Road 19	474	259	2	3	29	200	297	5	14	37	211	309	3	10	8	11	11	
County Road 19, north of Highway 52	473	251	3	8	52	441	680	7	22	66	463	700	4	14	15	22	20	
County Road 14, west of County Road 19	476	185	1	3	8	94	150	0	3	8	100	156	-1	0	1	6	6	
County Road 19, north of County Road 14	477	58	3	5	8	41	57	1	4	9	40	57	-2	-1	0	0	0	
County Road 19, north of County Road 14	477.1	231	1	4	18	172	258	2	8	20	177	263	1	4	2	5	5	

Table G.3.2: Little Dry Creek Basin Crossings With Proposed Improvements: Future Conditions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Main Flow Path												
LDC 6-D	Country Road 11, South of Summit Blvd	547	5' x 4' RCBC	5092.2	168	< 50 YR	37	82	140	481	679	
LDC 7-D	Summit Blvd, East of County Road 11	541	7' x 4' RCBC	5087.87	229	< 50 YR	55	121	202	665	932	
LDC 8-D*	East of County Road 11, North of Summit Blvd	544	(3) 8' x 4' RCBC	5079.3	904	< 100 YR	64	136	226	728	1042	
LDC 9-D*	East of County Road 11, North of Summit Blvd	528	9' CMP	5076.2	1455	> 100 YR	66	142	238	771	1142	
LDC 11-D	Colorado Blvd, North of Summit Blvd	526	(3) 19' x 4' RCBC	5064.3	2015	< 50 YR	150	312	510	1749	2585	Proposed raising roadway 3' to facilitate a taller crossing
LDC 12-D	County Road 15, North of County Road 10	515	(3) 13' x 6 RCBC	5019.5	2545	< 100 YR	166	362	615	2210	3284	
			EX 6' CMP add (7) 6' RCP	5019.5	2552	< 100 YR						
LDC 14-D	County Road 19, North of County Road 12	469	(5) 10' x 6 RCBC	4963.7	2922	< 50 YR	165	381	679	2453	3636	
			EX 6' CMP add (9) 6' RCP	4963.7	3003	< 50 YR						
LDC 15	County Road 14, West of County Road 21	439	(7) 10' x 5' RCBC	4936.1	3203	< 50 YR	170	403	721	2625	3931	
LDC 16	County Road 21, North of County Road 14	433	(6) 10' x 5' RCBC	4932.6	3055	< 50 YR	162	405	725	2646	3974	
LDC 18	County Road 14 1/2, West of County Road 23 1/2	402	(5) 11' x 5' RCBC	4891.5	3545	< 50 YR	29	347	714	2630	3966	
LDC 30-D*	Brantner Ditch, east of County Road 19	449	(4) 10' x 4' RCBC	4995.39	2862	< 50 YR	175	403	735	2563	3816	
Tributaries to Little Dry Creek												
LDC 1 **	I-25 south of Country Road 6	573	5' RCP	5195.6	231	> 100 YR	1	5	21	99	142	
LDC 2	Stanley Ditch crossing South of County Road 6	557	4' RCP	5151.35	132	< 50 YR	21	35	62	291	420	
LDC 3	County Road 6, East of County Road 11	538	4.5' RCP	5126.9	115	< 50 YR	41	71	102	468	578	
LDC 4	East of County Road 11, North of County road 6	966	EX 3' RCP add (2) 5.5' RCP	5114.9	757	< 50 YR	46	78	111	514	643	

Table G.3.2: Little Dry Creek Basin Crossings With Proposed Improvements: Future Conditions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)												
LDC 5	East of Country Road 11, South of Summit Blvd	533	9' x 5' RCBC	5097.4	591	< 50 YR	63	109	150	602	866	
LDC 10-D	Summit Blvd, West of Colorado Blvd	531	(3) 5' CMP	5070.5	733	< 50 YR	118	219	308	1120	1539	
LDC 13-D*	West of Country Road 19, South of Highway 52	467	12' x 4' RCBC	4977.3	429	< 50 YR	10	38	93	552	766	
LDC 19	County Road 11, south of County Road 6	554	3.5' RCP	5135	93	< 50 YR	32	54	85	421	540	
LDC 17	County Road 23, South of County Road 14 1/2	415	3.5' CMP	4909.3	74	< 50 YR	6	19	43	277	407	
LDC 20	County Road 11, south of Summit Blvd	551	3' RCP	5110.2	51	< 50 YR	13	27	40	175	241	
LDC 21-D	Colorado Blvd, north of Summit Blvd	523	3' RCP	5062.0	38	< 50 YR	8	18	30	190	202	
LDC 22-D	County Road 15, south of County Road 10	507	2' RCP	5083.3	19	< 50 YR	3	7	9	42	58	
LDC 23-D	County Road 15, and County Road 10	502	2' RCP	5031.2	25	< 50 YR	2	12	24	105	149	
LDC 24-D	County Road 10, east of County Road 15	501	(2) 2.5' RCP	5045.8	78	< 50 YR	8	25	54	310	372	
LDC 25-D	County Road 10, west of County Road 19	462	(2) 2.5' RCP	5033.5	67	< 50 YR	6	23	49	317	335	
LDC 26-D	County Road 19, north of County Road 10	461	2' RCP	5038.4	24	< 50 YR	0	2	13	67	94	
LDC 27-D	County Road 12, east of County Road 19	460	2' RCP	4992.2	30	< 50 YR	0	3	17	103	143	
LDC 28-D	County Road 12, east of County Road 19	459	2' RCP	5000.2	25	< 50 YR	0	1	6	69	101	
LDC 29-D	County Road 19, south of Highway 52	472	3.5' RCP	4962.0	105	< 50 YR	18	46	90	560	805	
LDC 31-F	County Road 14, and County Road 17	482	(4) 3' RCP	5055.5	174	> 100 YR	3	7	17	104	144	
LDC 32-F	County Road 14, west of County Road 19	475	(2) 2.5' RCP	5023.0	113	> 100 YR	2	4	10	75	108	

Table G.3.2: Little Dry Creek Basin Crossings With Proposed Improvements: Future Conditions with Future Conditions Upstream in Erie

Crossing Number	Location	SWMM Node	Existing/Proposed Culvert Crossing Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Condition SWMM Model Peak Discharge with Future Conditions Upstream in Erie OSP (cfs)					Notes:
			Size	U/S Invert Elevation (NAVD 88)	Capacity (cfs)*	Future Conditions with Future Conditions Upstream in Erie OSP	2	5	10	50	100	
Tributaries to Little Dry Creek (Continued)												
LDC 33-F	North of Highway 52, east of County Road 19	474	(5) 5' x 4' RCBC	4992.0	338	> 100 YR	5	14	37	211	309	
LDC 34-F	County Road 19, north of Highway 52	473	(4) 8' x 5' RCBC	4969.0	706	> 100 YR	7	22	66	463	700	
LDC 35-F	County Road 14, west of County Road 19	476	(3) 3' RCP	4991.0	185	> 100 YR	0	3	8	100	156	
LDC 36-F	County Road 19, north of County Road 14	477	(3) 2' RCP	4998.0	61	> 100 YR	1	4	9	40	57	
LDC 37-F	County Road 19, north of County Road 14	477.1	(2) 7' x 3' RCBC	5001.0	272	> 100 YR	2	8	20	177	263	
Bridges on Main Flow Path												
LDC B1-D	Highway 52, East of County Road 19	449	110' x 15' Bridge	4954.0	--	> 100 YR	175	403.02	718	2563.3	3816.4	
LDC B2	County Road 23, South of County Road 14 1/2	413	140' x 8' Bridge	4908.0	--	> 100 YR	31	420	867	2936	4450	

* HY-8 program used to evaluate capacities unless noted otherwise

-D Crossings in Dacono Planning Boundary

-F Crossings in Frederick Planning Boundary

-D* Crossings not included in cost estimate for City of Dacono

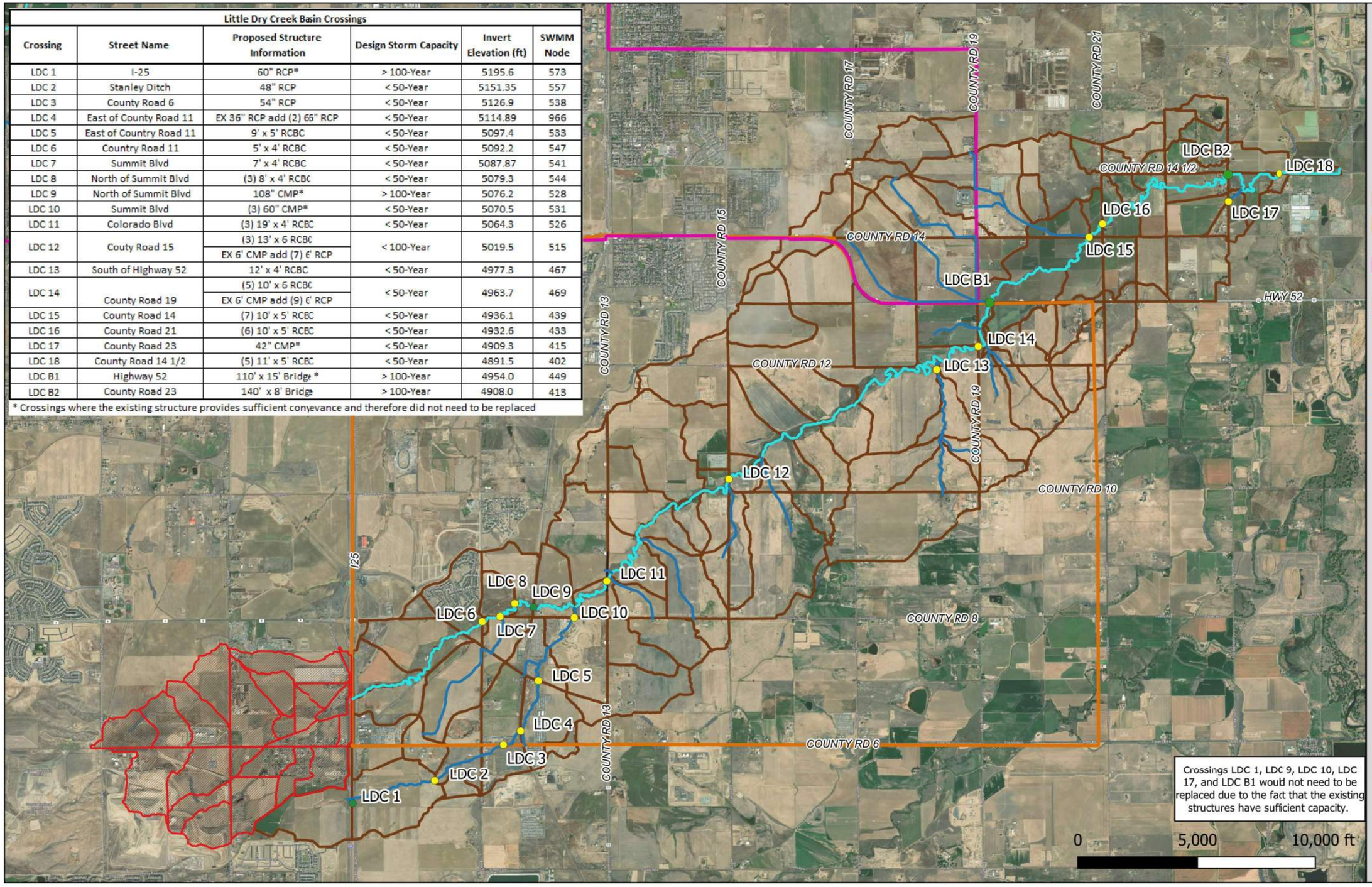
Crossings without notation are located outside of the Dacono and Frederick Planning Boundaries

Indicates revised information for proposed improvements

Little Dry Creek Basin Crossings

Crossing	Street Name	Proposed Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
LDC 1	I-25	60" RCP*	> 100-Year	5195.6	573
LDC 2	Stanley Ditch	48" RCP	< 50-Year	5151.35	557
LDC 3	County Road 6	54" RCP	< 50-Year	5126.9	538
LDC 4	East of County Road 11	EX 36" RCP add (2) 65" RCP	< 50-Year	5114.89	966
LDC 5	East of Country Road 11	9' x 5' RCBC	< 50-Year	5097.4	533
LDC 6	Country Road 11	5' x 4' RCBC	< 50-Year	5092.2	547
LDC 7	Summit Blvd	7' x 4' RCBC	< 50-Year	5087.87	541
LDC 8	North of Summit Blvd	(3) 8' x 4' RCBC	< 50-Year	5079.3	544
LDC 9	North of Summit Blvd	108" CMP*	> 100-Year	5076.2	528
LDC 10	Summit Blvd	(3) 60" CMP*	< 50-Year	5070.5	531
LDC 11	Colorado Blvd	(3) 19' x 4' RCBC	< 50-Year	5064.3	526
LDC 12	Couty Road 15	(3) 13' x 6 RCBC EX 6' CMP add (7) 6' RCP	< 100-Year	5019.5	515
LDC 13	South of Highway 52	12' x 4' RCBC	< 50-Year	4977.3	467
LDC 14	County Road 19	(5) 10' x 6 RCBC EX 6' CMP add (9) 6' RCP	< 50-Year	4963.7	469
LDC 15	County Road 14	(7) 10' x 5' RCBC	< 50-Year	4936.1	439
LDC 16	County Road 21	(6) 10' x 5' RCBC	< 50-Year	4932.6	433
LDC 17	County Road 23	42" CMP*	< 50-Year	4909.3	415
LDC 18	County Road 14 1/2	(5) 11' x 5' RCBC	< 50-Year	4891.5	402
LDC B1	Highway 52	110' x 15' Bridge *	> 100-Year	4954.0	449
LDC B2	County Road 23	140' x 8' Bridge	> 100-Year	4908.0	413

* Crossings where the existing structure provides sufficient conveyance and therefore did not need to be replaced



Legend

- Crossing with <10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Little Dry Creek Basin Studied By Erie OSP

Flow Path

- Little Dry Creek
- Tributary

ICON ENGINEERING

FREDERICK COLORADO

DACONO Colorado

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LITTLE DRY CREEK
FUTURE CONDITIONS
WITH FUTURE
CONDITIONS
UPSTREAM IN ERIE OSP
PROPOSED STRUCTURE
CAPACITY

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LDC	INDEX: FC/FC-CROSS

Appendix G.4. Little Dry Creek Cost Estimate Documentation

Table G.4.1: Little Dry Creek Basin Proposed Improvement Cost Summary: Future Conditions with Existing Conditions in Erie OSP

Crossing	Street Name	Improvement	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
City of Dacono									
ICON 6	East of County Road 11, South of Summit Blvd	(5) 9' x 4' RCBC	$711,000	$0	$107,000	$36,000	$71,000	$178,000	$1,103,000
ICON 7	County Road 11, South of Summit Blvd	(3) 13' x 4' RCBC	$549,000	$0	$82,000	$27,000	$55,000	$137,000	$850,000
ICON 11	Colorado Blvd, North of Summit Blvd	(4) 8' x 4' RCBC	$1,572,000	$0	$236,000	$79,000	$157,000	$393,000	$2,437,000
ICON 12	County Road 15, North of County Road 10	(5) 11' x 6' RCBC	$658,000	$0	$99,000	$33,000	$66,000	$164,000	$1,020,000
ICON 14	County Road 19, North of County Road 12	(6) 10' x 6' RCBC	$1,361,000	$0	$204,000	$68,000	$136,000	$340,000	$2,109,000
ICON 21	Colorado Blvd, North of Summit Blvd	3' RCP	$65,000	$0	$10,000	$3,000	$7,000	$16,000	$101,000
ICON 22	County Road 15, South of County Road 10	2' RCP	$50,000	$0	$8,000	$3,000	$5,000	$13,000	$79,000
ICON 23	County Road 15, and County Road 10	2' RCP	$58,000	$0	$9,000	$3,000	$6,000	$15,000	$91,000
ICON 24	County Road 10, East of County Road 15	(2) 2.5' RCP	$67,000	$0	$10,000	$3,000	$7,000	$17,000	$104,000
ICON 25	County Road 10, West of County Road 19	(2) 2.5' RCP	$80,000	$0	$12,000	$4,000	$8,000	$20,000	$124,000
ICON 26	County Road 19, North of County Road 10	2' RCP	$60,000	$0	$9,000	$3,000	$6,000	$15,000	$93,000
ICON 27	County Road 12, East of County Road 19	2' RCP	$47,000	$0	$7,000	$2,000	$5,000	$12,000	$73,000
ICON 28	County Road 12, East of County Road 19	2' RCP	$44,000	$0	$7,000	$2,000	$4,000	$11,000	$68,000
ICON 29	County Road 19, South of Highway 52	3.5' RCP	$82,000	$0	$12,000	$4,000	$8,000	$21,000	$127,000
Total Cost			**$5,404,000**	**$0**	**$812,000**	**$270,000**	**$541,000**	**$1,352,000**	**$8,379,000**
Town of Frederick									
ICON 31	County Road 14, and County Road 17	(4) 3' RCP	$144,000	$0	$22,000	$7,000	$14,000	$36,000	$223,000
ICON 32	County Road 14, west of County Road 19	(2) 2.5' RCP	$98,000	$0	$15,000	$5,000	$10,000	$24,000	$152,000
ICON 33	North of Highway 52, east of County Road 19	(5) 5' x 4' RCBC	$695,000	$0	$104,000	$35,000	$69,000	$174,000	$1,077,000
ICON 34	County Road 19, north of Highway 52	(4) 8' x 5' RCBC	$669,000	$0	$100,000	$33,000	$67,000	$167,000	$1,036,000
ICON 35	County Road 14, west of County Road 19	(3) 3' RCP	$129,000	$0	$19,000	$6,000	$13,000	$32,000	$199,000
ICON 36	County Road 19, north of County Road 14	(3) 2' RCP	$128,000	$0	$19,000	$6,000	$13,000	$32,000	$198,000
ICON 37	County Road 19, north of County Road 14	(2) 7' x 3' RCBC	$291,000	$0	$44,000	$15,000	$29,000	$73,000	$452,000
Total Cost			**$2,154,000**	**$0**	**$323,000**	**$107,000**	**$215,000**	**$538,000**	**$3,337,000**
Crossings Outside of Dacono and Frederick Boundaries									
ICON 2	Stanley Ditch crossing South of County Road 6	4' RCP	$213,000	$0	$32,000	$11,000	$21,000	$53,000	$330,000
ICON 3	Stanley Ditch crossing South of County Road 6	4.5' RCP	$169,000	$0	$25,000	$8,000	$17,000	$42,000	$261,000
ICON 4	County Road 6, East of County Road 11	EX 3' RCP add (2) 5.5' RCP	$408,000	$0	$61,000	$20,000	$41,000	$102,000	$632,000
ICON 5	East of County Road 11, North of County road 6	9' x 5' RCBC	$167,000	$0	$25,000	$8,000	$17,000	$42,000	$259,000
ICON 15	County Road 14, West of County Road 21	(8) 11' x 5' RCBC	$1,617,000	$0	$243,000	$81,000	$162,000	$404,000	$2,507,000
ICON 16	County Road 21, North of County Road 14	(7) 10' x 5' RCBC	$1,042,000	$0	$156,000	$52,000	$104,000	$261,000	$1,615,000
ICON 18	County Road 14 1/2, West of County Road 23 1/2	(5) 12' x 5' RCBC	$937,000	$0	$141,000	$47,000	$94,000	$234,000	$1,453,000
ICON 19	County Road 11, South of County Road 6	3.5' RCP	$90,000	$0	$13,000	$4,000	$9,000	$22,000	$138,000
ICON 20	County Road 11, South of Summit Blvd	3' RCP	$57,000	$0	$9,000	$3,000	$6,000	$14,000	$89,000
ICON B2	County Road 23, South of County Road 23 1/2	140' x 8' Bridge	$1,966,000	$0	$295,000	$98,000	$197,000	$492,000	$3,048,000
Total Cost			**$6,453,000**	**$0**	**$968,000**	**$321,000**	**$647,000**	**$1,613,000**	**$10,332,000**
Crossings in Dacono, on Private Access Roads									
ICON 8	East of County Road 11, North of Summit Blvd	(4) 10' x 5' RCBC	$401,000	$0	$60,000	$20,000	$40,000	$100,000	$621,000
ICON 9	East of County Road 11, North of Summit Blvd	EX 9' CMP add 6' RCP	$156,000	$0	$23,000	$8,000	$16,000	$39,000	$242,000
ICON 13	West of County Road 19, South of Highway 52	12' by 4' RCBC	$205,000	$0	$31,000	$10,000	$20,000	$51,000	$317,000
ICON 30	Branter Ditch, East of County Road 19	(7) 8' x 4' RCBC	$772,000	$0	$116,000	$39,000	$77,000	$193,000	$1,197,000
Total Cost			**$1,534,000**	**$0**	**$230,000**	**$77,000**	**$153,000**	**$383,000**	**$2,377,000**
ICON 12 and ICON 14 Alternative Costs									
ICON 12	County Road 15, North of County Road 10	EX 6' CMP add (11) 6' RCP	$483,000	$0	$72,000	$24,000	$48,000	$121,000	$748,000
ICON 14	County Road 19, North of County Road 12	EX 6' CMP add (11) 6' RCP	$1,012,000	$0	$152,000	$51,000	$101,000	$253,000	$1,569,000
Total Cost			**$1,495,000**	**$0**	**$224,000**	**$75,000**	**$149,000**	**$374,000**	**$2,317,000**

Table G.4.2: Little Dry Creek Basin Proposed Improvement Cost Summary: Future Conditions with Future Conditions in Erie OSP

Crossing	Street Name	Improvement	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
City of Dacono									
ICON 6	East of County Road 11, South of Summit Blvd	5' x 4' RCBC	$143,000	$0	$21,000	$7,000	$14,000	$36,000	$221,000
ICON 7	County Road 11, South of Summit Blvd	7' x 4' RCBC	$152,000	$0	$23,000	$8,000	$15,000	$38,000	$236,000
ICON 11	Colorado Blvd, North of Summit Blvd	(3) 19' x 4' RCBC	$1,567,000	$0	$235,000	$78,000	$157,000	$392,000	$2,429,000
ICON 12	County Road 15, North of County Road 10	(3) 13' x 6 RCBC	$515,000	$0	$77,000	$26,000	$51,000	$129,000	$798,000
ICON 14	County Road 19, North of County Road 12	(5) 10' x 6 RCBC	$1,190,000	$0	$178,000	$59,000	$119,000	$297,000	$1,843,000
ICON 21	Colorado Blvd, North of Summit Blvd	3' RCP	$65,000	$0	$10,000	$3,000	$7,000	$16,000	$101,000
ICON 22	County Road 15, South of County Road 10	2' RCP	$50,000	$0	$8,000	$3,000	$5,000	$13,000	$79,000
ICON 23	County Road 15, and County Road 10	2' RCP	$58,000	$0	$9,000	$3,000	$6,000	$15,000	$91,000
ICON 24	County Road 10, East of County Road 15	(2) 2.5' RCP	$67,000	$0	$10,000	$3,000	$7,000	$17,000	$104,000
ICON 25	County Road 10, West of County Road 19	(2) 2.5' RCP	$80,000	$0	$12,000	$4,000	$8,000	$20,000	$124,000
ICON 26	County Road 19, North of County Road 10	2' RCP	$60,000	$0	$9,000	$3,000	$6,000	$15,000	$93,000
ICON 27	County Road 12, East of County Road 19	2' RCP	$47,000	$0	$7,000	$2,000	$5,000	$12,000	$73,000
ICON 28	County Road 12, East of County Road 19	2' RCP	$44,000	$0	$7,000	$2,000	$4,000	$11,000	$68,000
ICON 29	County Road 19, South of Highway 52	3.5' RCP	$82,000	$0	$12,000	$4,000	$8,000	$21,000	$127,000
Total Cost			**$4,120,000**	**$0**	**$618,000**	**$205,000**	**$412,000**	**$1,032,000**	**$6,387,000**
Town of Frederick									
ICON 31	County Road 14, and County Road 17	(4) 3' RCP	$144,000	$0	$22,000	$7,000	$14,000	$36,000	$223,000
ICON 32	County Road 14, west of County Road 19	(2) 2.5' RCP	$98,000	$0	$15,000	$5,000	$10,000	$24,000	$152,000
ICON 33	North of Highway 52, east of County Road 19	(5) 5' x 4' RCBC	$695,000	$0	$104,000	$35,000	$69,000	$174,000	$1,077,000
ICON 34	County Road 19, north of Highway 52	(4) 8' x 5' RCBC	$669,000	$0	$100,000	$33,000	$67,000	$167,000	$1,036,000
ICON 35	County Road 14, west of County Road 19	(3) 3' RCP	$129,000	$0	$19,000	$6,000	$13,000	$32,000	$199,000
ICON 36	County Road 19, north of County Road 14	(3) 2' RCP	$128,000	$0	$19,000	$6,000	$13,000	$32,000	$198,000
ICON 37	County Road 19, north of County Road 14	(2) 7' x 3' RCBC	$291,000	$0	$44,000	$15,000	$29,000	$73,000	$452,000
Total Cost			**$2,154,000**	**$0**	**$323,000**	**$107,000**	**$215,000**	**$538,000**	**$3,337,000**
Crossings Outside of Dacono and Frederick Boundaries									
ICON 2	Stanley Ditch crossing South of County Road 6	4' RCP	$213,000	$0	$32,000	$11,000	$21,000	$53,000	$330,000
ICON 3	Stanley Ditch crossing South of County Road 6	4.5' RCP	$169,000	$0	$25,000	$8,000	$17,000	$42,000	$261,000
ICON 4	County Road 6, East of County Road 11	EX 3' RCP add (2) 5.5' RCP	$408,000	$0	$61,000	$20,000	$41,000	$102,000	$632,000
ICON 5	East of County Road 11, North of County road 6	9' x 5' RCBC	$167,000	$0	$25,000	$8,000	$17,000	$42,000	$259,000
ICON 15	County Road 14, West of County Road 21	(7) 10' x 5' RCBC	$1,362,000	$0	$204,000	$68,000	$136,000	$341,000	$2,111,000
ICON 16	County Road 21, North of County Road 14	(6) 10' x 5' RCBC	$923,000	$0	$138,000	$46,000	$92,000	$231,000	$1,430,000
ICON 18	County Road 14 1/2, West of County Road 23 1/2	(5) 11' x 5' RCBC	$877,000	$0	$132,000	$44,000	$88,000	$219,000	$1,360,000
ICON 19	County Road 11, South of County Road 6	3.5' RCP	$90,000	$0	$13,000	$4,000	$9,000	$22,000	$138,000
ICON 20	County Road 11, South of Summit Blvd	3' RCP	$57,000	$0	$9,000	$3,000	$6,000	$14,000	$89,000
ICON B2	County Road 23, South of County Road 23 1/2	140' x 8' Bridge	$1,966,000	$0	$295,000	$98,000	$197,000	$492,000	$3,048,000
Total Cost			**$4,266,000**	**$0**	**$639,000**	**$212,000**	**$427,000**	**$1,066,000**	**$9,658,000**
Crossings in Dacono, on Private Access Roads									
ICON 8	East of County Road 11, North of Summit Blvd	(3) 8' x 4' RCBC	$262,000	$0	$39,000	$13,000	$26,000	$66,000	$406,000
ICON 13	West of County Road 19, South of Highway 52	12' x 4' RCBC	$205,000	$0	$31,000	$10,000	$20,000	$51,000	$317,000
ICON 30	Branter Ditch, East of County Road 19	(4) 10' x 4' RCBC	$595,000	$0	$89,000	$30,000	$60,000	$149,000	$923,000
Total Cost			**$1,062,000**	**$0**	**$159,000**	**$53,000**	**$106,000**	**$266,000**	**$1,646,000**
ICON 12 and ICON 14 Alternative Costs									
ICON 12	County Road 15, North of County Road 10	EX 6' CMP add (7) 6' ft RCP	$364,000	$0	$55,000	$18,000	$36,000	$91,000	$564,000
ICON 14	County Road 19, North of County Road 12	EX 6' CMP add (9) 6' RCP	$876,000	$0	$131,000	$44,000	$88,000	$219,000	$1,358,000
Total Cost			**$1,240,000**	**$0**	**$186,000**	**$62,000**	**$124,000**	**$310,000**	**$1,922,000**

LDC 2 Stanley Ditch Crossing South of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	75	1	75	L.F.	$195.00	$14,625.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	1	2	EA	$2,791.00	$5,582.00	
Channel Improvements							
Soil Riprap, Type VH			42	C.Y.	$122.00	$5,124.00	
Removals							
Removal of culvert pipe (D<48")			75	L.F.	$27.00	$2,025.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Misc Ditch Crossing Repairs	<----User Defined Items		1		$50,000.00	$50,000.00	
Ditch Access Road	<----User Defined Items		1250	S.F.	$45.00	$56,250.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$20,207.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$5,124.00
Detention/Water Quality Facilities					$0.00
Removals					$2,025.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$106,250.00
Subtotal Capital Improvement Costs					**$134,284.00**
Additional Capital Improvement Costs					
Dewatering		$20,142.60	L.S.		$20,143.00
Mobilization		5%			$6,714.00
Traffic Control		$20,142.60	L.S.		$20,143.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$6,714.00
Subtotal Additional Capital Improvement Costs					**$78,714.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$31,950.00
Legal/Administrative		5%			$10,650.00
Contract Admin/Construction Management		10%			$21,300.00
Contingency		25%			$53,250.00
Subtotal Other Costs					**$117,150.00**
Total Capital Improvement Costs					**$330,148.00**

LDC 3 County Road 6, East of County 11

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
54-inch	50	1	50	L.F.	$293.00	$14,650.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	2	EA	$1,932.56	$3,865.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
54-inch		1	2	EA	$11,851.54	$23,703.00	
Channel Improvements							
Soil Riprap, Type VH			76	C.Y.	$122.00	$9,272.00	
Removals							
Removal of culvert pipe (D<48")			50	L.F.	$27.00	$1,350.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		120	S.Y	$100.00	$12,000.00	
Base Course	<----User Defined Items		20	C.Y.	$80.00	$1,600.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$42,218.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$9,272.00
Detention/Water Quality Facilities					$0.00
Removals					$1,350.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$13,600.00
Subtotal Capital Improvement Costs					**$67,118.00**
Additional Capital Improvement Costs					
Dewatering		$10,067.70	L.S.		$10,068.00
Mobilization		5%			$3,356.00
Traffic Control		$10,067.70	L.S.		$10,068.00
Utility Coordination/Relocation		$75,000.00	L.S.		$75,000.00
Stormwater Management/Erosion Control		5%			$3,356.00
Subtotal Additional Capital Improvement Costs					**$101,848.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$25,345.00
Legal/Administrative		5%			$8,448.00
Contract Admin/Construction Management		10%			$16,897.00
Contingency		25%			$42,242.00
Subtotal Other Costs					**$92,932.00**
Total Capital Improvement Costs					**$261,898.00**

LDC 4 East County Road 11, North of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
66-inch	67	2	134	L.F.	$358.00	$47,972.00	
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
66-inch	Yes	2	2	EA	$4,062.72	$8,125.00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
66-inch		2	2	EA	$16,452.30	$32,905.00	
Channel Improvements							
Soil Riprap, Type VH			192	C.Y.	$122.00	$23,424.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
66 RCP Bore	**<----User Defined Items**		134	L.F.	$1,200.00	$160,800.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$89,002.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$23,424.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$678.00	
Special Items (User Defined)			$160,800.00	
Subtotal Capital Improvement Costs			**$273,904.00**	
Additional Capital Improvement Costs				
Dewatering	$41,085.60	L.S.	$41,086.00	
Mobilization	5%		$13,695.00	
Traffic Control	$41,085.60	L.S.	$41,086.00	
Utility Coordination/Relocation	$25,000.00	L.S.	$25,000.00	
Stormwater Management/Erosion Control	5%		$13,695.00	
Subtotal Additional Capital Improvement Costs			**$134,562.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$61,270.00	
Legal/Administrative	5%		$20,423.00	
Contract Admin/Construction Management	10%		$40,847.00	
Contingency	25%		$102,117.00	
Subtotal Other Costs			**$224,657.00**	
Total Capital Improvement Costs			**$633,123.00**	

LDC 5 East of County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	5	1	60	L.F.	$998.66	$59,920.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
9	1	11.00	2	EA	$1,007.66	$2,015.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
9	5	1	2	EA	$11,917.59	$23,835.20	
Channel Improvements							
Soil Riprap, Type VH			93	C.Y.	$122.00	$11,346.00	
Removals							
Removal of culvert pipe (D<48")			60	L.F.	$27.00	$1,620.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	**<----User Defined Items**		225	S.Y	$45.00	$10,125.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$85,770.00	
Hydraulic Structures			$0.00	
Channel Improvements			$11,346.00	
Detention/Water Quality Facilities			$0.00	
Removals			$1,620.00	
Landscaping and Maintenance Improvements			$678.00	
Special Items (User Defined)			$10,125.00	
Subtotal Capital Improvement Costs			**$109,539.00**	
Additional Capital Improvement Costs				
Dewatering	$10,953.90	L.S.	$10,954.00	
Mobilization	5%		$5,477.00	
Traffic Control	$10,953.90	L.S.	$10,954.00	
Utility Coordination/Relocation	$25,000.00	L.S.	$25,000.00	
Stormwater Management/Erosion Control	5%		$5,477.00	
Subtotal Additional Capital Improvement Costs			**$57,862.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$25,110.00	
Legal/Administrative	5%		$8,370.00	
Contract Admin/Construction Management	10%		$16,740.00	
Contingency	25%		$41,850.00	
Subtotal Other Costs			**$92,070.00**	
Total Capital Improvement Costs			**$259,471.00**	

LDC 6 County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	4	5	60	L.F.	$4,583.83	$275,030.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9	5	50.00	2	EA	$4,580.25	$9,161.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	4	5	2	EA	$18,354.66	$36,709.30	
Channel Improvements							
Soil Riprap, Type VH			152	C.Y.	$122.00	$18,544.00	
Removals							
Removal of culvert pipe (D<48")			60	L.F.	$27.00	$1,620.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		453	S.Y	$100.00	$45,333.00	
Base Course	<----User Defined Items		76	C.Y.	$80.00	$6,044.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$320,900.00
Hydraulic Structures				$0.00
Channel Improvements				$18,544.00
Detention/Water Quality Facilities				$0.00
Removals				$1,620.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$51,377.00
Subtotal Capital Improvement Costs				**$393,119.00**
Additional Capital Improvement Costs				
Dewatering	$39,311.90	L.S.		$39,312.00
Mobilization	5%			$19,656.00
Traffic Control	$39,311.90	L.S.		$39,312.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$19,656.00
Subtotal Additional Capital Improvement Costs				**$317,936.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$106,658.00
Legal/Administrative	5%			$35,553.00
Contract Admin/Construction Management	10%			$71,106.00
Contingency	25%			$177,764.00
Subtotal Other Costs				**$391,081.00**
Total Capital Improvement Costs				**$1,102,136.00**

LDC 7 Summit Blvd, East of County Road 11

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	3	40	L.F.	$3,314.95	$132,598.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	3	39.00	2	EA	$3,771.50	$7,543.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	3	2	EA	$15,989.00	$31,978.00	
Channel Improvements							
Soil Riprap, Type VH			228	C.Y.	$122.00	$27,816.00	
Removals							
Removal of culvert pipe (48"<D<84")			120	L.F.	$68.00	$8,160.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		350	S.Y.	$100.00	$35,000.00	
Base Course	<----User Defined Items		58	C.Y.	$85.00	$4,958.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$172,119.00
Hydraulic Structures				$0.00
Channel Improvements				$27,816.00
Detention/Water Quality Facilities				$0.00
Removals				$8,160.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$39,958.00
Subtotal Capital Improvement Costs				**$249,408.00**
Additional Capital Improvement Costs				
Dewatering	$37,411.20	L.S.		$37,411.00
Mobilization	5%			$12,470.00
Traffic Control	$37,411.20	L.S.		$37,411.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$12,470.00
Subtotal Additional Capital Improvement Costs				**$299,762.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$82,376.00
Legal/Administrative	5%			$27,459.00
Contract Admin/Construction Management	10%			$54,917.00
Contingency	25%			$137,293.00
Subtotal Other Costs				**$302,045.00**
Total Capital Improvement Costs				**$851,215.00**

LDC 8 East of County Road 11, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	5	4	40	L.F.	$4,364.65	$174,586.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	4	44.00	2	EA	$4,281.42	$8,563.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	5	4	2	EA	$20,899.88	$41,799.80	
Channel Improvements							
Soil Riprap, Type VH			256	C.Y.	$122.00	$31,232.00	
Removals							
Removal of culvert pipe (48"<D<84")			25	L.F.	$68.00	$1,700.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		200	S.Y	$45.00	$9,000.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$224,949.00
Hydraulic Structures					$0.00
Channel Improvements					$31,232.00
Detention/Water Quality Facilities					$0.00
Removals					$1,700.00
Landscaping and Maintenance Improvements					$1,355.00
Special Items (User Defined)					$9,000.00
Subtotal Capital Improvement Costs					**$268,236.00**
Additional Capital Improvement Costs					
Dewatering		$40,235.40	L.S.		$40,235.00
Mobilization		5%			$13,412.00
Traffic Control		$40,235.40	L.S.		$40,235.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$13,412.00
Subtotal Additional Capital Improvement Costs					**$132,294.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$60,080.00
Legal/Administrative		5%			$20,027.00
Contract Admin/Construction Management		10%			$40,053.00
Contingency		25%			$100,133.00
Subtotal Other Costs					**$220,293.00**
Total Capital Improvement Costs					**$620,823.00**

LDC 9 East of County Road 11, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
72-inch	65	1	65	L.F.	$488.00	$31,720.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
72-inch	Yes	1	2	EA	$2,587.05	$5,174.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
72-inch		1	2	EA	$15,675.35	$31,351.00	
Channel Improvements							
Soil Riprap, Type VH			178	C.Y.	$122.00	$21,716.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		70	S.Y	$45.00	$3,150.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$68,245.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$21,716.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$3,150.00
Subtotal Capital Improvement Costs					**$93,789.00**
Additional Capital Improvement Costs					
Dewatering		$14,068.35	L.S.		$14,068.00
Mobilization		5%			$4,689.00
Traffic Control		$14,068.35	L.S.		$14,068.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$4,689.00
Subtotal Additional Capital Improvement Costs					**$62,514.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$23,445.00
Legal/Administrative		5%			$7,815.00
Contract Admin/Construction Management		10%			$15,630.00
Contingency		25%			$39,076.00
Subtotal Other Costs					**$85,966.00**
Total Capital Improvement Costs					**$242,269.00**

LDC 11 Colorado Blvd, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	4	4	65	L.F.	$3,420.69	$222,345.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	4	36.00	2	EA	$3,297.78	$6,596.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	4	4	2	EA	$15,279.30	$30,558.60	
Channel Improvements							
Soil Riprap, Type VH			408	C.Y.	$122.00	$49,776.00	
Removals							
Removal of culvert pipe (D<48")			65	L.F.	$27.00	$1,755.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		5867	S.Y	$100.00	$586,667.00	
Base Course	<----User Defined Items		978	C.Y.	$85.00	$83,111.00	
Road Fill	<----User Defined Items		2933	C.Y.	$25.00	$73,333.00	Earthwork to raise the road 3ft

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$259,500.00
Hydraulic Structures				$0.00
Channel Improvements				$49,776.00
Detention/Water Quality Facilities				$0.00
Removals				$1,755.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$743,111.00
Subtotal Capital Improvement Costs				**$1,055,497.00**
Additional Capital Improvement Costs				
Dewatering	$105,549.70	L.S.		$105,550.00
Mobilization	5%			$52,775.00
Traffic Control	$105,549.70	L.S.		$105,550.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$52,775.00
Subtotal Additional Capital Improvement Costs				**$516,650.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$235,822.00
Legal/Administrative	5%			$78,607.00
Contract Admin/Construction Management	10%			$157,215.00
Contingency	25%			$393,037.00
Subtotal Other Costs				**$864,681.00**
Total Capital Improvement Costs				**$2,436,828.00**

LDC 12 County Road 15, North of County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	6	5	40	L.F.	$6,498.47	$259,939.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	5	60.00	2	EA	$5,838.30	$11,677.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	6	5	2	EA	$29,390.12	$58,780.20	
Channel Improvements							
Soil Riprap, Type VH			389	C.Y.	$122.00	$47,458.00	
Removals							
Removal of culvert pipe (48"<D<84")			40	L.F.	$68.00	$2,720.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		300	S.Y	$100.00	$30,000.00	
Base Course	<----User Defined Items		50	C.Y.	$85.00	$4,250.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$330,396.00
Hydraulic Structures				$0.00
Channel Improvements				$47,458.00
Detention/Water Quality Facilities				$0.00
Removals				$2,720.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$34,250.00
Subtotal Capital Improvement Costs				**$416,179.00**
Additional Capital Improvement Costs				
Dewatering	$62,426.85	L.S.		$62,427.00
Mobilization	5%			$20,809.00
Traffic Control	$62,426.85	L.S.		$62,427.00
Utility Coordination/Relocation	$75,000.00	L.S.		$75,000.00
Stormwater Management/Erosion Control	5%			$20,809.00
Subtotal Additional Capital Improvement Costs				**$241,472.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$98,648.00
Legal/Administrative	5%			$32,883.00
Contract Admin/Construction Management	10%			$65,765.00
Contingency	25%			$164,413.00
Subtotal Other Costs				**$361,709.00**
Total Capital Improvement Costs				**$1,019,360.00**

LDC 12 County Road 12, North of County Road 10: Alternative Sizing

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
72-inch	40	11	440	L.F.	$488.00	$214,720.00	
Channel Improvements							
Soil Riprap, Type VH			347	C.Y.	$122.00	$42,334.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		300	S.Y	$100.00	$30,000.00	
Base Course	**<----User Defined Items**		50	C.Y.	$85.00	$4,250.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$214,720.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$42,334.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$34,250.00	
Subtotal Capital Improvement Costs						**$291,304.00**	
Additional Capital Improvement Costs							
Dewatering			$43,695.60	L.S.		$43,696.00	
Mobilization			5%			$14,565.00	
Traffic Control			$43,695.60	L.S.		$43,696.00	
Utility Coordination/Relocation			$75,000.00	L.S.		$75,000.00	
Stormwater Management/Erosion Control			5%			$14,565.00	
Subtotal Additional Capital Improvement Costs						**$191,522.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$72,424.00	
Legal/Administrative			5%			$24,141.00	
Contract Admin/Construction Management			10%			$48,283.00	
Contingency			25%			$120,707.00	
Subtotal Other Costs						**$265,555.00**	
Total Capital Improvement Costs						**$748,381.00**	

LDC 13 West of County Road 19, South of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
12	4	1	70	L.F.	$1,104.98	$77,349.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
12	1	14.00	2	EA	$1,353.87	$2,708.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
12	4	1	2	EA	$9,838.26	$19,676.50	
Channel Improvements							
Soil Riprap, Type VH			64	C.Y.	$122.00	$7,808.00	
Removals							
Removal of culvert pipe (D<48")			70	L.F.	$27.00	$1,890.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		160	S.Y	$100.00	$16,000.00	
Base Course	**<----User Defined Items**		27	C.Y.	$85.00	$2,267.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$99,734.00	
Hydraulic Structures						$0.00	
Channel Improvements						$7,808.00	
Detention/Water Quality Facilities						$0.00	
Removals						$1,890.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$18,267.00	
Subtotal Capital Improvement Costs						**$128,377.00**	
Additional Capital Improvement Costs							
Dewatering			$19,256.55	L.S.		$19,257.00	
Mobilization			5%			$6,419.00	
Traffic Control			$19,256.55	L.S.		$19,257.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$6,419.00	
Subtotal Additional Capital Improvement Costs						**$76,352.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$30,709.00	
Legal/Administrative			5%			$10,236.00	
Contract Admin/Construction Management			10%			$20,473.00	
Contingency			25%			$51,182.00	
Subtotal Other Costs						**$112,600.00**	
Total Capital Improvement Costs						**$317,329.00**	

LDC 14 County Road 19, North of County Road 12

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
9	6	7	90	L.F.	$7,563.95	$680,756.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
9	7	70.00	2	EA	$6,412.35	$12,825.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
9	6	7	2	EA	$32,308.16	$64,616.30	
Channel Improvements							
Soil Riprap, Type VH			480	C.Y.	$122.00	$58,560.00	
Removals							
Removal of culvert pipe (48"<D<84")			90	L.F.	$68.00	$6,120.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		600	S.Y	$100.00	$60,000.00	
Base Course	<----User Defined Items		100	C.Y.	$85.00	$8,500.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$758,197.00
Hydraulic Structures				$0.00
Channel Improvements				$58,560.00
Detention/Water Quality Facilities				$0.00
Removals				$6,120.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$68,500.00
Subtotal Capital Improvement Costs				**$892,732.00**
Additional Capital Improvement Costs				
Dewatering	$89,273.20	L.S.		$89,273.00
Mobilization	5%			$44,637.00
Traffic Control	$89,273.20	L.S.		$89,273.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$44,637.00
Subtotal Additional Capital Improvement Costs				**$467,820.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$204,083.00
Legal/Administrative	5%			$68,028.00
Contract Admin/Construction Management	10%			$136,055.00
Contingency	25%			$340,138.00
Subtotal Other Costs				**$748,304.00**
Total Capital Improvement Costs				**$2,108,856.00**

LDC 14 County Road 19, North of County Road 12: Alternative Sizing

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
72-inch	90	11	990	L.F.	$488.00	$483,120.00	
Channel Improvements							
Soil Riprap, Type VH			600	C.Y.	$122.00	$73,200.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		600	S.Y	$100.00	$60,000.00	
Base Course	<----User Defined Items		100	C.Y.	$85.00	$8,500.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$483,120.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$73,200.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$68,500.00
Subtotal Capital Improvement Costs				**$624,820.00**
Additional Capital Improvement Costs				
Dewatering	$62,482.00	L.S.		$62,482.00
Mobilization	5%			$31,241.00
Traffic Control	$62,482.00	L.S.		$62,482.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$31,241.00
Subtotal Additional Capital Improvement Costs				**$387,446.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$151,840.00
Legal/Administrative	5%			$50,613.00
Contract Admin/Construction Management	10%			$101,227.00
Contingency	25%			$253,067.00
Subtotal Other Costs				**$556,747.00**
Total Capital Improvement Costs				**$1,569,013.00**

LDC 15 County Road 14, West of County Road 21

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	5	8	90	L.F.	$9,369.08	$843,217.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	8	96.00	2	EA	$9,341.28	$18,683.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	5	8	2	EA	$34,373.32	$68,746.60	
Channel Improvements							
Soil Riprap, Type VH			470	C.Y.	$122.00	$57,340.00	
Removals							
Removal of culvert pipe (D>84")			90	L.F.	$102.00	$9,180.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		800	S.Y	$100.00	$80,000.00	
Base Course	<----User Defined Items		133	C.Y.	$85.00	$11,333.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$930,647.00
Hydraulic Structures				$0.00
Channel Improvements				$57,340.00
Detention/Water Quality Facilities				$0.00
Removals				$9,180.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$91,333.00
Subtotal Capital Improvement Costs				**$1,089,855.00**
Additional Capital Improvement Costs				
Dewatering	$108,985.50	L.S.		$108,986.00
Mobilization	5%			$54,493.00
Traffic Control	$108,985.50	L.S.		$108,986.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$54,493.00
Subtotal Additional Capital Improvement Costs				**$526,958.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$242,522.00
Legal/Administrative	5%			$80,841.00
Contract Admin/Construction Management	10%			$161,681.00
Contingency	25%			$404,203.00
Subtotal Other Costs				**$889,247.00**
Total Capital Improvement Costs				**$2,506,060.00**

LDC 16 County Road 21, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	5	7	60	L.F.	$7,638.13	$458,288.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	7	77.00	2	EA	$7,492.49	$14,985.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	5	7	2	EA	$29,353.80	$58,707.60	
Channel Improvements							
Soil Riprap, Type VH			385	C.Y.	$122.00	$46,970.00	
Removals							
Removal of culvert pipe (48"<D<84")			60	L.F.	$68.00	$4,080.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		556	S.Y	$100.00	$55,556.00	
Base Course	<----User Defined Items		93	C.Y.	$85.00	$7,870.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$531,981.00
Hydraulic Structures				$0.00
Channel Improvements				$46,970.00
Detention/Water Quality Facilities				$0.00
Removals				$4,080.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$63,426.00
Subtotal Capital Improvement Costs				**$647,812.00**
Additional Capital Improvement Costs				
Dewatering	$64,781.20	L.S.		$64,781.00
Mobilization	5%			$32,391.00
Traffic Control	$64,781.20	L.S.		$64,781.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$32,391.00
Subtotal Additional Capital Improvement Costs				**$394,344.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$156,323.00
Legal/Administrative	5%			$52,108.00
Contract Admin/Construction Management	10%			$104,216.00
Contingency	25%			$260,539.00
Subtotal Other Costs				**$573,186.00**
Total Capital Improvement Costs				**$1,615,342.00**

LDC 18 County Road 14 1/2, West of County Road 23 1/2

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	5	5	55	L.F.	$6,253.04	$343,917.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	5	65.00	2	EA	$6,285.83	$12,572.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	5	5	2	EA	$26,183.58	$52,367.20	
Channel Improvements							
Soil Riprap, Type VH			330	C.Y.	$122.00	$40,260.00	
Removals							
Removal of culvert pipe (48"<D<84")			55	L.F.	$68.00	$3,740.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		633	S.Y	$100.00	$63,333.00	
Base Course	<----User Defined Items		106	C.Y.	$85.00	$8,972.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$408,856.00	
Hydraulic Structures			$0.00	
Channel Improvements			$40,260.00	
Detention/Water Quality Facilities			$0.00	
Removals			$3,740.00	
Landscaping and Maintenance Improvements			$1,355.00	
Special Items (User Defined)			$72,305.00	
Subtotal Capital Improvement Costs			**$526,516.00**	
Additional Capital Improvement Costs				
Dewatering	$78,977.40	L.S.	$78,977.00	
Mobilization	5%		$26,326.00	
Traffic Control	$78,977.40	L.S.	$78,977.00	
Utility Coordination/Relocation	$200,000.00	L.S.	$200,000.00	
Stormwater Management/Erosion Control	5%		$26,326.00	
Subtotal Additional Capital Improvement Costs			**$410,606.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$140,568.00	
Legal/Administrative	5%		$46,856.00	
Contract Admin/Construction Management	10%		$93,712.00	
Contingency	25%		$234,281.00	
Subtotal Other Costs			**$515,417.00**	
Total Capital Improvement Costs			**$1,452,539.00**	

LDC 19, South of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	65	1	65	L.F.	$171.00	$11,115.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	2	EA	$2,304.00	$4,608.00	
Channel Improvements							
Soil Riprap, Type VH			41	C.Y.	$122.00	$5,002.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		222	S.Y.	$100.00	$22,222.00	
Base Course	<----User Defined Items		37	C.Y.	$75.00	$2,778.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$15,723.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$5,002.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$678.00	
Special Items (User Defined)			$25,000.00	
Subtotal Capital Improvement Costs			**$46,403.00**	
Additional Capital Improvement Costs				
Dewatering	$6,960.45	L.S.	$6,960.00	
Mobilization	5%		$2,320.00	
Traffic Control	$6,960.45	L.S.	$6,960.00	
Utility Coordination/Relocation	$25,000.00	L.S.	$25,000.00	
Stormwater Management/Erosion Control	5%		$2,320.00	
Subtotal Additional Capital Improvement Costs			**$43,560.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$13,494.00	
Legal/Administrative	5%		$4,498.00	
Contract Admin/Construction Management	10%		$8,996.00	
Contingency	25%		$22,491.00	
Subtotal Other Costs			**$49,479.00**	
Total Capital Improvement Costs			**$139,442.00**	

LDC 20 County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	70	1	70	L.F.	$146.00	$10,220.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	$2,182.00	$4,364.00	
Channel Improvements							
Soil Riprap, Type VH			20	C.Y.	$122.00	$2,440.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		111	S.Y.	$45.00	$5,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$14,584.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,440.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$5,000.00	
Subtotal Capital Improvement Costs						**$22,702.00**	
Additional Capital Improvement Costs							
Dewatering			$3,405.30	L.S.		$3,405.00	
Mobilization			5%			$1,135.00	
Traffic Control			$3,405.30	L.S.		$3,405.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,135.00	
Subtotal Additional Capital Improvement Costs						**$34,080.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$8,517.00	
Legal/Administrative			5%			$2,839.00	
Contract Admin/Construction Management			10%			$5,678.00	
Contingency			25%			$14,196.00	
Subtotal Other Costs						**$31,230.00**	
Total Capital Improvement Costs						**$88,012.00**	

LDC 21 Colroado Blvd, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	60	1	60	L.F.	$146.00	$8,760.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	$2,182.00	$4,364.00	
Channel Improvements							
Soil Riprap, Type VH			20	C.Y.	$122.00	$2,440.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		111	S.Y	$100.00	$11,100.00	
Base Course	<----User Defined Items		19	C.Y.	$85.00	$1,573.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$13,124.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,440.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$12,673.00	
Subtotal Capital Improvement Costs						**$28,915.00**	
Additional Capital Improvement Costs							
Dewatering			$4,337.25	L.S.		$4,337.00	
Mobilization			5%			$1,446.00	
Traffic Control			$4,337.25	L.S.		$4,337.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,446.00	
Subtotal Additional Capital Improvement Costs						**$36,566.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$9,822.00	
Legal/Administrative			5%			$3,274.00	
Contract Admin/Construction Management			10%			$6,548.00	
Contingency			25%			$16,370.00	
Subtotal Other Costs						**$36,014.00**	
Total Capital Improvement Costs						**$101,495.00**	

LDC 22 County Road 15, South of County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	90	1	90	L.F.	$98.00	$8,820.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		109	S.Y.	$45.00	$4,905.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$11,448.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$4,905.00	
Subtotal Capital Improvement Costs						**$17,885.00**	
Additional Capital Improvement Costs							
Dewatering			$2,682.75	L.S.		$2,683.00	
Mobilization			5%			$894.00	
Traffic Control			$2,682.75	L.S.		$2,683.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$894.00	
Subtotal Additional Capital Improvement Costs						**$32,154.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$7,506.00	
Legal/Administrative			5%			$2,502.00	
Contract Admin/Construction Management			10%			$5,004.00	
Contingency			25%			$12,510.00	
Subtotal Other Costs						**$27,522.00**	
Total Capital Improvement Costs						**$77,561.00**	

LDC 23 County Road 15, and County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	150	1	150	L.F.	$98.00	$14,700.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$17,328.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$4,860.00	
Subtotal Capital Improvement Costs						**$23,720.00**	
Additional Capital Improvement Costs							
Dewatering			$3,558.00	L.S.		$3,558.00	
Mobilization			5%			$1,186.00	
Traffic Control			$3,558.00	L.S.		$3,558.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,186.00	
Subtotal Additional Capital Improvement Costs						**$34,488.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$8,731.00	
Legal/Administrative			5%			$2,910.00	
Contract Admin/Construction Management			10%			$5,821.00	
Contingency			25%			$14,552.00	
Subtotal Other Costs						**$32,014.00**	
Total Capital Improvement Costs						**$90,222.00**	

LDC 24 County Road 10, East of County Road 15

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	50	2	100	L.F.	$122.00	$12,200.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		125	S.Y.	$45.00	$5,625.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$20,708.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,806.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$5,625.00	
Subtotal Capital Improvement Costs						**$29,817.00**	
Additional Capital Improvement Costs							
Dewatering			$4,472.55	L.S.		$4,473.00	
Mobilization			5%			$1,491.00	
Traffic Control			$4,472.55	L.S.		$4,473.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,491.00	
Subtotal Additional Capital Improvement Costs						**$36,928.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$10,012.00	
Legal/Administrative			5%			$3,337.00	
Contract Admin/Construction Management			10%			$6,675.00	
Contingency			25%			$16,686.00	
Subtotal Other Costs						**$36,710.00**	
Total Capital Improvement Costs						**$103,455.00**	

LDC 25 County Road 10, West of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	90	2	180	L.F.	$122.00	$21,960.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		125	S.Y.	$45.00	$5,625.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$30,468.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,806.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$5,625.00	
Subtotal Capital Improvement Costs						**$39,577.00**	
Additional Capital Improvement Costs							
Dewatering			$5,936.55	L.S.		$5,937.00	
Mobilization			5%			$1,979.00	
Traffic Control			$5,936.55	L.S.		$5,937.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,979.00	
Subtotal Additional Capital Improvement Costs						**$40,832.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$12,061.00	
Legal/Administrative			5%			$4,020.00	
Contract Admin/Construction Management			10%			$8,041.00	
Contingency			25%			$20,102.00	
Subtotal Other Costs						**$44,224.00**	
Total Capital Improvement Costs						**$124,633.00**	

LDC 26 County Road, North of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	84	1	84	L.F.	$98.00	$8,232.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		108	S.Y	$100.00	$10,800.00	
Base Course	<----User Defined Items		18	C.Y.	$85.00	$1,530.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$10,860.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$854.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$12,330.00
Subtotal Capital Improvement Costs				**$24,722.00**
Additional Capital Improvement Costs				
Dewatering	$3,708.30	L.S.		$3,708.00
Mobilization	5%			$1,236.00
Traffic Control	$3,708.30	L.S.		$3,708.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$1,236.00
Subtotal Additional Capital Improvement Costs				**$34,888.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$8,942.00
Legal/Administrative	5%			$2,981.00
Contract Admin/Construction Management	10%			$5,961.00
Contingency	25%			$14,903.00
Subtotal Other Costs				**$32,787.00**
Total Capital Improvement Costs				**$92,397.00**

LDC 27 County Road 12, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	70	1	70	L.F.	$98.00	$6,860.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$9,488.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$854.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$4,860.00
Subtotal Capital Improvement Costs				**$15,880.00**
Additional Capital Improvement Costs				
Dewatering	$2,382.00	L.S.		$2,382.00
Mobilization	5%			$794.00
Traffic Control	$2,382.00	L.S.		$2,382.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$794.00
Subtotal Additional Capital Improvement Costs				**$31,352.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$7,085.00
Legal/Administrative	5%			$2,362.00
Contract Admin/Construction Management	10%			$4,723.00
Contingency	25%			$11,808.00
Subtotal Other Costs				**$25,978.00**
Total Capital Improvement Costs				**$73,210.00**

LDC 28 County Road 12, East of County Road 19

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	Length (ft)	No. of Barrels				
24-inch	50	1	50	L.F.	$98.00	$4,900.00
Flare End Sections						
Diameter (in)	Applicable	No. of Barrels				
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00
Channel Improvements						
Soil Riprap, Type VH		7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements						
Reclamation & seeding (native grasses)		1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)						
Access Road	<----User Defined Items	108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$7,528.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$854.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$4,860.00
Subtotal Capital Improvement Costs				**$13,920.00**
Additional Capital Improvement Costs				
Dewatering	$2,088.00	L.S.		$2,088.00
Mobilization	5%			$696.00
Traffic Control	$2,088.00	L.S.		$2,088.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$696.00
Subtotal Additional Capital Improvement Costs				**$30,568.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$6,673.00
Legal/Administrative	5%			$2,224.00
Contract Admin/Construction Management	10%			$4,449.00
Contingency	25%			$11,122.00
Subtotal Other Costs				**$24,468.00**
Total Capital Improvement Costs				**$68,956.00**

LDC 29 County Road 19, South of Highway 52

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains						
Circular Pipes						
Diameter (in)	Length (ft)	No. of Barrels				
42-inch	90	1	90	L.F.	$171.00	$15,390.00
Flare End Sections						
Diameter (in)	Applicable	No. of Barrels				
42-inch	Yes	1	2	EA	$2,304.00	$4,608.00
Channel Improvements						
Soil Riprap, Type VH		41	C.Y.	$122.00	$5,002.00	
Landscaping and Maintenance Improvements						
Reclamation & seeding (native grasses)		1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)						
Asphalt	<----User Defined Items	132	S.Y	$100.00	$13,200.00	
Base Course	<----User Defined Items	22	C.Y.	$85.00	$1,870.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$19,998.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$5,002.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$15,070.00
Subtotal Capital Improvement Costs				**$40,748.00**
Additional Capital Improvement Costs				
Dewatering	$6,112.20	L.S.		$6,112.00
Mobilization	5%			$2,037.00
Traffic Control	$6,112.20	L.S.		$6,112.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$2,037.00
Subtotal Additional Capital Improvement Costs				**$41,298.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$12,307.00
Legal/Administrative	5%			$4,102.00
Contract Admin/Construction Management	10%			$8,205.00
Contingency	25%			$20,512.00
Subtotal Other Costs				**$45,126.00**
Total Capital Improvement Costs				**$127,172.00**

LDC 30 Brantner Ditch, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	4	7	55	L.F.	$5,986.20	$329,241.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	7	63.00	2	EA	$5,771.12	$11,542.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	4	7	2	EA	$21,430.03	$42,860.10	
Channel Improvements							
Soil Riprap, Type VH			352	C.Y.	$122.00	$42,944.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		267	S.Y.	$45.00	$12,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$383,643.00
Hydraulic Structures						$0.00
Channel Improvements						$42,944.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$1,355.00
Special Items (User Defined)						$12,000.00
Subtotal Capital Improvement Costs						**$439,942.00**
Additional Capital Improvement Costs						
Dewatering			$43,994.20	L.S.		$43,994.00
Mobilization			5%			$21,997.00
Traffic Control			$43,994.20	L.S.		$43,994.00
Utility Coordination/Relocation			$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control			5%			$21,997.00
Subtotal Additional Capital Improvement Costs						**$331,982.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$115,789.00
Legal/Administrative			5%			$38,596.00
Contract Admin/Construction Management			10%			$77,192.00
Contingency			25%			$192,981.00
Subtotal Other Costs						**$424,558.00**
Total Capital Improvement Costs						**$1,196,482.00**

LDC 31 County Road 14 and County Road 17

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	100	4	400	L.F.	$146.00	$58,400.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	4	8	EA	$2,182.00	$17,456.00	
Channel Improvements							
Soil Riprap, Type VH			35	C.Y.	$122.00	$4,270.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		110	S.Y.	$45.00	$4,950.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$75,856.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$4,270.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$4,950.00
Subtotal Capital Improvement Costs					**$85,076.00**
Additional Capital Improvement Costs					
Dewatering			$12,761.40	L.S.	$12,761.00
Mobilization			5%		$4,254.00
Traffic Control			$12,761.40	L.S.	$12,761.00
Utility Coordination/Relocation			$25,000.00	L.S.	$25,000.00
Stormwater Management/Erosion Control			5%		$4,254.00
Subtotal Additional Capital Improvement Costs					**$59,030.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$21,616.00
Legal/Administrative			5%		$7,205.00
Contract Admin/Construction Management			10%		$14,411.00
Contingency			25%		$36,027.00
Subtotal Other Costs					**$79,259.00**
Total Capital Improvement Costs					**$223,365.00**

LDC 32 County Road 14, West of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	150	2	300	L.F.	$122.00	$36,600.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		90	S.Y	$45.00	$4,050.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$45,108.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$2,806.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$0.00
Special Items (User Defined)					$4,050.00
Subtotal Capital Improvement Costs					**$51,964.00**
Additional Capital Improvement Costs					
Dewatering			$7,794.60	L.S.	$7,795.00
Mobilization			5%		$2,598.00
Traffic Control			$7,794.60	L.S.	$7,795.00
Utility Coordination/Relocation			$25,000.00	L.S.	$25,000.00
Stormwater Management/Erosion Control			5%		$2,598.00
Subtotal Additional Capital Improvement Costs					**$45,786.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering			15%		$14,663.00
Legal/Administrative			5%		$4,888.00
Contract Admin/Construction Management			10%		$9,775.00
Contingency			25%		$24,438.00
Subtotal Other Costs					**$53,764.00**
Total Capital Improvement Costs					**$151,514.00**

LDC 33 North of Highway 52, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
5	4	5	120	L.F.	$3,334.77	$400,172.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
5	5	30.00	2	EA	$2,640.15	$5,280.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
5	4	5	2	EA	$13,623.33	$27,246.70	
Channel Improvements							
Soil Riprap, Type VH			172	C.Y.	$122.00	$20,984.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		150	S.Y	$45.00	$6,750.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$432,699.00	
Hydraulic Structures						$0.00	
Channel Improvements						$20,984.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$6,750.00	
Subtotal Capital Improvement Costs						**$460,433.00**	
Additional Capital Improvement Costs							
Dewatering			$69,064.95	L.S.		$69,065.00	
Mobilization			5%			$23,022.00	
Traffic Control			$69,064.95	L.S.		$69,065.00	
Utility Coordination/Relocation			$50,000.00	L.S.		$50,000.00	
Stormwater Management/Erosion Control			5%			$23,022.00	
Subtotal Additional Capital Improvement Costs						**$234,174.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$104,191.00	
Legal/Administrative			5%			$34,730.00	
Contract Admin/Construction Management			10%			$69,461.00	
Contingency			25%			$173,652.00	
Subtotal Other Costs						**$382,034.00**	
Total Capital Improvement Costs						**$1,076,641.00**	

LDC 34 County Road 19, North of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	3	4	120	L.F.	$3,167.06	$380,048.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	4	36.00	2	EA	$3,297.78	$6,596.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	3	4	2	EA	$13,136.69	$26,273.40	
Channel Improvements							
Soil Riprap, Type VH			182	C.Y.	$122.00	$22,204.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		200	S.Y	$100.00	$20,000.00	
Base Course	<----User Defined Items		60	C.Y.	$85.00	$5,100.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$412,917.00	
Hydraulic Structures						$0.00	
Channel Improvements						$22,204.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$25,100.00	
Subtotal Capital Improvement Costs						**$460,221.00**	
Additional Capital Improvement Costs							
Dewatering			$69,033.15	L.S.		$69,033.00	
Mobilization			5%			$23,011.00	
Traffic Control			$69,033.15	L.S.		$69,033.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$23,011.00	
Subtotal Additional Capital Improvement Costs						**$209,088.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$100,396.00	
Legal/Administrative			5%			$33,465.00	
Contract Admin/Construction Management			10%			$66,931.00	
Contingency			25%			$167,327.00	
Subtotal Other Costs						**$368,119.00**	
Total Capital Improvement Costs						**$1,037,428.00**	

LDC 35 County Road 14, West of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	80	3	240	L.F.	$146.00	$35,040.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	3	6	EA	$2,182.00	$13,092.00	
Channel Improvements							
Soil Riprap, Type VH			30	C.Y.	$122.00	$3,660.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		100	S.Y	$45.00	$4,500.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$48,132.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$3,660.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$4,500.00
Subtotal Capital Improvement Costs				**$56,292.00**
Additional Capital Improvement Costs				
Dewatering	$8,443.80	L.S.		$8,444.00
Mobilization	5%			$2,815.00
Traffic Control	$8,443.80	L.S.		$8,444.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$2,815.00
Subtotal Additional Capital Improvement Costs				**$72,518.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$19,322.00
Legal/Administrative	5%			$6,441.00
Contract Admin/Construction Management	10%			$12,881.00
Contingency	25%			$32,203.00
Subtotal Other Costs				**$70,847.00**
Total Capital Improvement Costs				**$199,657.00**

LDC 36 County Road, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	110	3	330	L.F.	$98.00	$32,340.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	3	6	EA	$1,314.00	$7,884.00	
Channel Improvements							
Soil Riprap, Type VH			10	C.Y.	$122.00	$1,220.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		100	S.Y	$100.00	$10,000.00	
Base Course	<----User Defined Items		50	C.Y.	$85.00	$4,250.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$40,224.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$1,220.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$14,250.00
Subtotal Capital Improvement Costs				**$55,694.00**
Additional Capital Improvement Costs				
Dewatering	$8,354.10	L.S.		$8,354.00
Mobilization	5%			$2,785.00
Traffic Control	$8,354.10	L.S.		$8,354.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$2,785.00
Subtotal Additional Capital Improvement Costs				**$72,278.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$19,196.00
Legal/Administrative	5%			$6,399.00
Contract Admin/Construction Management	10%			$12,797.00
Contingency	25%			$31,993.00
Subtotal Other Costs				**$70,385.00**
Total Capital Improvement Costs				**$198,357.00**

LDC 37 County Road 19, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
7	3	2	90	L.F.	$1,458.72	$131,285.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
7	2	17.00	2	EA	$1,550.49	$3,101.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
7	3	2	2	EA	$8,681.54	$17,363.10	
Channel Improvements							
Soil Riprap, Type VH			38	C.Y.	$122.00	$4,636.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		110	S.Y	$100.00	$11,000.00	
Base Course	**<----User Defined Items**		55	C.Y.	$85.00	$4,675.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$151,749.00
Hydraulic Structures				$0.00
Channel Improvements				$4,636.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$15,675.00
Subtotal Capital Improvement Costs				**$172,060.00**
Additional Capital Improvement Costs				
Dewatering	$25,809.00	L.S.		$25,809.00
Mobilization	5%			$8,603.00
Traffic Control	$25,809.00	L.S.		$25,809.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$8,603.00
Subtotal Additional Capital Improvement Costs				**$118,824.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$43,633.00
Legal/Administrative	5%			$14,544.00
Contract Admin/Construction Management	10%			$29,088.00
Contingency	25%			$72,721.00
Subtotal Other Costs				**$159,986.00**
Total Capital Improvement Costs				**$450,870.00**

LDC 2 Stanley Ditch Crossing South of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	75	1	75	L.F.	$195.00	$14,625.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	1	2	EA	$2,791.00	$5,582.00	
Channel Improvements							
Soil Riprap, Type VH			42	C.Y.	$122.00	$5,124.00	
Removals							
Removal of culvert pipe (D<48")			75	L.F.	$27.00	$2,025.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Misc Ditch Crossing Repairs	<----User Defined Items		1		$50,000.00	$50,000.00	
Ditch Access Road	<----User Defined Items		1250	S.F.	$45.00	$56,250.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$20,207.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$5,124.00
Detention/Water Quality Facilities					$0.00
Removals					$2,025.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$106,250.00
Subtotal Capital Improvement Costs					**$134,284.00**
Additional Capital Improvement Costs					
Dewatering		$20,142.60	L.S.		$20,143.00
Mobilization		5%			$6,714.00
Traffic Control		$20,142.60	L.S.		$20,143.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$6,714.00
Subtotal Additional Capital Improvement Costs					**$78,714.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$31,950.00
Legal/Administrative		5%			$10,650.00
Contract Admin/Construction Management		10%			$21,300.00
Contingency		25%			$53,250.00
Subtotal Other Costs					**$117,150.00**
Total Capital Improvement Costs					**$330,148.00**

LDC 3 County Road 6, East of County 11

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
54-inch	50	1	50	L.F.	$293.00	$14,650.00	
Headwalls							
Diameter (in)	Applicable	No. of Barrels					
54-inch	Yes	1	2	EA	$1,932.56	$3,865.00	
Wingwalls (includes concrete apron)							
Diameter (in)		No. of Barrels					
54-inch		1	2	EA	$11,851.54	$23,703.00	
Channel Improvements							
Soil Riprap, Type VH			76	C.Y.	$122.00	$9,272.00	
Removals							
Removal of culvert pipe (D<48")			50	L.F.	$27.00	$1,350.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		120	S.Y	$100.00	$12,000.00	
Base Course	<----User Defined Items		20	C.Y.	$80.00	$1,600.00	

Master Plan Capital Improvement Cost Summary					
Capital Improvement Costs					
Pipe Culverts and Storm Drains					$42,218.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$9,272.00
Detention/Water Quality Facilities					$0.00
Removals					$1,350.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$13,600.00
Subtotal Capital Improvement Costs					**$67,118.00**
Additional Capital Improvement Costs					
Dewatering		$10,067.70	L.S.		$10,068.00
Mobilization		5%			$3,356.00
Traffic Control		$10,067.70	L.S.		$10,068.00
Utility Coordination/Relocation		$75,000.00	L.S.		$75,000.00
Stormwater Management/Erosion Control		5%			$3,356.00
Subtotal Additional Capital Improvement Costs					**$101,848.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$25,345.00
Legal/Administrative		5%			$8,448.00
Contract Admin/Construction Management		10%			$16,897.00
Contingency		25%			$42,242.00
Subtotal Other Costs					**$92,932.00**
Total Capital Improvement Costs					**$261,898.00**

LDC 4 East County Road 11, North of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
66-inch	67	2	134	L.F.	$358.00	$47,972.00	
Headwalls							
Diameter (in)	**Applicable**	**No. of Barrels**					
66-inch	Yes	2	2	EA	$4,062.72	$8,125.00	
Wingwalls (includes concrete apron)							
Diameter (in)		**No. of Barrels**					
66-inch		2	2	EA	$16,452.30	$32,905.00	
Channel Improvements							
Soil Riprap, Type VH			192	C.Y.	$122.00	$23,424.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
66 RCP Bore	**<----User Defined Items**		134	L.F.	$1,200.00	$160,800.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$89,002.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$23,424.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$678.00	
Special Items (User Defined)			$160,800.00	
Subtotal Capital Improvement Costs			**$273,904.00**	
Additional Capital Improvement Costs				
Dewatering	$41,085.60	L.S.	$41,086.00	
Mobilization	5%		$13,695.00	
Traffic Control	$41,085.60	L.S.	$41,086.00	
Utility Coordination/Relocation	$25,000.00	L.S.	$25,000.00	
Stormwater Management/Erosion Control	5%		$13,695.00	
Subtotal Additional Capital Improvement Costs			**$134,562.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$61,270.00	
Legal/Administrative	5%		$20,423.00	
Contract Admin/Construction Management	10%		$40,847.00	
Contingency	25%		$102,117.00	
Subtotal Other Costs			**$224,657.00**	
Total Capital Improvement Costs			**$633,123.00**	

LDC 5 East of County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
9	5	1	60	L.F.	$998.66	$59,920.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
9	1	11.00	2	EA	$1,007.66	$2,015.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
9	5	1	2	EA	$11,917.59	$23,835.20	
Channel Improvements							
Soil Riprap, Type VH			93	C.Y.	$122.00	$11,346.00	
Removals							
Removal of culvert pipe (D<48")			60	L.F.	$27.00	$1,620.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	**<----User Defined Items**		225	S.Y	$45.00	$10,125.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$85,770.00	
Hydraulic Structures			$0.00	
Channel Improvements			$11,346.00	
Detention/Water Quality Facilities			$0.00	
Removals			$1,620.00	
Landscaping and Maintenance Improvements			$678.00	
Special Items (User Defined)			$10,125.00	
Subtotal Capital Improvement Costs			**$109,539.00**	
Additional Capital Improvement Costs				
Dewatering	$10,953.90	L.S.	$10,954.00	
Mobilization	5%		$5,477.00	
Traffic Control	$10,953.90	L.S.	$10,954.00	
Utility Coordination/Relocation	$25,000.00	L.S.	$25,000.00	
Stormwater Management/Erosion Control	5%		$5,477.00	
Subtotal Additional Capital Improvement Costs			**$57,862.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$25,110.00	
Legal/Administrative	5%		$8,370.00	
Contract Admin/Construction Management	10%		$16,740.00	
Contingency	25%		$41,850.00	
Subtotal Other Costs			**$92,070.00**	
Total Capital Improvement Costs			**$259,471.00**	

LDC 6 County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
5	4	1	60	L.F.	$666.95	$40,017.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
5	1	7.00	2	EA	$616.04	$1,232.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
5	4	1	2	EA	$8,182.30	$16,364.60	
Channel Improvements							
Soil Riprap, Type VH			45	C.Y.	$122.00	$5,490.00	
Removals							
Removal of culvert pipe (D<48")			60	L.F.	$27.00	$1,620.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		167	S.Y	$100.00	$16,667.00	
Base Course	<----User Defined Items		28	C.Y.	$80.00	$2,222.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$57,614.00	
Hydraulic Structures						$0.00	
Channel Improvements						$5,490.00	
Detention/Water Quality Facilities						$0.00	
Removals						$1,620.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$18,889.00	
Subtotal Capital Improvement Costs						**$84,291.00**	
Additional Capital Improvement Costs							
Dewatering			$12,643.65	L.S.		$12,644.00	
Mobilization			5%			$4,215.00	
Traffic Control			$12,643.65	L.S.		$12,644.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$4,215.00	
Subtotal Additional Capital Improvement Costs						**$58,718.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$21,451.00	
Legal/Administrative			5%			$7,150.00	
Contract Admin/Construction Management			10%			$14,301.00	
Contingency			25%			$35,752.00	
Subtotal Other Costs						**$78,654.00**	
Total Capital Improvement Costs						**$221,663.00**	

LDC 7 Summit Blvd, East of County Road 11

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
7	4	1	40	L.F.	$791.77	$31,671.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
7	1	9.00	2	EA	$820.85	$1,642.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
7	4	1	2	EA	$8,655.43	$17,310.90	
Channel Improvements							
Soil Riprap, Type VH			100	C.Y.	$122.00	$12,200.00	
Removals							
Removal of culvert pipe (48"<D<84")			120	L.F.	$68.00	$8,160.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		167	S.Y.	$100.00	$16,667.00	
Base Course	<----User Defined Items		28	C.Y.	$85.00	$2,361.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$50,624.00	
Hydraulic Structures						$0.00	
Channel Improvements						$12,200.00	
Detention/Water Quality Facilities						$0.00	
Removals						$8,160.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$19,028.00	
Subtotal Capital Improvement Costs						**$90,690.00**	
Additional Capital Improvement Costs							
Dewatering			$13,603.50	L.S.		$13,604.00	
Mobilization			5%			$4,535.00	
Traffic Control			$13,603.50	L.S.		$13,604.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$4,535.00	
Subtotal Additional Capital Improvement Costs						**$61,278.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$22,795.00	
Legal/Administrative			5%			$7,598.00	
Contract Admin/Construction Management			10%			$15,197.00	
Contingency			25%			$37,992.00	
Subtotal Other Costs						**$83,582.00**	
Total Capital Improvement Costs						**$235,550.00**	

LDC 8 East of County Road 11, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
8	4	3	40	L.F.	$2,565.52	$102,621.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
8	3	27.00	2	EA	$2,473.34	$4,947.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
8	4	3	2	EA	$13,150.20	$26,300.40	
Channel Improvements							
Soil Riprap, Type VH			192	C.Y.	$122.00	$23,424.00	
Removals							
Removal of culvert pipe (48"<D<84")			25	L.F.	$68.00	$1,700.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Access Road	**<----User Defined Items**		200	S.Y	$45.00	$9,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$133,868.00
Hydraulic Structures				$0.00
Channel Improvements				$23,424.00
Detention/Water Quality Facilities				$0.00
Removals				$1,700.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$9,000.00
Subtotal Capital Improvement Costs				**$169,347.00**
Additional Capital Improvement Costs				
Dewatering	$25,402.05	L.S.		$25,402.00
Mobilization	5%			$8,467.00
Traffic Control	$25,402.05	L.S.		$25,402.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$8,467.00
Subtotal Additional Capital Improvement Costs				**$92,738.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$39,313.00
Legal/Administrative	5%			$13,104.00
Contract Admin/Construction Management	10%			$26,209.00
Contingency	25%			$65,521.00
Subtotal Other Costs				**$144,147.00**
Total Capital Improvement Costs				**$406,232.00**

LDC 11 Colorado Blvd, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	4	6	36	L.F.	$5,875.03	$211,501.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	6	66.00	2	EA	$6,422.13	$12,844.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	4	6	2	EA	$22,139.73	$44,279.50	
Channel Improvements							
Soil Riprap, Type VH			300	C.Y.	$122.00	$36,600.00	
Removals							
Removal of culvert pipe (D<48")			65	L.F.	$27.00	$1,755.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		5867	S.Y	$100.00	$586,667.00	
Base Course	**<----User Defined Items**		978	C.Y.	$85.00	$83,111.00	
Road Fill	**<----User Defined Items**		2933	C.Y.	$25.00	$73,333.00	Earthwork to raise the road 3ft

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$268,625.00
Hydraulic Structures				$0.00
Channel Improvements				$36,600.00
Detention/Water Quality Facilities				$0.00
Removals				$1,755.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$743,111.00
Subtotal Capital Improvement Costs				**$1,051,446.00**
Additional Capital Improvement Costs				
Dewatering	$105,144.60	L.S.		$105,145.00
Mobilization	5%			$52,572.00
Traffic Control	$105,144.60	L.S.		$105,145.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$52,572.00
Subtotal Additional Capital Improvement Costs				**$515,434.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$235,032.00
Legal/Administrative	5%			$78,344.00
Contract Admin/Construction Management	10%			$156,688.00
Contingency	25%			$391,720.00
Subtotal Other Costs				**$861,784.00**
Total Capital Improvement Costs				**$2,428,664.00**

Note: Cost were calculated as (6) 10' x 4' culverts instead of (3) 19' x 4' feet culverts. MHFD cost software did not accept a 19' x 4' RCBC as a culvert size

LDC 12 County Road 15, North of County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
13	6	3	40	L.F.	$4,658.70	$186,348.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
13	3	42.00	2	EA	$4,061.61	$8,123.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
13	6	3	2	EA	$24,429.46	$48,858.90	
Channel Improvements							
Soil Riprap, Type VH			304	C.Y.	$122.00	$37,088.00	
Removals							
Removal of culvert pipe (48"<D<84")			40	L.F.	$68.00	$2,720.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		260	S.Y	$100.00	$26,000.00	
Base Course	<----User Defined Items		43	C.Y.	$85.00	$3,683.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$243,330.00	
Hydraulic Structures						$0.00	
Channel Improvements						$37,088.00	
Detention/Water Quality Facilities						$0.00	
Removals						$2,720.00	
Landscaping and Maintenance Improvements						$1,355.00	
Special Items (User Defined)						$29,683.00	
Subtotal Capital Improvement Costs						**$314,176.00**	
Additional Capital Improvement Costs							
Dewatering			$47,126.40	L.S.		$47,126.00	
Mobilization			5%			$15,709.00	
Traffic Control			$47,126.40	L.S.		$47,126.00	
Utility Coordination/Relocation			$75,000.00	L.S.		$75,000.00	
Stormwater Management/Erosion Control			5%			$15,709.00	
Subtotal Additional Capital Improvement Costs						**$200,670.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$77,227.00	
Legal/Administrative			5%			$25,742.00	
Contract Admin/Construction Management			10%			$51,485.00	
Contingency			25%			$128,712.00	
Subtotal Other Costs						**$283,166.00**	
Total Capital Improvement Costs						**$798,012.00**	

LDC 12 County Road 12, North of County Road 10: Alternative Sizing

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
72-inch	40	7	280	L.F.	$488.00	$136,640.00	
Channel Improvements							
Soil Riprap, Type VH			329	C.Y.	$122.00	$40,138.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		260	S.Y	$100.00	$26,000.00	
Base Course	<----User Defined Items		43	C.Y.	$85.00	$3,655.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$136,640.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$40,138.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$29,655.00	
Subtotal Capital Improvement Costs						**$206,433.00**	
Additional Capital Improvement Costs							
Dewatering			$30,964.95	L.S.		$30,965.00	
Mobilization			5%			$10,322.00	
Traffic Control			$30,964.95	L.S.		$30,965.00	
Utility Coordination/Relocation			$75,000.00	L.S.		$75,000.00	
Stormwater Management/Erosion Control			5%			$10,322.00	
Subtotal Additional Capital Improvement Costs						**$157,574.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$54,601.00	
Legal/Administrative			5%			$18,200.00	
Contract Admin/Construction Management			10%			$36,401.00	
Contingency			25%			$91,002.00	
Subtotal Other Costs						**$200,204.00**	
Total Capital Improvement Costs						**$564,211.00**	

LDC 13 West of County Road 19, South of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
12	4	1	70	L.F.	$1,104.98	$77,349.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
12	1	14.00	2	EA	$1,353.87	$2,708.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
12	4	1	2	EA	$9,838.26	$19,676.50	
Channel Improvements							
Soil Riprap, Type VH			64	C.Y.	$122.00	$7,808.00	
Removals							
Removal of culvert pipe (D<48")			70	L.F.	$27.00	$1,890.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		160	S.Y	$100.00	$16,000.00	
Base Course	<----User Defined Items		27	C.Y.	$85.00	$2,267.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$99,734.00
Hydraulic Structures				$0.00
Channel Improvements				$7,808.00
Detention/Water Quality Facilities				$0.00
Removals				$1,890.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$18,267.00
Subtotal Capital Improvement Costs				**$128,377.00**
Additional Capital Improvement Costs				
Dewatering	$19,256.55	L.S.		$19,257.00
Mobilization	5%			$6,419.00
Traffic Control	$19,256.55	L.S.		$19,257.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$6,419.00
Subtotal Additional Capital Improvement Costs				**$76,352.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$30,709.00
Legal/Administrative	5%			$10,236.00
Contract Admin/Construction Management	10%			$20,473.00
Contingency	25%			$51,182.00
Subtotal Other Costs				**$112,600.00**
Total Capital Improvement Costs				**$317,329.00**

LDC 14 County Road 19, North of County Road 12

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
13	6	4	90	L.F.	$6,211.59	$559,043.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
13	4	56.00	2	EA	$5,415.48	$10,831.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
13	6	4	2	EA	$28,514.71	$57,029.40	
Channel Improvements							
Soil Riprap, Type VH			416	C.Y.	$122.00	$50,752.00	
Removals							
Removal of culvert pipe (48"<D<84")			90	L.F.	$68.00	$6,120.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		667	S.Y	$100.00	$66,667.00	
Base Course	<----User Defined Items		111	C.Y.	$85.00	$9,444.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$626,903.00
Hydraulic Structures				$0.00
Channel Improvements				$50,752.00
Detention/Water Quality Facilities				$0.00
Removals				$6,120.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$76,111.00
Subtotal Capital Improvement Costs				**$761,241.00**
Additional Capital Improvement Costs				
Dewatering	$76,124.10	L.S.		$76,124.00
Mobilization	5%			$38,062.00
Traffic Control	$76,124.10	L.S.		$76,124.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$38,062.00
Subtotal Additional Capital Improvement Costs				**$428,372.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$178,442.00
Legal/Administrative	5%			$59,481.00
Contract Admin/Construction Management	10%			$118,961.00
Contingency	25%			$297,403.00
Subtotal Other Costs				**$654,287.00**
Total Capital Improvement Costs				**$1,843,900.00**

LDC 14 County Road 19, North of County Road 12: Alternative Sizing

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	**Length (ft)**	**No. of Barrels**					
72-inch	90	9	810	L.F.	$488.00	$395,280.00	
Channel Improvements							
Soil Riprap, Type VH			520	C.Y.	$122.00	$63,440.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		520	S.Y	$100.00	$52,000.00	
	<----User Defined Items		111	C.Y	$85.00	$9,435.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$395,280.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$63,440.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$0.00
Special Items (User Defined)						$61,435.00
Subtotal Capital Improvement Costs						**$520,155.00**
Additional Capital Improvement Costs						
Dewatering			$52,015.50	L.S.		$52,016.00
Mobilization			5%			$26,008.00
Traffic Control			$52,015.50	L.S.		$52,016.00
Utility Coordination/Relocation			$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control			5%			$26,008.00
Subtotal Additional Capital Improvement Costs						**$356,048.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$131,430.00
Legal/Administrative			5%			$43,810.00
Contract Admin/Construction Management			10%			$87,620.00
Contingency			25%			$219,051.00
Subtotal Other Costs						**$481,911.00**
Total Capital Improvement Costs						**$1,358,114.00**

LDC 15 County Road 14, West of County Road 21

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
10	5	7	90	L.F.	$7,638.13	$687,432.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
10	7	77.00	2	EA	$7,492.49	$14,985.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
10	5	7	2	EA	$29,353.80	$58,707.60	
Channel Improvements							
Soil Riprap, Type VH			385	C.Y.	$122.00	$46,970.00	
Removals							
Removal of culvert pipe (D>84")			90	L.F.	$102.00	$9,180.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		667	S.Y	$100.00	$66,667.00	
Base Course	**<----User Defined Items**		111	C.Y.	$85.00	$9,444.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains						$0.00
Concrete Box Culverts						$761,125.00
Hydraulic Structures						$0.00
Channel Improvements						$46,970.00
Detention/Water Quality Facilities						$0.00
Removals						$9,180.00
Landscaping and Maintenance Improvements						$678.00
Special Items (User Defined)						$76,111.00
Subtotal Capital Improvement Costs						**$894,064.00**
Additional Capital Improvement Costs						
Dewatering			$89,406.40	L.S.		$89,406.00
Mobilization			5%			$44,703.00
Traffic Control			$89,406.40	L.S.		$89,406.00
Utility Coordination/Relocation			$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control			5%			$44,703.00
Subtotal Additional Capital Improvement Costs						**$468,218.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$204,342.00
Legal/Administrative			5%			$68,114.00
Contract Admin/Construction Management			10%			$136,228.00
Contingency			25%			$340,571.00
Subtotal Other Costs						**$749,255.00**
Total Capital Improvement Costs						**$2,111,537.00**

LDC 16 County Road 21, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	5	6	60	L.F.	$6,546.97	$392,818.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	6	66.00	2	EA	$6,422.13	$12,844.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	5	6	2	EA	$26,447.77	$52,895.50	
Channel Improvements							
Soil Riprap, Type VH			338	C.Y.	$122.00	$41,236.00	
Removals							
Removal of culvert pipe (48"<D<84")			60	L.F.	$68.00	$4,080.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		444	S.Y	$100.00	$44,444.00	
Base Course	<----User Defined Items		74	C.Y.	$85.00	$6,296.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$458,558.00
Hydraulic Structures				$0.00
Channel Improvements				$41,236.00
Detention/Water Quality Facilities				$0.00
Removals				$4,080.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$50,740.00
Subtotal Capital Improvement Costs				**$555,969.00**
Additional Capital Improvement Costs				
Dewatering	$55,596.90	L.S.		$55,597.00
Mobilization	5%			$27,798.00
Traffic Control	$55,596.90	L.S.		$55,597.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$27,798.00
Subtotal Additional Capital Improvement Costs				**$366,790.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$138,414.00
Legal/Administrative	5%			$46,138.00
Contract Admin/Construction Management	10%			$92,276.00
Contingency	25%			$230,690.00
Subtotal Other Costs				**$507,518.00**
Total Capital Improvement Costs				**$1,430,277.00**

LDC 18 County Road 14 1/2, West of County Road 23 1/2

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
11	5	5	55	L.F.	$5,855.68	$322,062.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
11	5	60.00	2	EA	$5,838.30	$11,677.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
11	5	5	2	EA	$24,862.66	$49,725.30	
Channel Improvements							
Soil Riprap, Type VH			311	C.Y.	$122.00	$37,942.00	
Removals							
Removal of culvert pipe (48"<D<84")			55	L.F.	$68.00	$3,740.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		500	S.Y	$100.00	$50,000.00	
Base Course	<----User Defined Items		83	C.Y.	$85.00	$7,083.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$383,464.00
Hydraulic Structures				$0.00
Channel Improvements				$37,942.00
Detention/Water Quality Facilities				$0.00
Removals				$3,740.00
Landscaping and Maintenance Improvements				$1,355.00
Special Items (User Defined)				$57,083.00
Subtotal Capital Improvement Costs				**$483,584.00**
Additional Capital Improvement Costs				
Dewatering	$72,537.60	L.S.		$72,538.00
Mobilization	5%			$24,179.00
Traffic Control	$72,537.60	L.S.		$72,538.00
Utility Coordination/Relocation	$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control	5%			$24,179.00
Subtotal Additional Capital Improvement Costs				**$393,434.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$131,553.00
Legal/Administrative	5%			$43,851.00
Contract Admin/Construction Management	10%			$87,702.00
Contingency	25%			$219,255.00
Subtotal Other Costs				**$482,361.00**
Total Capital Improvement Costs				**$1,359,379.00**

LDC 19, South of County Road 6

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	65	1	65	L.F.	$171.00	$11,115.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	2	EA	$2,304.00	$4,608.00	
Channel Improvements							
Soil Riprap, Type VH			41	C.Y.	$122.00	$5,002.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		222	S.Y.	$100.00	$22,222.00	
Base Course	<----User Defined Items		37	C.Y.	$75.00	$2,778.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$15,723.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$5,002.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$25,000.00
Subtotal Capital Improvement Costs				**$46,403.00**
Additional Capital Improvement Costs				
Dewatering	$6,960.45	L.S.		$6,960.00
Mobilization	5%			$2,320.00
Traffic Control	$6,960.45	L.S.		$6,960.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$2,320.00
Subtotal Additional Capital Improvement Costs				**$43,560.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$13,494.00
Legal/Administrative	5%			$4,498.00
Contract Admin/Construction Management	10%			$8,996.00
Contingency	25%			$22,491.00
Subtotal Other Costs				**$49,479.00**
Total Capital Improvement Costs				**$139,442.00**

LDC 20 County Road 11, South of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	70	1	70	L.F.	$146.00	$10,220.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	$2,182.00	$4,364.00	
Channel Improvements							
Soil Riprap, Type VH			20	C.Y.	$122.00	$2,440.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		111	S.Y.	$45.00	$5,000.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$14,584.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$2,440.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$678.00
Special Items (User Defined)				$5,000.00
Subtotal Capital Improvement Costs				**$22,702.00**
Additional Capital Improvement Costs				
Dewatering	$3,405.30	L.S.		$3,405.00
Mobilization	5%			$1,135.00
Traffic Control	$3,405.30	L.S.		$3,405.00
Utility Coordination/Relocation	$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control	5%			$1,135.00
Subtotal Additional Capital Improvement Costs				**$34,080.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$8,517.00
Legal/Administrative	5%			$2,839.00
Contract Admin/Construction Management	10%			$5,678.00
Contingency	25%			$14,196.00
Subtotal Other Costs				**$31,230.00**
Total Capital Improvement Costs				**$88,012.00**

LDC 21 Colroado Blvd, North of Summit Blvd

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	60	1	60	L.F.	$146.00	$8,760.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	1	2	EA	$2,182.00	$4,364.00	
Channel Improvements							
Soil Riprap, Type VH			20	C.Y.	$122.00	$2,440.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		111	S.Y	$100.00	$11,100.00	
Base Course	<----User Defined Items		19	C.Y.	$85.00	$1,573.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$13,124.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$2,440.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$678.00
Special Items (User Defined)						$12,673.00
Subtotal Capital Improvement Costs						**$28,915.00**
Additional Capital Improvement Costs						
Dewatering			$4,337.25	L.S.		$4,337.00
Mobilization			5%			$1,446.00
Traffic Control			$4,337.25	L.S.		$4,337.00
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control			5%			$1,446.00
Subtotal Additional Capital Improvement Costs						**$36,566.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$9,822.00
Legal/Administrative			5%			$3,274.00
Contract Admin/Construction Management			10%			$6,548.00
Contingency			25%			$16,370.00
Subtotal Other Costs						**$36,014.00**
Total Capital Improvement Costs						**$101,495.00**

LDC 22 County Road 15, South of County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	90	1	90	L.F.	$98.00	$8,820.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		109	S.Y.	$45.00	$4,905.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs						
Pipe Culverts and Storm Drains						$11,448.00
Concrete Box Culverts						$0.00
Hydraulic Structures						$0.00
Channel Improvements						$854.00
Detention/Water Quality Facilities						$0.00
Removals						$0.00
Landscaping and Maintenance Improvements						$678.00
Special Items (User Defined)						$4,905.00
Subtotal Capital Improvement Costs						**$17,885.00**
Additional Capital Improvement Costs						
Dewatering			$2,682.75	L.S.		$2,683.00
Mobilization			5%			$894.00
Traffic Control			$2,682.75	L.S.		$2,683.00
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control			5%			$894.00
Subtotal Additional Capital Improvement Costs						**$32,154.00**
Land Acquisition Costs						
ROW/Easements						$0.00
Subtotal Land Acquisition Costs						**$0.00**
Other Costs (percentage of Capital Improvement Costs)						
Engineering			15%			$7,506.00
Legal/Administrative			5%			$2,502.00
Contract Admin/Construction Management			10%			$5,004.00
Contingency			25%			$12,510.00
Subtotal Other Costs						**$27,522.00**
Total Capital Improvement Costs						**$77,561.00**

LDC 23 County Road 15, and County Road 10

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	150	1	150	L.F.	$98.00	$14,700.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$17,328.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$4,860.00	
Subtotal Capital Improvement Costs						**$23,720.00**	
Additional Capital Improvement Costs							
Dewatering			$3,558.00	L.S.		$3,558.00	
Mobilization			5%			$1,186.00	
Traffic Control			$3,558.00	L.S.		$3,558.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,186.00	
Subtotal Additional Capital Improvement Costs						**$34,488.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$8,731.00	
Legal/Administrative			5%			$2,910.00	
Contract Admin/Construction Management			10%			$5,821.00	
Contingency			25%			$14,552.00	
Subtotal Other Costs						**$32,014.00**	
Total Capital Improvement Costs						**$90,222.00**	

LDC 24 County Road 10, East of County Road 15

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	50	2	100	L.F.	$122.00	$12,200.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		125	S.Y.	$45.00	$5,625.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$20,708.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,806.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$5,625.00	
Subtotal Capital Improvement Costs						**$29,817.00**	
Additional Capital Improvement Costs							
Dewatering			$4,472.55	L.S.		$4,473.00	
Mobilization			5%			$1,491.00	
Traffic Control			$4,472.55	L.S.		$4,473.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,491.00	
Subtotal Additional Capital Improvement Costs						**$36,928.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$10,012.00	
Legal/Administrative			5%			$3,337.00	
Contract Admin/Construction Management			10%			$6,675.00	
Contingency			25%			$16,686.00	
Subtotal Other Costs						**$36,710.00**	
Total Capital Improvement Costs						**$103,455.00**	

LDC 25 County Road 10, West of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	90	2	180	L.F.	$122.00	$21,960.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		125	S.Y.	$45.00	$5,625.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$30,468.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,806.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$5,625.00	
Subtotal Capital Improvement Costs						**$39,577.00**	
Additional Capital Improvement Costs							
Dewatering			$5,936.55	L.S.		$5,937.00	
Mobilization			5%			$1,979.00	
Traffic Control			$5,936.55	L.S.		$5,937.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,979.00	
Subtotal Additional Capital Improvement Costs						**$40,832.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$12,061.00	
Legal/Administrative			5%			$4,020.00	
Contract Admin/Construction Management			10%			$8,041.00	
Contingency			25%			$20,102.00	
Subtotal Other Costs						**$44,224.00**	
Total Capital Improvement Costs						**$124,633.00**	

LDC 26 County Road, North of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	84	1	84	L.F.	$98.00	$8,232.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		108	S.Y	$100.00	$10,800.00	
Base Course	<----User Defined Items		18	C.Y.	$85.00	$1,530.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$10,860.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$12,330.00	
Subtotal Capital Improvement Costs						**$24,722.00**	
Additional Capital Improvement Costs							
Dewatering			$3,708.30	L.S.		$3,708.00	
Mobilization			5%			$1,236.00	
Traffic Control			$3,708.30	L.S.		$3,708.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$1,236.00	
Subtotal Additional Capital Improvement Costs						**$34,888.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$8,942.00	
Legal/Administrative			5%			$2,981.00	
Contract Admin/Construction Management			10%			$5,961.00	
Contingency			25%			$14,903.00	
Subtotal Other Costs						**$32,787.00**	
Total Capital Improvement Costs						**$92,397.00**	

LDC 27 County Road 12, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	70	1	70	L.F.	$98.00	$6,860.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$9,488.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$4,860.00	
Subtotal Capital Improvement Costs						**$15,880.00**	
Additional Capital Improvement Costs							
Dewatering			$2,382.00	L.S.		$2,382.00	
Mobilization			5%			$794.00	
Traffic Control			$2,382.00	L.S.		$2,382.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$794.00	
Subtotal Additional Capital Improvement Costs						**$31,352.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$7,085.00	
Legal/Administrative			5%			$2,362.00	
Contract Admin/Construction Management			10%			$4,723.00	
Contingency			25%			$11,808.00	
Subtotal Other Costs						**$25,978.00**	
Total Capital Improvement Costs						**$73,210.00**	

LDC 28 County Road 12, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	50	1	50	L.F.	$98.00	$4,900.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	1	2	EA	$1,314.00	$2,628.00	
Channel Improvements							
Soil Riprap, Type VH			7	C.Y.	$122.00	$854.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		108	S.Y.	$45.00	$4,860.00	

Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$7,528.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$854.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$678.00	
Special Items (User Defined)						$4,860.00	
Subtotal Capital Improvement Costs						**$13,920.00**	
Additional Capital Improvement Costs							
Dewatering			$2,088.00	L.S.		$2,088.00	
Mobilization			5%			$696.00	
Traffic Control			$2,088.00	L.S.		$2,088.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$696.00	
Subtotal Additional Capital Improvement Costs						**$30,568.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$6,673.00	
Legal/Administrative			5%			$2,224.00	
Contract Admin/Construction Management			10%			$4,449.00	
Contingency			25%			$11,122.00	
Subtotal Other Costs						**$24,468.00**	
Total Capital Improvement Costs						**$68,956.00**	

LDC 29 County Road 19, South of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
42-inch	90	1	90	L.F.	$171.00	$15,390.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
42-inch	Yes	1	2	EA	$2,304.00	$4,608.00	
Channel Improvements							
Soil Riprap, Type VH			41	C.Y.	$122.00	$5,002.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$678.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		132	S.Y	$100.00	$13,200.00	
Base Course	<----User Defined Items		22	C.Y.	$85.00	$1,870.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs					
Pipe Culverts and Storm Drains					$19,998.00
Concrete Box Culverts					$0.00
Hydraulic Structures					$0.00
Channel Improvements					$5,002.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$678.00
Special Items (User Defined)					$15,070.00
Subtotal Capital Improvement Costs					**$40,748.00**
Additional Capital Improvement Costs					
Dewatering		$6,112.20	L.S.		$6,112.00
Mobilization		5%			$2,037.00
Traffic Control		$6,112.20	L.S.		$6,112.00
Utility Coordination/Relocation		$25,000.00	L.S.		$25,000.00
Stormwater Management/Erosion Control		5%			$2,037.00
Subtotal Additional Capital Improvement Costs					**$41,298.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$12,307.00
Legal/Administrative		5%			$4,102.00
Contract Admin/Construction Management		10%			$8,205.00
Contingency		25%			$20,512.00
Subtotal Other Costs					**$45,126.00**
Total Capital Improvement Costs					**$127,172.00**

LDC 30 Brantner Ditch, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
10	4	4	55	L.F.	$3,916.68	$215,418.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
10	4	44.00	2	EA	$4,281.42	$8,563.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
10	4	4	2	EA	$17,171.83	$34,343.70	
Channel Improvements							
Soil Riprap, Type VH			264	C.Y.	$122.00	$32,208.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		267	S.Y.	$45.00	$12,000.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs					
Pipe Culverts and Storm Drains					$0.00
Concrete Box Culverts					$258,325.00
Hydraulic Structures					$0.00
Channel Improvements					$32,208.00
Detention/Water Quality Facilities					$0.00
Removals					$0.00
Landscaping and Maintenance Improvements					$1,355.00
Special Items (User Defined)					$12,000.00
Subtotal Capital Improvement Costs					**$303,888.00**
Additional Capital Improvement Costs					
Dewatering		$30,388.80	L.S.		$30,389.00
Mobilization		5%			$15,194.00
Traffic Control		$30,388.80	L.S.		$30,389.00
Utility Coordination/Relocation		$200,000.00	L.S.		$200,000.00
Stormwater Management/Erosion Control		5%			$15,194.00
Subtotal Additional Capital Improvement Costs					**$291,166.00**
Land Acquisition Costs					
ROW/Easements					$0.00
Subtotal Land Acquisition Costs					**$0.00**
Other Costs (percentage of Capital Improvement Costs)					
Engineering		15%			$89,258.00
Legal/Administrative		5%			$29,753.00
Contract Admin/Construction Management		10%			$59,505.00
Contingency		25%			$148,764.00
Subtotal Other Costs					**$327,280.00**
Total Capital Improvement Costs					**$922,334.00**

LDC 31 County Road 14 and County Road 17							
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	100	4	400	L.F.	$146.00	$58,400.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	4	8	EA	$2,182.00	$17,456.00	
Channel Improvements							
Soil Riprap, Type VH			35	C.Y.	$122.00	$4,270.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		110	S.Y.	$45.00	$4,950.00	
Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$75,856.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$4,270.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$4,950.00	
Subtotal Capital Improvement Costs						**$85,076.00**	
Additional Capital Improvement Costs							
Dewatering			$12,761.40	L.S.		$12,761.00	
Mobilization			5%			$4,254.00	
Traffic Control			$12,761.40	L.S.		$12,761.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$4,254.00	
Subtotal Additional Capital Improvement Costs						**$59,030.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$21,616.00	
Legal/Administrative			5%			$7,205.00	
Contract Admin/Construction Management			10%			$14,411.00	
Contingency			25%			$36,027.00	
Subtotal Other Costs						**$79,259.00**	
Total Capital Improvement Costs						**$223,365.00**	

LDC 32 County Road 14, West of County Road 19							
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
30-inch	150	2	300	L.F.	$122.00	$36,600.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
30-inch	Yes	2	4	EA	$2,127.00	$8,508.00	
Channel Improvements							
Soil Riprap, Type VH			23	C.Y.	$122.00	$2,806.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		90	S.Y	$45.00	$4,050.00	
Master Plan Capital Improvement Cost Summary							
Capital Improvement Costs							
Pipe Culverts and Storm Drains						$45,108.00	
Concrete Box Culverts						$0.00	
Hydraulic Structures						$0.00	
Channel Improvements						$2,806.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$4,050.00	
Subtotal Capital Improvement Costs						**$51,964.00**	
Additional Capital Improvement Costs							
Dewatering			$7,794.60	L.S.		$7,795.00	
Mobilization			5%			$2,598.00	
Traffic Control			$7,794.60	L.S.		$7,795.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$2,598.00	
Subtotal Additional Capital Improvement Costs						**$45,786.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$14,663.00	
Legal/Administrative			5%			$4,888.00	
Contract Admin/Construction Management			10%			$9,775.00	
Contingency			25%			$24,438.00	
Subtotal Other Costs						**$53,764.00**	
Total Capital Improvement Costs						**$151,514.00**	

LDC 33 North of Highway 52, East of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
5	4	5	120	L.F.	$3,334.77	$400,172.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
5	5	30.00	2	EA	$2,640.15	$5,280.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
5	4	5	2	EA	$13,623.33	$27,246.70	
Channel Improvements							
Soil Riprap, Type VH			172	C.Y.	$122.00	$20,984.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		150	S.Y	$45.00	$6,750.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$432,699.00	
Hydraulic Structures						$0.00	
Channel Improvements						$20,984.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$6,750.00	
Subtotal Capital Improvement Costs						**$460,433.00**	
Additional Capital Improvement Costs							
Dewatering			$69,064.95	L.S.		$69,065.00	
Mobilization			5%			$23,022.00	
Traffic Control			$69,064.95	L.S.		$69,065.00	
Utility Coordination/Relocation			$50,000.00	L.S.		$50,000.00	
Stormwater Management/Erosion Control			5%			$23,022.00	
Subtotal Additional Capital Improvement Costs						**$234,174.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$104,191.00	
Legal/Administrative			5%			$34,730.00	
Contract Admin/Construction Management			10%			$69,461.00	
Contingency			25%			$173,652.00	
Subtotal Other Costs						**$382,034.00**	
Total Capital Improvement Costs						**$1,076,641.00**	

LDC 34 County Road 19, North of Highway 52

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	Box Height (ft)	No. of Barrels	Length (ft)				
8	3	4	120	L.F.	$3,167.06	$380,048.00	
Headwall and Toewalls							
Individual Box Span (ft)	No. of Barrels	Total Span (ft)					
8	4	36.00	2	EA	$3,297.78	$6,596.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	Box Rise (ft)	No. of Barrels					
8	3	4	2	EA	$13,136.69	$26,273.40	
Channel Improvements							
Soil Riprap, Type VH			182	C.Y.	$122.00	$22,204.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		200	S.Y	$100.00	$20,000.00	
Base Course	<----User Defined Items		60	C.Y.	$85.00	$5,100.00	

Master Plan Capital Improvement Cost Summary

Capital Improvement Costs							
Pipe Culverts and Storm Drains						$0.00	
Concrete Box Culverts						$412,917.00	
Hydraulic Structures						$0.00	
Channel Improvements						$22,204.00	
Detention/Water Quality Facilities						$0.00	
Removals						$0.00	
Landscaping and Maintenance Improvements						$0.00	
Special Items (User Defined)						$25,100.00	
Subtotal Capital Improvement Costs						**$460,221.00**	
Additional Capital Improvement Costs							
Dewatering			$69,033.15	L.S.		$69,033.00	
Mobilization			5%			$23,011.00	
Traffic Control			$69,033.15	L.S.		$69,033.00	
Utility Coordination/Relocation			$25,000.00	L.S.		$25,000.00	
Stormwater Management/Erosion Control			5%			$23,011.00	
Subtotal Additional Capital Improvement Costs						**$209,088.00**	
Land Acquisition Costs							
ROW/Easements						$0.00	
Subtotal Land Acquisition Costs						**$0.00**	
Other Costs (percentage of Capital Improvement Costs)							
Engineering			15%			$100,396.00	
Legal/Administrative			5%			$33,465.00	
Contract Admin/Construction Management			10%			$66,931.00	
Contingency			25%			$167,327.00	
Subtotal Other Costs						**$368,119.00**	
Total Capital Improvement Costs						**$1,037,428.00**	

LDC 35 County Road 14, West of County Road 19

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
36-inch	80	3	240	L.F.	$146.00	$35,040.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
36-inch	Yes	3	6	EA	$2,182.00	$13,092.00	
Channel Improvements							
Soil Riprap, Type VH			30	C.Y.	$122.00	$3,660.00	
Special Items (User Defined)							
Access Road	<----User Defined Items		100	S.Y	$45.00	$4,500.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$48,132.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$3,660.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$4,500.00
Subtotal Capital Improvement Costs				**$56,292.00**
Additional Capital Improvement Costs				
Dewatering	$8,443.80	L.S.		$8,444.00
Mobilization	5%			$2,815.00
Traffic Control	$8,443.80	L.S.		$8,444.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$2,815.00
Subtotal Additional Capital Improvement Costs				**$72,518.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$19,322.00
Legal/Administrative	5%			$6,441.00
Contract Admin/Construction Management	10%			$12,881.00
Contingency	25%			$32,203.00
Subtotal Other Costs				**$70,847.00**
Total Capital Improvement Costs				**$199,657.00**

LDC 36 County Road, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
24-inch	110	3	330	L.F.	$98.00	$32,340.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
24-inch	Yes	3	6	EA	$1,314.00	$7,884.00	
Channel Improvements							
Soil Riprap, Type VH			10	C.Y.	$122.00	$1,220.00	
Special Items (User Defined)							
Asphalt	<----User Defined Items		100	S.Y	$100.00	$10,000.00	
Base Course	<----User Defined Items		50	C.Y.	$85.00	$4,250.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$40,224.00
Concrete Box Culverts				$0.00
Hydraulic Structures				$0.00
Channel Improvements				$1,220.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$14,250.00
Subtotal Capital Improvement Costs				**$55,694.00**
Additional Capital Improvement Costs				
Dewatering	$8,354.10	L.S.		$8,354.00
Mobilization	5%			$2,785.00
Traffic Control	$8,354.10	L.S.		$8,354.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$2,785.00
Subtotal Additional Capital Improvement Costs				**$72,278.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$19,196.00
Legal/Administrative	5%			$6,399.00
Contract Admin/Construction Management	10%			$12,797.00
Contingency	25%			$31,993.00
Subtotal Other Costs				**$70,385.00**
Total Capital Improvement Costs				**$198,357.00**

LDC 37 County Road 19, North of County Road 14

DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Concrete Box Culverts							
Box Culvert Pipe							
Individual Box Span (ft)	**Box Height (ft)**	**No. of Barrels**	**Length (ft)**				
7	3	2	90	L.F.	$1,458.72	$131,285.00	
Headwall and Toewalls							
Individual Box Span (ft)	**No. of Barrels**	**Total Span (ft)**					
7	2	17.00	2	EA	$1,550.49	$3,101.00	
Wingwalls (includes wingwalls on either side of channel and concrete apron)							
Individual Box Span (ft)	**Box Rise (ft)**	**No. of Barrels**					
7	3	2	2	EA	$8,681.54	$17,363.10	
Channel Improvements							
Soil Riprap, Type VH			38	C.Y.	$122.00	$4,636.00	
Special Items (User Defined)							
Asphalt	**<----User Defined Items**		110	S.Y	$100.00	$11,000.00	
Base Course	**<----User Defined Items**		55	C.Y.	$85.00	$4,675.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains				$0.00
Concrete Box Culverts				$151,749.00
Hydraulic Structures				$0.00
Channel Improvements				$4,636.00
Detention/Water Quality Facilities				$0.00
Removals				$0.00
Landscaping and Maintenance Improvements				$0.00
Special Items (User Defined)				$15,675.00
Subtotal Capital Improvement Costs				**$172,060.00**
Additional Capital Improvement Costs				
Dewatering	$25,809.00	L.S.		$25,809.00
Mobilization	5%			$8,603.00
Traffic Control	$25,809.00	L.S.		$25,809.00
Utility Coordination/Relocation	$50,000.00	L.S.		$50,000.00
Stormwater Management/Erosion Control	5%			$8,603.00
Subtotal Additional Capital Improvement Costs				**$118,824.00**
Land Acquisition Costs				
ROW/Easements				$0.00
Subtotal Land Acquisition Costs				**$0.00**
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%			$43,633.00
Legal/Administrative	5%			$14,544.00
Contract Admin/Construction Management	10%			$29,088.00
Contingency	25%			$72,721.00
Subtotal Other Costs				**$159,986.00**
Total Capital Improvement Costs				**$450,870.00**

Appendix H. Boulder Creek Documentation

Appendix H.1. Boulder Creek Existing Condition Documentation

AREA OF BOULDER CREEK FROM ERIE OSP STUDY THAT WAS RE-EVALUATED FOR FREDERICK/DACONO OSP STUDY

MATCHLINE B-9

MATCHLINE B-7

OXFORD RD

COUNTYLINE RD

WELD COUNTY RD 16 1/2

WELD COUNTY RD 3

WELD COUNTY RD 3 1/2

WELD COUNTY RD 5

WELD COUNTY RD 7

BNRR

52

25

Legend

- Study Area Boundary
- Subbasin Boundary

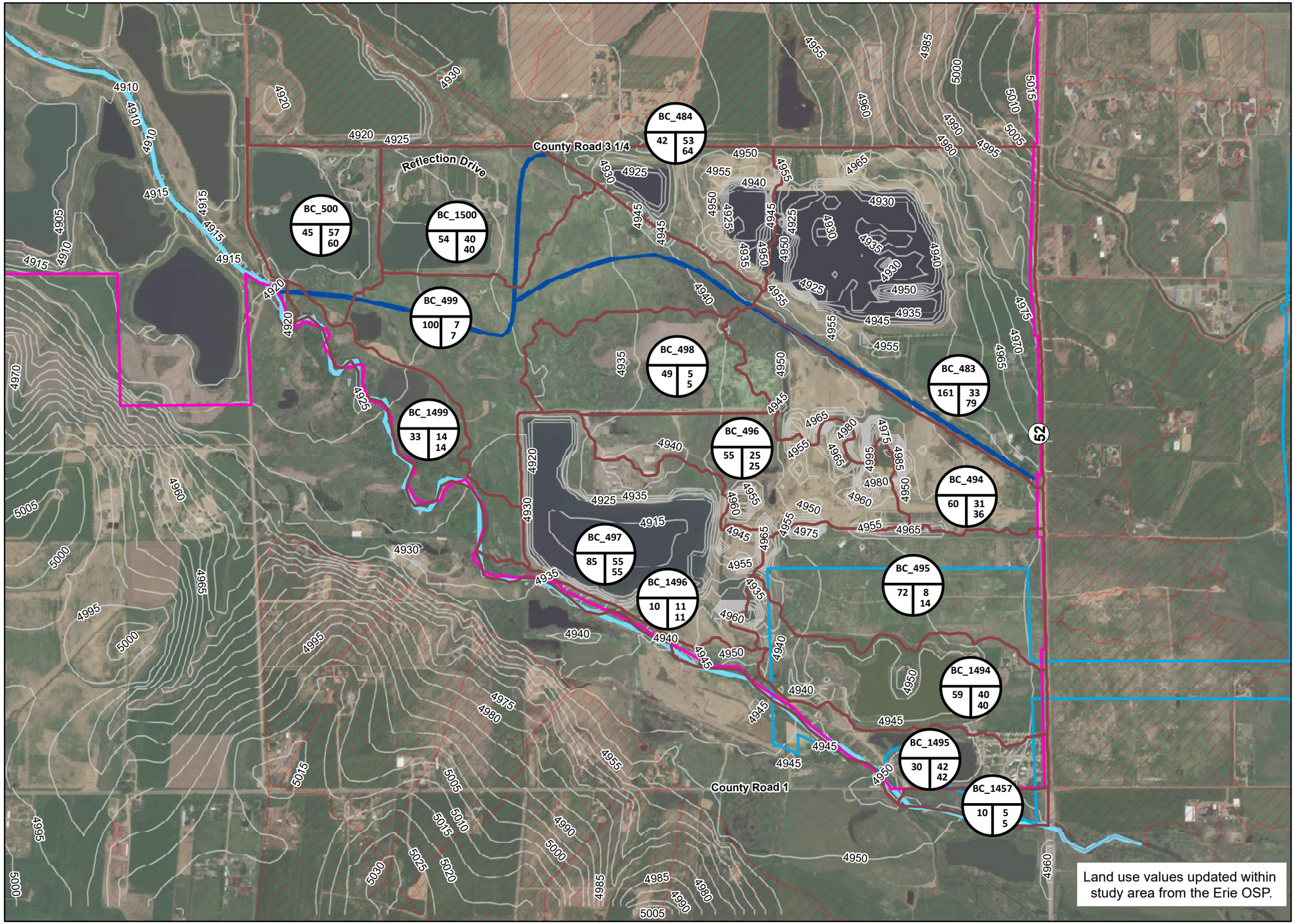
XXX — Subbasin ID
XX | X — % Impervious (Existing Land Use)
X — % Impervious (Future Land Use)
Area (Acres)

KEY MAP

N
W E
S

1 inch = 2,000 feet
0 1,000 2,000
Feet

MERRICK® Merrick and Company, 2480 W 26th Ave, Unit B225, Denver, CO 80211, Phone: 303-964-3333, Fax: 303-964-3355	TOWN OF ERIE	TOWN OF ERIE OUTFALL SYSTEMS PLAN (EAST OF COAL CREEK)	SUBBASIN MAP	FIGURE B-6



Legend

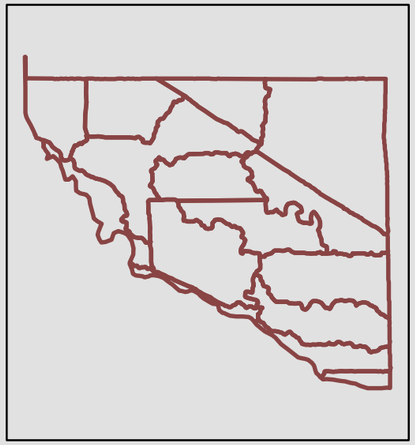
- Subbasin
- Frederick Planning Boundary
- Dacono Planning Boundary
- Erie Boundary
- Basins in Erie OSP not Updated by ICON

Flow Path

- Boulder Creek
- Tributary

XX — Subbasin ID
XX X — % Impervious (Existing)
X — % Impervious (Future)
Acreage

Key Map



N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LOWER BOULDER CREEK
SUBBASIN MAP

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: 1 of 1

TABLE H.1.1: EXISTING CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
BOULDER CREEK																				
BC_1457	P-944	0.015	9.6	0.21	1109	0.39	2059	0.0080	5	0.40	0.10	3.00	0.0018	0.50	8.29	0.86	5.73	1.33	0.34	0.10
BC_1494	P-1494	0.092	58.9	0.16	845	0.31	1637	0.0060	40	0.35	0.10	3.00	0.0018	0.50	77.69	1.32	58.70	23.35	15.15	8.79
BC_1495	P-1495	0.047	30.1	0.23	1214	0.52	2746	0.0040	42	0.35	0.10	3.00	0.0018	0.50	32.32	1.07	24.23	9.75	6.45	3.79
BC_1496	P-1496	0.016	10.2	0.27	1426	0.51	2693	0.0030	11	0.40	0.10	3.00	0.0018	0.50	3.84	0.38	2.68	0.72	0.27	0.11
BC_1499	P-1499	0.051	32.6	0.21	1109	0.44	2323	0.0040	14	0.40	0.10	3.00	0.0018	0.50	21.50	0.66	15.05	4.18	1.76	0.81
BC_1500	P-1500	0.084	53.8	0.13	686	0.28	1478	0.0040	40	0.35	0.10	3.00	0.0018	0.50	99.48	1.85	75.77	30.77	20.00	11.60
BC_483	P-483	0.251	160.6	0.24	1267	0.58	3062	0.0120	33	0.35	0.10	4.06	0.0018	0.57	312.04	1.94	234.16	84.16	49.93	30.25
BC_484	P-484	0.066	42.2	0.18	950	0.44	2323	0.0100	53	0.35	0.10	3.61	0.0018	0.54	83.31	1.97	64.26	28.29	19.77	12.83
BC_494	P-494	0.094	60.2	0.40	2112	0.72	3802	0.0030	31	0.35	0.10	3.00	0.0018	0.50	55.44	0.92	40.53	14.74	8.98	4.73
BC_495	P-495	0.113	72.3	0.43	2270	1.01	5333	0.0060	8	0.40	0.10	3.00	0.0018	0.50	52.73	0.73	36.51	8.83	2.75	0.99
BC_496	P-496	0.085	54.4	0.37	1954	0.85	4488	0.0180	25	0.35	0.10	3.00	0.0018	0.50	85.11	1.56	63.62	22.85	13.22	6.57
BC_497	P-497	0.133	85.1	0.19	1003	0.54	2851	0.0060	55	0.35	0.10	3.00	0.0018	0.50	186.57	2.19	145.01	66.37	46.79	29.85
BC_498	P-498	0.077	49.3	0.42	2218	0.86	4541	0.0050	5	0.40	0.10	3.00	0.0018	0.50	41.30	0.84	28.52	6.57	1.66	0.51
BC_499	P-499	0.156	99.8	0.25	1320	0.75	3960	0.0060	7	0.40	0.10	3.00	0.0018	0.50	72.93	0.73	50.32	11.86	3.40	1.15
BC_500	P-500	0.070	44.8	0.16	845	0.26	1373	0.0020	57	0.35	0.10	3.00	0.0018	0.50	81.34	1.82	63.47	28.92	20.63	13.26
Totals/Averages			**864.0**						**28**						**80.93**	**1.40**	**60.57**	**22.85**	**14.07**	**8.36**

[1] From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

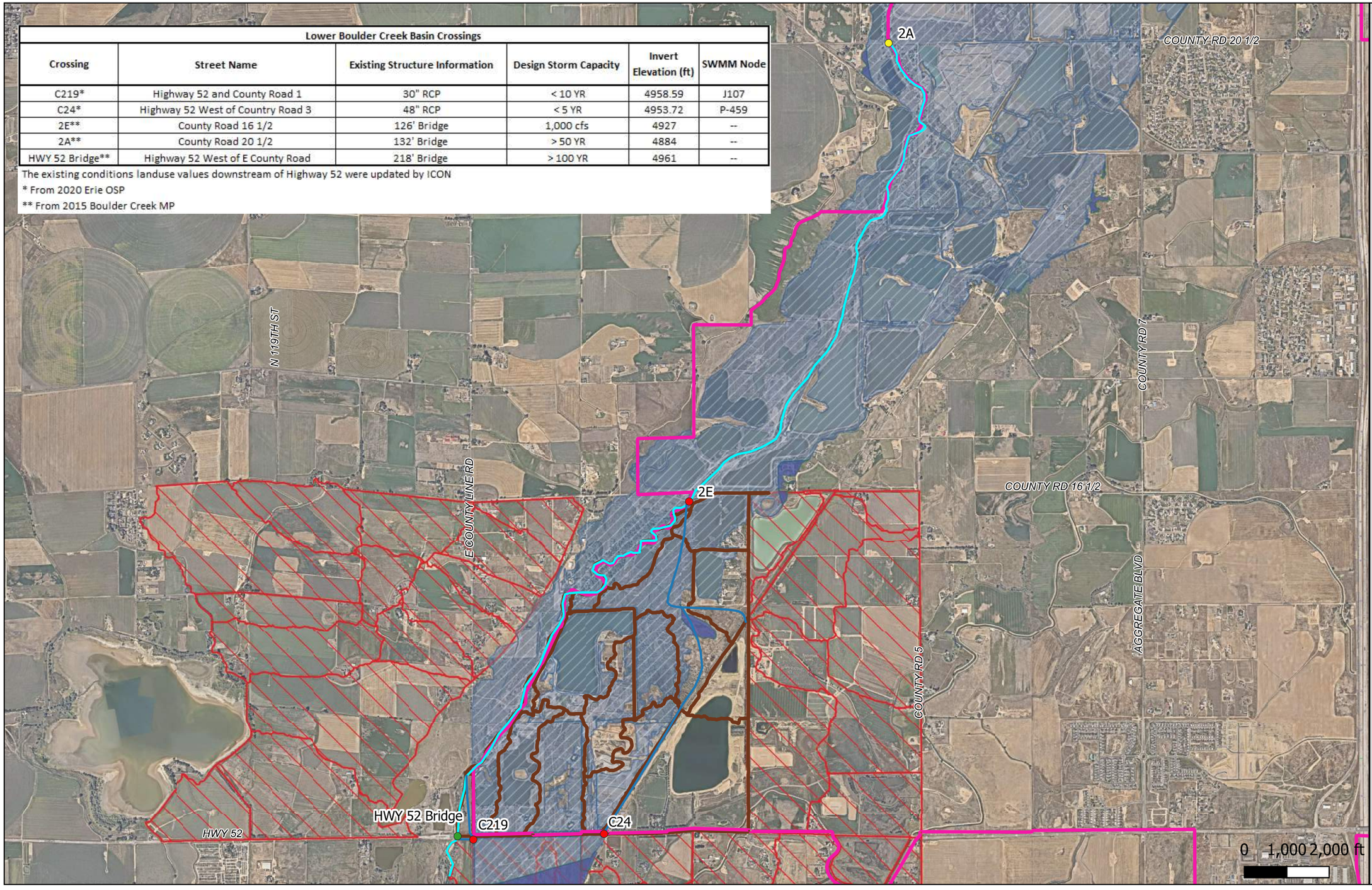
[2] Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Lower Boulder Creek Basin Crossings					
Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
C219*	Highway 52 and County Road 1	30" RCP	< 10 YR	4958.59	J107
C24*	Highway 52 West of Country Road 3	48" RCP	< 5 YR	4953.72	P-459
2E**	County Road 16 1/2	126' Bridge	1,000 cfs	4927	--
2A**	County Road 20 1/2	132' Bridge	> 50 YR	4884	--
HWY 52 Bridge**	Highway 52 West of E County Road	218' Bridge	> 100 YR	4961	--

The existing conditions landuse values downstream of Highway 52 were updated by ICON

* From 2020 Erie OSP

** From 2015 Boulder Creek MP



Legend

- Crossings with < 10-Year Capacity
- Crossins with > 10-Year and < 100-Year Capacity
- Crossings with > 100-Year Capacity
- Subbasin
- Basins in Erie OSP not Updated by ICON
- Frederick Planning Boundary

Flow Path

- Boulder Creek
- Tributary

Flooding Zones

- 100-YR
- FLOODWAY

ICON ENGINEERING

FREDERICK AND DACONO OUTFALL SYSTEMS PLAN

LOWER BOULDER CREEK EXISTING CONDITION EXISTING STRUCTURES CAPACITY MAP

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LBC	INDEX: EC-CROSS

Table H.1.2: Lower Boulder Creek Basin Crossings																		
Crossing Number	Location	SWMM Node	Existing Crossing Information			Design Storm Capacity		Existing Conditions SWMM Model Peak Discharge (cfs)					Future Conditions SWMM Model Peak Discharge (cfs)					Notes
			Size	U/S Invert Elevation (NAVD 88)*	Capacity (cfs)	Existing Conditions	Future Conditions	2	5	10	50	100	2	5	10	50	100	
C219*	Highway 52 and County Road 1	J107	30" RCP	4958.59	19^	< 10 YR	> 50 YR	3	8	24	240	393	0	0	0	0	43	
C24*	Highway 52 West of Country Road 3	P-459	48" RCP	4953.72	85^	< 5 YR	> 100 YR	41	89	255	1101	1612	2	3	6	27	43	
2E**	County Road 16 1/2	--	126' Bridge	4927	1000	< 10 YR	> 100 YR	--	--	3000	8500	13750	--	--	--	--	--	
2A**	County Road 20 1/2	--	132' Bridge	4884	--	> 50 YR	> 100 YR	--	--	2200	7500	12250	--	--	--	--	--	
HWY 52 Bridge**	Highway 52 West of E County Road	--	218' Bridge	4961	--	> 100 YR	> 100 YR	--	--	3000	9000	14000	--	--	--	--	--	

* Structure information obtained from the Erie OSP

** Structure information obtained from the Boulder MP

^ Capacity Evaluated in HY-8

The existing conditions land use values downstream of Highway 52 were updated by ICON

AREA OF BOULDER CREEK FROM ERIE OSP STUDY THAT WAS RE-EVALUATED FOR FREDERICK/DACONO OSP STUDY

MATCHLINE B-13

MATCHLINE B-11

OXFORD RD

COUNTY LINE RD

WELD COUNTY RD 16 1/2

WELD COUNTY RD 3

WELD COUNTY RD 3 1/4

WELD COUNTY RD 5

WELD COUNTY RD 7

Boulder Creek

Boulder + Weld County Ditch

Sullivan Ditch

BNRR

52

25

Legend

- Study Area Boundary
- Subcatchments
- Major Watershed Boundary

SWMM Elements

- Subbasin
- Design Points
- Conveyance Element
- Detention Facility
- Outfall

KEY MAP

N
W E
S

0 1,000 2,000
Feet

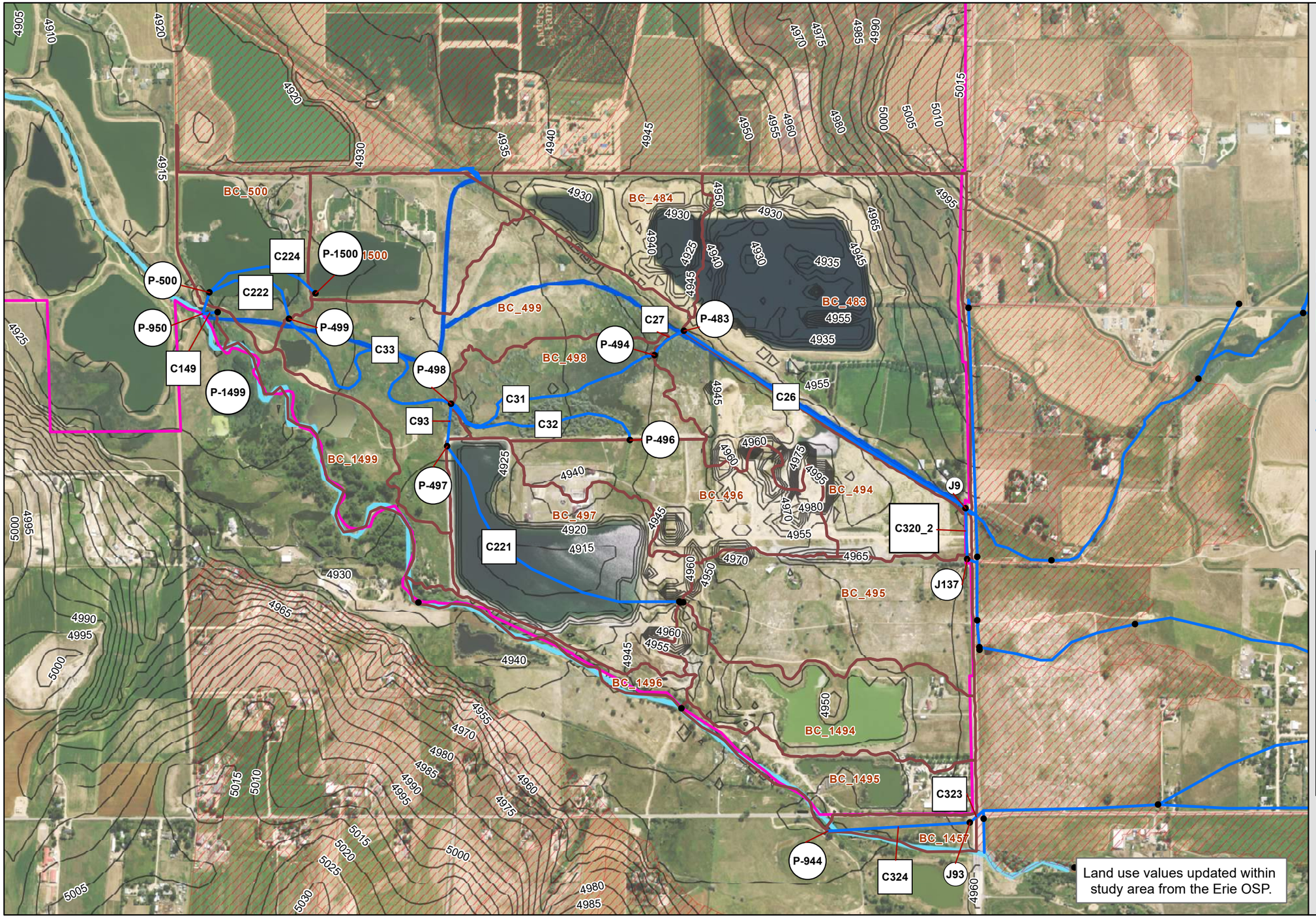
MERRICK®
Merrick and Company
2480 W 26th Ave, Unit B225
Denver, CO 80211
Phone: 303-964-3333
Fax: 303-964-3355

TOWN OF ERIE

TOWN OF ERIE OUTFALL SYSTEMS PLAN (EAST OF COAL CREEK)

SWMM ROUTING MAP

FIGURE B-10



Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

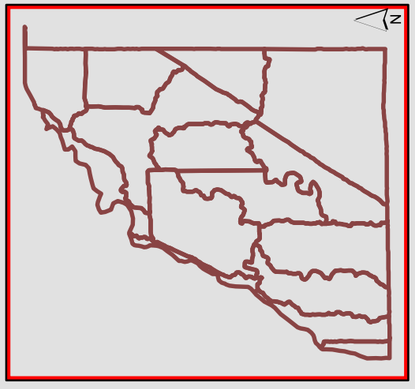
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Basins in Erie OSP not Updated by ICON

Flow Path

- Boulder Creek
- Tributary

Note: No nodes in existing model have inflows from CUHP

Key Map



N

0 500 1,000 2,000
Feet

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LOWER BOULDER CREEK
EXISTING CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: 1 of 1

Table H.1.3: Lower Boulder Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions																		
Location	**SWMM Node**	**Drainage Area (acres)**	**Existing Conditions (2020 Erie OSP) Peak Discharge (cfs)**					**Existing Conditions (Updated) Peak Discharge (cfs)**					**Difference (2020 OSP - Updated) Peak Discharge (cfs)**					**Notes**
			2	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	
Highway 52 and County Road 1	J107	50	3	8	24	240	393	3	8	24	240	393	0	0	0	0	0	
Highway 52, West of Country Road 3	P-459	2194	41	89	255	1101	1612	41	89	255	1101	1612	0	0	0	0	0	

Note: The existing land use values were updated by ICON. Both crossings originate just south of where the land use updates occurred and cross into the updated area. This is why the flows at the crossing are the same for both existing condition scenarios. The crossings were included in the analysis because the crossings cross into the study area, and the flows from these crossings will influence the flows in the study area.

Appendix H.2. Boulder Creek Proposed Improvement Documentation

LEGEND

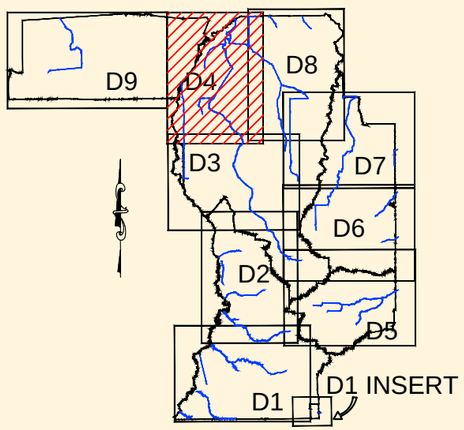
- ERIE MAJOR WATERSHED BOUNDARY
- WATERSHED BOUNDARY
- EXISTING DETENTION POND
- OUTFALL TRIBUTARY ALIGNMENT (> 130 ACRES)
- 915 TRIBUTARY OUTFALL

ALTERNATIVES

- PROPOSED DETENTION POND
- PROPOSED CHANNEL (LABELED "H")
- MAJOR DRAINAGE PRESERVATION
- CULVERT IMPROVEMENTS (LABELED "C")

NOTES:

- UNLESS OTHERWISE SPECIFIED, ALL VOLUMES AND FLOW ARE 100-YEAR DEVELOPED CONDITION.
- PROPOSED DETENTION FACILITIES MAY BE DIVIDED INTO MULTIPLE DETENTION FACILITIES PROVIDED THE ALTERNATIVE OFFERS THE EQUIVALENT INTENT OF THE PLAN INCLUDING HYDRAULIC CAPACITY AND WATER QUALITY FUNCTIONS.
- ELEVATIONS SHOWN ARE ON NAVD88 VERTICAL DATUM
- TOWN GIS DATA AS OF DECEMBER 2017



KEY MAP

0 1000' 2000'

1" = 1000'

OUTFALL 951 - REACH 1
4. MAJOR DRAINAGEWAY PRESERVATION
5. CULVERT IMPROVEMENTS
Q = 115 CFS : 60" RCP
U/S INV = 4911.14, S = 0.5%

OUTFALL 951 - REACH 1A
3. 100-YR CONVEYANCE
Q= 2,152 CFS
5. CULVERT IMPROVEMENTS
C1 - Q = 2,125 CFS : 4-14'X4' RCBC
U/S INV = 4929.94, S = 0.5%
C2 - Q = 77 CFS : 48" RCP
U/S INV = 4930.98, S = 0.73%

C1 - Q = 2,050 CFS : 4-10'X5' RCBC
U/S INV = 4964.54, S = 0.4%
C2 - Q = 680 CFS : 3-7'X4' RCBC
U/S INV = 4966.09, S = 0.4%
C3 - Q = 680 CFS : 12'X6' RCBC
U/S INV = 4978.77, S = 1.07%
C4 - Q = 469 CFS : 8'X5' RCBC
U/S INV = 4985.62, S = 0.76%

OUTFALL 950 - REACH 3
3. 100-YR CONVEYANCE
H1 - Q = 1,551 CFS (WITH DROPS)
H2 - Q = 1,533 CFS (WITH DROPS)
4. MAJOR DRAINAGEWAY PRESERVATION
5. CULVERT IMPROVEMENTS
C1 - Q = 1,532 CFS : 2 - 8'X8' RCBC
U/S INV = 4968.41, S = 0.5%
C2 - Q = 1,482 CFS : 2 - 10'X8' RCBC
U/S INV = 4986.79, S = 0.37%
C3 - Q = 1,482 CFS : 2 - 8'X8' RCBC
U/S INV = 4988.33, S = 0.5%

OUTFALL 950 - REACH 1
3. 100-YR CONVEYANCE
H1-Q = 474 CFS
4. MAJOR DRAINAGEWAY PRESERVATION

OUTFALL 950 - REACH 2
1. 100-YR DETENTION (NO WQ)
V = 23.8 ACFT
Q_{IN} = 311 CFS, Q_{OUT} = 43 CFS
4. MAJOR DRAINAGEWAY PRESERVATION
5. CULVERT IMPROVEMENTS (FLOW REDUCED TO EXISTING CAPACITY)
C1 - Q = 43 CFS : 48" RCP (EXISTING)
C2 - Q = 30 CFS : 42" CMP (EXISTING)

OUTFALL 950 - REACH 2A
3. 100-YR CONVEYANCE
Q = 1,657 CFS

OUTFALL 943A - REACH 1 NEW OUTFALL (REDIRECTED FLOW)
3. 100-YR CONVEYANCE
Q = 1,698 CFS
4. MAJOR DRAINAGEWAY PRESERVATION
5. CULVERT IMPROVEMENTS
Q = 1,698 CFS : 4 - 14'X4' RCBC
U/S INV = 4956.84, S = 0.5%

OUTFALL 944 - REACH 1
4. MAJOR DRAINAGEWAY PRESERVATION

AREA OF BOULDER CREEK RECOMMENDED IMPROVEMENTS FROM ERIE OSP STUDY

951 950 935 944 943 943A

REACH 1 REACH 1A REACH 2 REACH 2A REACH 3

C1 C2 C3 H1 H2

HWY 52 WELD CR. 3 1/4 WELD CR. 3 WELD CR. 16 1/2 COUNTY LINE RD

DECOMMISSIONED RAILROAD BOULDER CREEK SULLIVAN DITCH BOULDER & WELD COUNTY DITCH SPRING HILL DITCH COAL CREEK

TOWN OF ERIE	TOWN OF ERIE OUTFALL SYSTEMS PLAN (EAST OF COAL CREEK)	RECOMMENDED PLANS	JANUARY 2020	MERRICK 2480 W. 26th Ave. Suite B225 Denver, CO 80211 T303.964.3333 F303.964.3355	FIGURE D4

December 2015

Figure 11-2

Boulder Creek Restoration Master Plan

Conceptual Design

Legend

- Hydraulic Feature
- 100-Year Floodplain
- Open Space
- Existing Stream Alignment

Alternate Centerline

- Reach 1
- Reach 2
- Reach 3

High Priority

Medium Priority

Low Priority

3A:
Stream Restoration
Upstream of CO Rd 16.5

2D:
Modify Idaho Creek Diversion for Aquatic and Habitat Passage

2G:
Stream Restoration
Downstream of CO Rd 16.5

2F (All ● Markers):
Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical.

2A:
Location: CO Rd 20.5
Replace Bridge With 180' Span Bridge
Q_{100}: 12,250 cfs

Downstream Limit of Study

Reach 1

Reach 3

Bridge

Diversion Structure
Bridge

Diversion Structure

Reach 2

Channel Bank Breach

1A:
Stream Restoration & Debris Removal
City of Longmont Open Space

3B (All ● Markers):
Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical.

2E:
Location: CO Rd 16.5
Replace Bridge With 180' Span Bridge
Q_{100}: 13,750 cfs

2C:
Modify Rural Ditch for Aquatic and Habitat Passage

2B:
Replace Existing Grade Control for Aquatic and Habitat Passage

1B (All ● Markers):
Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical.

Idaho Creek Ditch

Rural Ditch

County Road 20 1/2

Harbor Drive

Rural ditch

Idaho Creek Ditch

Mineral Road

Louisville

0 0.25 0.5 0.75 1 mi

AREA OF BOULDER CREEK RECOMMENDED IMPROVEMENTS FROM ICON BOULDER CREEK RESTORATION MASTER PLAN STUDY

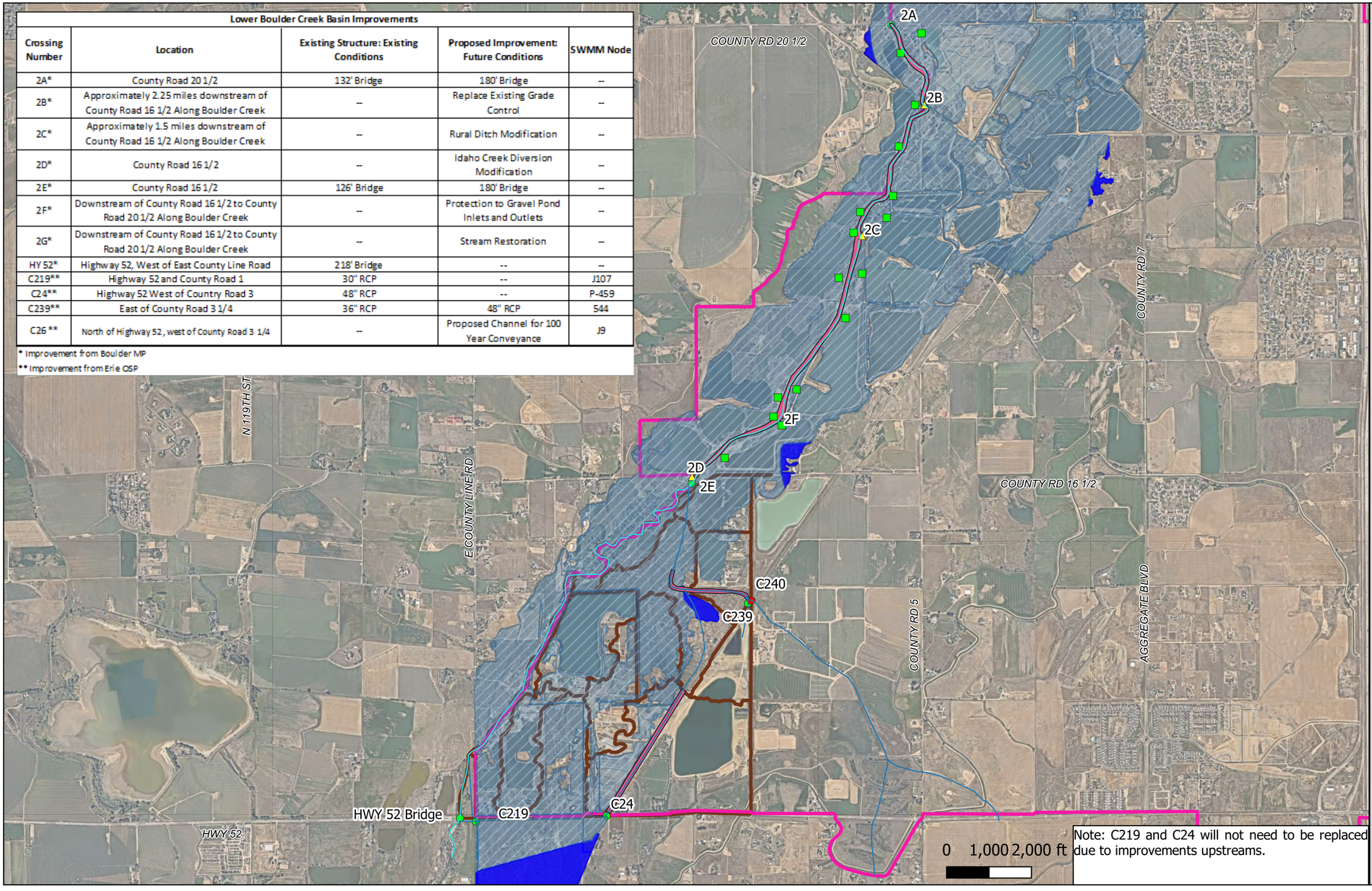
ICON ENGINEERING, INC.

Lower Boulder Creek Basin Improvements

Crossing Number	Location	Existing Structure: Existing Conditions	Proposed Improvement: Future Conditions	SWMM Node
2A*	County Road 20 1/2	132' Bridge	180' Bridge	--
2B*	Approximately 2.25 miles downstream of County Road 16 1/2 Along Boulder Creek	--	Replace Existing Grade Control	--
2C*	Approximately 1.5 miles downstream of County Road 16 1/2 Along Boulder Creek	--	Rural Ditch Modification	--
2D*	County Road 16 1/2	--	Idaho Creek Diversion Modification	--
2E*	County Road 16 1/2	126' Bridge	180' Bridge	--
2F*	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	--	Protection to Gravel Pond Inlets and Outlets	--
2G*	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	--	Stream Restoration	--
HY 52*	Highway 52, West of East County Line Road	218' Bridge	--	--
C219**	Highway 52 and County Road 1	30" RCP	--	J107
C24**	Highway 52 West of Country Road 3	48" RCP	--	P-459
C239**	East of County Road 3 1/4	36" RCP	48" RCP	544
C26 **	North of Highway 52, west of County Road 3 1/4	--	Proposed Channel for 100 Year Conveyance	J9

* Improvement from Boulder MP

** Improvement from Erie OSP



Legend

- Proposed Improvements at Existing Crossings
- Proposed Culverts at New Locations
- Gravel Pond Inlet and Outlet Improvements
- Other Improvements

Channel Improvements

- Subbasin

Basins in Erie OSP not Updated by ICON

- Frederick Planning Boundary

Flow Path

- Boulder Creek
- Tributary

Flooding Zones

Note: The Label 2F applies to all green square markers.

ICON ENGINEERING

FREDERICK COLORADO

DACONO Colorado

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LOWER BOULDER CREEK
IMPROVEMENT
LOCATION MAP

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LBC	INDEX: EC-CROSS

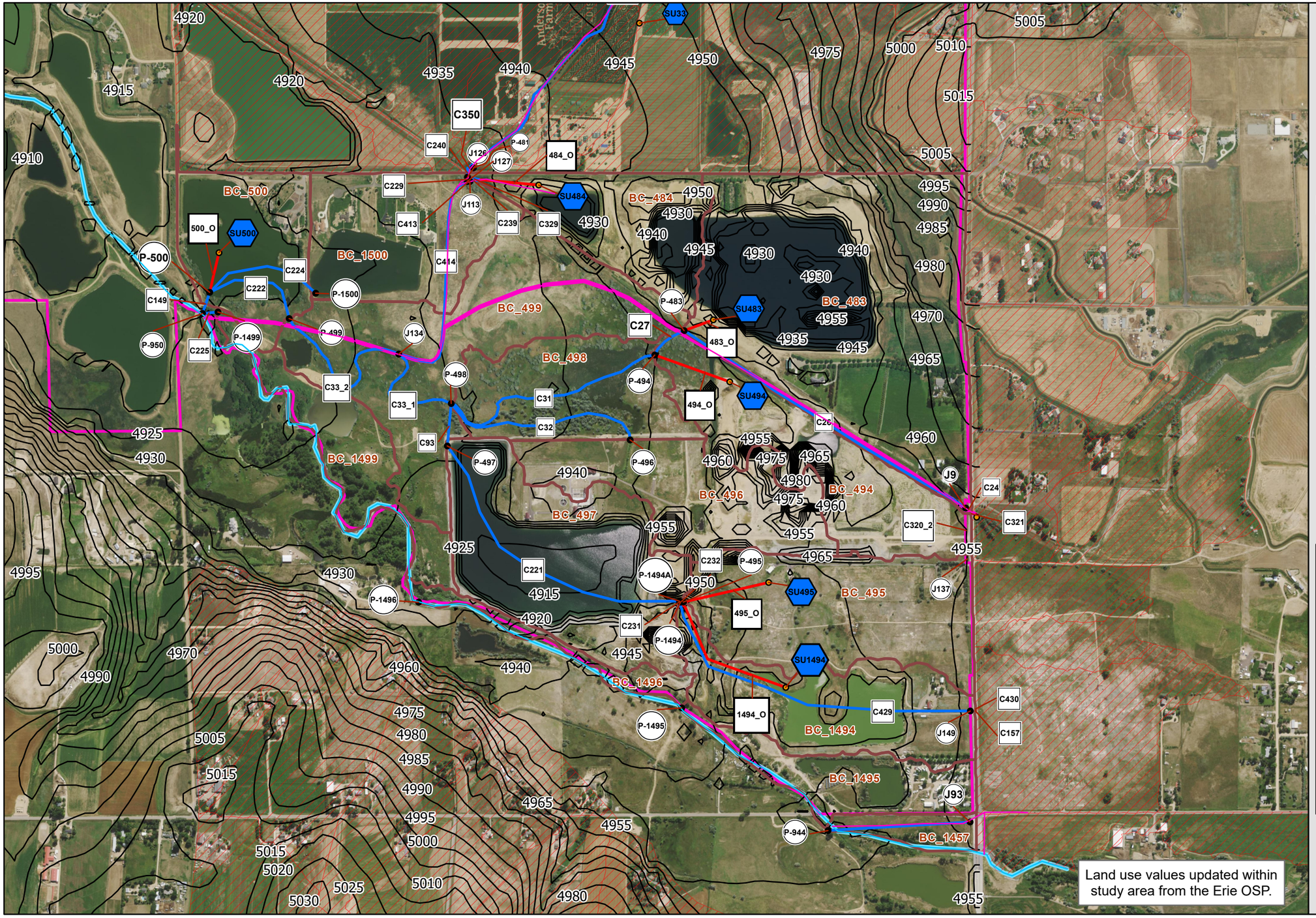
TABLE H.2.1: FUTURE CONDITION CUHP INPUT PARAMETERS

Basin #	EPA SWMM Target Node	Area (mi^2)[1]	Area (Ac)[1]	Length to Centroid (mi)	Length to Centroid (ft)	Length (mi)	Length (ft)	Slope (ft/ft)	Percent Impervious[2]	Depression Storage		Horton's Infiltration Parameters			Max Q_{100} (cfs)	Unit Runoff Q_{100}/A (cfs/acre)	Max Q_{50} (cfs)	Max Q_{10} (cfs)	Max Q_5 (cfs)	Max Q_2 (cfs)
										Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)						
BOULDER CREEK																				
BC_1457	P-944	0.015	9.6	0.21	1109	0.39	2059	0.0080	5	0.40	0.10	3.00	0.0018	0.50	8.29	0.86	5.73	1.33	0.34	0.10
BC_1494	P-1494	0.092	58.9	0.16	845	0.31	1637	0.0060	40	0.35	0.10	3.00	0.0018	0.50	78.00	1.32	58.82	23.50	15.25	8.82
BC_1495	P-1495	0.047	30.1	0.23	1214	0.52	2746	0.0040	42	0.35	0.10	3.00	0.0018	0.50	32.32	1.07	24.23	9.75	6.45	3.79
BC_1496	P-1496	0.016	10.2	0.27	1426	0.51	2693	0.0030	11	0.40	0.10	3.00	0.0018	0.50	3.84	0.38	2.68	0.72	0.27	0.11
BC_1499	P-1499	0.051	32.6	0.21	1109	0.44	2323	0.0040	14	0.40	0.10	3.00	0.0018	0.50	21.50	0.66	15.05	4.18	1.76	0.81
BC_1500	P-1500	0.084	53.8	0.13	686	0.28	1478	0.0040	40	0.35	0.10	3.00	0.0018	0.50	99.48	1.85	75.77	30.77	20.00	11.60
BC_483	P-483	0.251	160.6	0.24	1267	0.58	3062	0.0120	79	0.35	0.10	4.06	0.0018	0.57	554.41	3.45	448.37	236.40	180.14	124.93
BC_484	P-484	0.066	42.2	0.18	950	0.44	2323	0.0100	64	0.35	0.10	3.61	0.0018	0.54	94.42	2.24	74.81	35.61	26.09	17.48
BC_494	P-494	0.094	60.2	0.40	2112	0.72	3802	0.0030	35	0.35	0.10	3.00	0.0018	0.50	61.55	1.02	45.46	17.28	10.90	6.03
BC_495	P-495	0.113	72.3	0.43	2270	1.01	5333	0.0060	13	0.40	0.10	3.00	0.0018	0.50	55.55	0.77	38.90	10.64	4.39	1.99
BC_496	P-496	0.085	54.4	0.37	1954	0.85	4488	0.0180	25	0.35	0.10	3.00	0.0018	0.50	85.11	1.56	63.62	22.85	13.22	6.57
BC_497	P-497	0.133	85.1	0.19	1003	0.54	2851	0.0060	55	0.35	0.10	3.00	0.0018	0.50	186.57	2.19	145.01	66.37	46.79	29.85
BC_498	P-498	0.077	49.3	0.42	2218	0.86	4541	0.0050	5	0.40	0.10	3.00	0.0018	0.50	41.30	0.84	28.52	6.57	1.66	0.51
BC_499	P-499	0.156	99.8	0.25	1320	0.75	3960	0.0060	7	0.40	0.10	3.00	0.0018	0.50	72.93	0.73	50.32	11.86	3.40	1.15
BC_500	P-500	0.070	44.8	0.16	845	0.26	1373	0.0020	60	0.35	0.10	3.00	0.0018	0.50	84.90	1.90	66.48	30.92	22.38	14.62
Totals/Averages			**864.0**						**33**						**98.68**	**1.71**	**76.25**	**33.92**	**23.54**	**15.22**

[1] From ACAD/GIS delineations. Delineations based on 2013 LiDAR data, field reconnaissance, and available drainage reports.

[2] Land use/percent impervious informed by recommended values from Mile High Flood District Table 6-3

Comparison of Basin Runoff, Pond Outflow and Pond Detention: Existing Conditions and Future Conditions								
Basin	10YR Existing Basin Runoff	10YR Future Basin Runoff	10YR Pond Outflow	Approximate 10YR Detention (Ac-ft)	100YR Existing Basin Runoff	100YR Future Basin Runoff	100YR Pond Outflow (cfs)	Approximate 100YR Detention (Ac-ft)
BC_1457	1.3	1.3	--	--	8.3	8.3	--	--
BC_1494	23.4	23.5	22.9	0.00006	77.7	78.0	76.0	0.00030
BC_1495	9.7	9.7	--	--	32.3	32.3	--	--
BC_1496	0.7	0.7	--	--	3.8	3.8	--	--
BC_1499	4.2	4.2	--	--	21.5	21.5	--	--
BC_1500	30.8	30.8	--	--	99.5	99.5	--	--
BC_483	84.2	236.4	83.2	0.00736	312.0	554.4	312.0	0.00994
BC_484	28.3	35.6	28.6	0.00048	83.3	94.4	83.3	0.00095
BC_494	14.7	17.3	14.7	0.00049	55.4	61.6	55.4	0.00154
BC_495	8.8	10.6	8.7	0.00033	52.7	55.6	52.7	0.00059
BC_496	22.9	22.9	--	--	85.1	85.1	--	--
BC_497	66.4	66.4	--	--	186.6	186.6	--	--
BC_498	6.6	6.6	--	--	41.3	41.3	--	--
BC_499	11.9	11.9	--	--	72.9	72.9	--	--
BC_500	28.9	30.9	29.5	0.00020	81.3	84.9	81.3	0.00057



Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

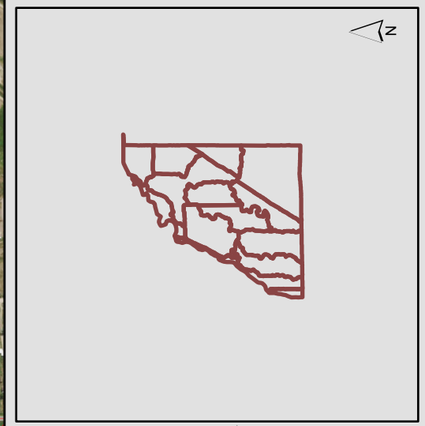
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Basins in Erie OSP not Updated by ICON

Flow Path

- Boulder Creek
- Tributary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO OUTFALL SYSTEM PLAN

LOWER BOULDER CREEK FUTURE CONDITION SWMM CONVEYANCE ELEMENT MAPS

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: 1 of 1

Legend

- Junction
- Outfall
- Detention Pond
- Outlet
- Link

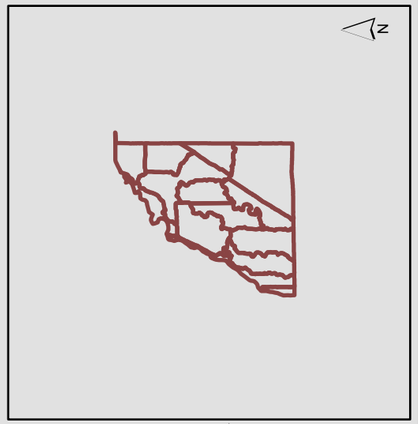
- Subbasin
- Dacono Planning Boundary
- Frederick Planning Boundary
- Basins in Erie OSP not Updated by ICON

Flow Path

- Boulder Creek
- Tributary

Note: A blue symbol designates a CUHP Inflow Node

Key Map



Land use values updated within study area from the Erie OSP.

ICON ENGINEERING

FREDERICK COLORADO

Dacono Colorado

FREDERICK AND DACONO
OUTFALL SYSTEM PLAN

LOWER BOULDER CREEK
FUTURE CONDITION
SWMM CONVEYANCE
ELEMENT MAPS

DRAWN BY:	JAK
DESIGNED BY:	JAK
CHECKED BY:	JKD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: 1	INDEX: 1 of 1

Table H.2.2: Lower Boulder Creek Basin Peak Discharge Comparison: Existing Conditions and Future Conditions																		
Location	**SWMM Node**	**Drainage Area (acres)**	**Existing Conditions Peak Discharge (cfs)**					**Future Conditions Peak Discharge (cfs)**					**Difference (Existing Conditions - Future Conditions) Peak Discharge (cfs)**					**Notes**
			2	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	**2**	**5**	**10**	**50**	**100**	
Highway 52 and County Road 1	J107	50	3	8	24	240	393	0	0	0	0	43	-3	-8	-24	-240	-350	
Highway 52, West of Country Road 3	P-459	2194	41	89	255	1101	1612	2	3	6	27	43	-40	-86	-249	-1073	-1569	

Table H.2.3: Lower Boulder Creek Basin Crossings With Proposed Improvements

Improvement number	Location	SWMM Node	Existing Structure/Proposed Culvert Improvement Information (Proposed Improvements are Highlighted in Gray)			Design Storm Capacity	Future Condition SWMM Model Peak Discharge (cfs)					Notes:
			Size/Improvement	U/S Invert Elevation (NAVD 88)	Capacity (cfs)	Future Conditions	2	5	10	50	100	
Main Channel												
2A*	County Road 20 1/2	--	180' Bridge	4884	--	> 100 YR	--	--	--	--	--	
2B*	Approximately 2.25 miles downstream of County Road 16 1/2 Along Boulder Creek	--	Replace Existing Grade Control	--	--	--	--	--	--	--	--	
2C*	Approximately 1.5 miles downstream of County Road 16 1/2 Along Boulder Creek	--	Rural Ditch Modification	--	--	--	--	--	--	--	--	
2D*	County Road 16 1/2	--	Idaho Creek Diversion Modification	--	--	--	--	--	--	--	--	
2E*	County Road 16 1/2	--	180' Bridge	4927	--	> 100 YR	--	--	--	--	--	
2F*	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	--	Protection to Gravel Pond Inlets and Outlets	--	--	--	--	--	--	--	--	
2G*	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	--	Stream Restoration	--	--	--	--	--	--	--	--	
HWY 52*	Highway 52, West of East County Line Road	--	218' Bridge	4961	--	> 100 YR	--	--	--	--	--	
Tributaries to Lower Boulder Creek												
C219**	Highway 52 and County Road 1	J107	30" RCP	4959	19^	> 50 YR	0	0	0	0	43	
C24**	Highway 52 West of Country Road 3	P-459	48" RCP	4954	85^	> 100 YR	2	3	6	27	43	
C239**	East of County Road 3 1/4	544	48" RCP	4931	***	> 100 YR	15	22	28	66	83	
C26 **	North of Highway 52, west of County Road 3 1/4	J9	Proposed Channel for 100 Year Conveyance	4954	***	> 100 YR	2	3	6	29	43	

* Improvement from Boulder MP

**Improvement from Erie OSP, Improvements from Erie OSP were sized to contain the 100 YR Storm

*** Capacity Evaluated in Erie OSP

^ Capacity Evaluated in HY-8

Indicates information for proposed improvements

Lower Boulder Creek Basin Crossings					
Crossing	Street Name	Existing Structure Information	Design Storm Capacity	Invert Elevation (ft)	SWMM Node
C219*	Highway 52 and County Road 1	30" RCP	> 50 YR	4958.59	J107
C24*	Highway 52 West of Country Road 3	48" RCP	> 100 YR	4953.72	P-459
2E**	County Road 16 1/2	126' Bridge	1,000 cfs	4927	--
2A**	County Road 20 1/2	132' Bridge	> 50 YR	4884	--
HWY 52 Bridge**	Highway 52 West of E County Road	218' Bridge	> 100 YR	4961	--

The existing conditions landuse values downstream of Highway 52 were updated by ICON

* From 2020 Erie OSP

** From 2015 Boulder Creek MP

2A

COUNTY RD 20 1/2

COUNTY RD 7

N 119TH ST

E COUNTY LINE RD

2E

COUNTY RD 16 1/2

AGGREGATE BLVD

COUNTY RD 5

HWY 52 Bridge

C219

C24

HWY 52

0 1,000 2,000 ft

Legend

- Crossings with < 10-Year Capacity
- Crossing with > 10-Year and < 100-Year Capacity
- Crossing with > 100-Year Capacity
- Subbasin
- Basins in Erie OSP not Updated by ICON
- Frederick Planning Boundary

Flow Path

- Boulder Creek
- Tributary

Flooding Zones

- 100-YR
- FLOODWAY

ICON ENGINEERING

FREDERICK AND DACONO
OUTFALL SYSTEMS PLAN

LOWER BOULDER CREEK
FUTURE CONDITION
EXISTING STRUCTURES
CAPACITY MAP

DRAWN BY:	DH
DESIGNED BY:	DH
CHECKED BY:	JD
PROJECT NUMBER: 20-026	
DATE: 11/18/2021	
SHEET: LBC	INDEX: FC-CROSS

Appendix H.3. Boulder Creek Cost Estimate Documentation

Table H.3.1: Lower Boulder Creek Basin Proposed Improvement Cost Summary: Proposed Improvements From 2020 OSP and 2015 MP

Improvement Number	Location	Improvement	Capital	Easement/ROW	Engineering	Legal/Administrative	Contract Admin/CM	Contingency	Total Capital Cost
Town of Fredrick									
C239 **	South of County Road 16 1/2, west of County Road 3 1/4	4' RCP	$114,000	$0	$17,000	$6,000	$11,000	$29,000	$177,000
C26 **	North of Highway 52, west of County Road 3 1/4	Proposed Channel for 100 Year Conveyance	$208,000	$0	$31,000	$10,000	$21,000	$52,000	$322,000
2A *	County Road 20 1/2	Bridge Replacement	$1,792,000	$0	$269,000	$90,000	$179,000	$448,000	$2,778,000
2B *	Approximately 2.25 miles downstream of County Road 16 1/2 Along Boulder Creek	Replace Existing Grade Control	$238,000	$0	$36,000	$12,000	$24,000	$59,000	$369,000
2C *	Approximately 1.5 miles downstream of County Road 16 1/2 Along Boulder Creek	Rural Ditch Modification	$290,000	$0	$44,000	$15,000	$29,000	$73,000	$451,000
2D *	County Road 16 1/2	Idaho Creek Diversion Modification	$290,000	$0	$44,000	$15,000	$29,000	$73,000	$451,000
2E *	County Road 16 1/2	Bridge Replacement	$1,792,000	$0	$269,000	$90,000	$179,000	$448,000	$2,778,000
2F *	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Protection to Gravel Pond Inlets and Outlets	$5,481,000	$0	$822,000	$274,000	$548,000	$1,370,000	$8,495,000
2G *	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Stream Restoration	$1,054,000	$0	$158,000	$53,000	$105,000	$264,000	$1,634,000
Total Cost			**$11,259,000**	**$0**	**$1,690,000**	**$565,000**	**$1,125,000**	**$2,816,000**	**$17,455,000**

* Improvements from 2015 Boulder Creek Restoration Master Plan.

** Improvement from 2020 Erie OSP

10.0 RECOMMENDED PLAN

The recommended plan is shown in Figure 10-1-10-5: Recommended Plan Maps. Project descriptions and summary of costs are provided in Table 10-1. In general, the recommended plan incorporates project alternatives discussed under Section 9.0, with exception to the following items:

1. 100-year stream crossings were recommended at 61st Street, 75th Street, 95th Street and County Line Road to maintain emergency access during flood events in the future.
2. High Hazard and floodplain mitigation for the Millennium Harvest House Property and Carillion Senior Housing Facility were not recommended in the master plan, as improvements in these areas would occur through future private redevelopment and planning.

Table 10-1 : Summary of Recommended Plan Project Alternatives (Reach 1-6)

Reach	ID	Description	Jurisdiction	Capital	Eng / Admin / Legal	Contingency	Total Capital Cost	50-yr O&M Cost
1	A	Stream Restoration & Debris Removal City of Longmont Open Space	City of Longmont / Weld County	$ 476,965	$ 143,090	$ 119,241	$ 739,296	$ 19,600
	B	Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical	City of Longmont / Weld County	$ 261,000	$ 78,300	$ 65,250	$ 404,550	$ 4,270
2	A	CO Rd. 20.5 - Replace Bridge with 180 ft. Span Bridge	Weld County	$ 1,792,200	$ 537,660	$ 448,050	$ 2,777,910	$ 420
	B	Replace Existing Grade Control for Aquatic and Habitat Passage	Weld County	$ 237,800	$ 71,340	$ 59,450	$ 368,590	$ 4,270
	C	Modify Rural Ditch for Aquatic and Habitat Passage	Town of Frederick / Weld County	$ 290,000	$ 87,000	$ 72,500	$ 449,500	$ 4,270
	D	Modify Idaho Creek Diversion for Aquatic and Habitat Passage	Weld County	$ 290,000	$ 87,000	$ 72,500	$ 449,500	$ 4,270
	E	CO Rd. 16.5 - Replace Bridge with 180 ft. Span Bridge	Weld County	$ 1,792,200	$ 537,660	$ 448,050	$ 2,777,910	$ 420
	F	Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical	Town of Frederick / Weld County	$ 5,481,000	$ 1,644,300	$ 1,370,250	$ 8,495,550	$ 89,389
	G	Stream Restoration Downstream of CO Rd. 16.5	Weld County	$ 1,054,200	$ 316,260	$ 263,550	$ 1,634,010	$ 28,000
3	A	Stream Restoration Upstream of CO Rd. 16.5	Weld County	$ 1,058,840	$ 317,652	$ 264,710	$ 1,641,202	$ 28,000
	B	Protect Gravel Pond Inlet & Outlet During Storm Flows, Typical	Weld County	$ 261,000	$ 78,300	$ 65,250	$ 404,550	$ 4,270
4	A	Modify Godding A. and D. Plumb Ditch for Aquatic and Habitat Passage	Weld County	$ 290,000	$ 87,000	$ 72,500	$ 449,500	$ 4,270
	B	East County Line Road - 100-yr Option: Replace Bridge with 220 ft. Span Bridge	Boulder County	$ 3,655,196	$ 1,096,559	$ 913,799	$ 5,665,554	$ 560
	C	Protect Gravel Ponds / Town of Erie Reuse Pond / Wittemeyer Ponds Inlet & Outlet During Strom Flows, Typical.	Town of Erie / Weld County / Boulder County	$ 3,915,000	$ 1,174,500	$ 978,750	$ 6,068,250	$ 63,840
	D	Stabilize Bank at Bailey-Kenosha Pond Outlet	Boulder County	$ 17,088	$ 5,126	$ 4,272	$ 26,486	$ 3,220
	E	DS of Kenosha Rd. - Remove Washed Out Bridge		$ 69,600	$ 20,880	$ 17,400	$ 107,880	$ -
	F	Stream Restoration Through Doniphan, Wittemeyer Ponds, Bailey-Kenosha Ponds, and Open Space		$ 4,477,600	$ 1,343,280	$ 1,119,400	$ 6,940,280	$ 118,999
	G	Stabilize Howell Ditch Diversion System, Modify Diversion for Aquatic and Habitat Passage		$ 399,308	$ 119,792	$ 99,827	$ 618,927	$ 7,490
	H	Kenosha Rd. - Replace Bridge with 180 ft. Span Bridge		$ 2,296,800	$ 689,040	$ 574,200	$ 3,560,040	$ 560
	I	Replace Grade Control for Aquatic and Habitat Passage		$ 237,800	$ 71,340	$ 59,450	$ 368,590	$ 4,270
	J	109th St. - Replace Bridge with 180 ft. Span Bridge; Restore Adjacent Channel		$ 2,834,752	$ 850,426	$ 708,688	$ 4,393,866	$ 420
	K	Stream Restoration Through Wheeler Ranch		$ 2,424,657	$ 727,398	$ 606,164	$ 3,758,219	$ 64,399
5	A	Stream Restoration at Alexander Dawson Open Space	Boulder County	$ 2,378,000	$ 713,400	$ 594,500	$ 3,685,900	$ 62,999
	B	Modify Boulder and Weld County Ditch for Aquatic and Habitat Passage		$ 290,000	$ 87,000	$ 72,500	$ 449,500	$ 4,270
	C	Protect Boulder Valley Ponds Inlet & Outlet During Storm Flows, Typical.		$ 1,305,000	$ 391,500	$ 326,250	$ 2,022,750	$ 21,280
	D	Modify Grade Control Structures for Aquatic and Habitat Passage		$ 237,800	$ 71,340	$ 59,450	$ 368,590	$ 4,270
	E	Modify Lower Boulder Ditch for Aquatic and Habitat Passage		$ 237,800	$ 71,340	$ 59,450	$ 368,590	$ 4,270
	F	Stream Restoration Downstream of 95th Street		$ 1,054,200	$ 316,260	$ 263,550	$ 1,634,010	$ 28,000
	G	95th St. - 100-yr Option: Replace Bridge with 220 ft. Span Bridge		$ 3,778,680	$ 1,133,604	$ 944,670	$ 5,856,954	$ 560
	H	Stream Restoration from Upstream of 95th St. to White Rocks Trail	City of Boulder	$ 2,371,947	$ 711,584	$ 592,987	$ 3,676,518	$ 62,999
6	A	Modify Leggett Ditch for Aquatic and Habitat Passage	Boulder County	$ 290,000	$ 87,000	$ 72,500	$ 449,500	$ 4,270
	B	75th Street - 100-yr Option: Replace Bridge with 220 ft. Span Bridge		$ 3,097,220	$ 929,166	$ 774,305	$ 4,800,691	$ 560

Beginning of Cost Estimates for Improvements from Erie OSP: Costs not Determined in Erie OSP, Costs Determined by ICON

C239 East of County Road 3 1/4							
DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Pipe Culverts and Storm Drains							
Circular Pipes							
Diameter (in)	Length (ft)	No. of Barrels					
48-inch	167	1	167	L.F.	$195.00	$32,565.00	
Flare End Sections							
Diameter (in)	Applicable	No. of Barrels					
48-inch	Yes	1	2	EA	$2,791.00	$5,582.00	
Channel Improvements							
Soil Riprap, Type VH			42	C.Y.	$122.00	$5,124.00	
Landscaping and Maintenance Improvements							
Reclamation & seeding (native grasses)			1	ACRE	$1,355.00	$1,355.00	
Special Items (User Defined)							
48 RCP Bore	<----User Defined Items		1	L.F	$1,200.00	$1,200.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$38,147.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$5,124.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$1,355.00	
Special Items (User Defined)			$1,200.00	
Subtotal Capital Improvement Costs			**$45,826.00**	
Additional Capital Improvement Costs				
Dewatering	$6,873.90	L.S.	$6,874.00	
Mobilization	5%		$2,291.00	
Traffic Control	$6,873.90	L.S.	$6,874.00	
Utility Coordination/Relocation	$50,000.00	L.S.	$50,000.00	
Stormwater Management/Erosion Control	5%		$2,291.00	
Subtotal Additional Capital Improvement Costs			**$68,330.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$17,123.00	
Legal/Administrative	5%		$5,708.00	
Contract Admin/Construction Management	10%		$11,416.00	
Contingency	25%		$28,539.00	
Subtotal Other Costs			**$62,786.00**	
Total Capital Improvement Costs			**$176,942.00**	

C26 North of Highway 52						
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Channel Improvements						
Excavation, Low Range		2494	C.Y.	$15.00	$37,410.00	
Special Items (User Defined)						
Landscaping	<-----User Defined Items	3368	L.F	$25.00	$84,200.00	

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$37,410.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$84,200.00	
Subtotal Capital Improvement Costs			**$121,610.00**	
Additional Capital Improvement Costs				
Dewatering	$18,241.50	L.S.	$18,242.00	
Mobilization	5%		$6,081.00	
Traffic Control	$6,080.50	L.S.	$6,081.00	
Utility Coordination/Relocation	$50,000.00	L.S.	$50,000.00	
Stormwater Management/Erosion Control	5%		$6,081.00	
Subtotal Additional Capital Improvement Costs			**$86,485.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$31,214.00	
Legal/Administrative	5%		$10,405.00	
Contract Admin/Construction Management	10%		$20,810.00	
Contingency	25%		$52,024.00	
Subtotal Other Costs			**$114,453.00**	
Total Capital Improvement Costs			**$322,548.00**	

Beginning of Cost Estimates for Improvements from Boulder MP: Costs Determined in Boulder MP

2A County Road 20 1/2							
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)							
180 ft. span bridge at CO Rd 20.5	<----User Defined Items	5400	SF	$250.00	$1,350,000.00	30 ft width bridge
Removal of old bridge	<----User Defined Items	3900	SF	$50.00	$195,000.00	130 ft x 30 ft

Master Plan Capital Improvement Cost Summary				
Capital Improvement Costs				
Pipe Culverts and Storm Drains			$0.00	
Concrete Box Culverts			$0.00	
Hydraulic Structures			$0.00	
Channel Improvements			$0.00	
Detention/Water Quality Facilities			$0.00	
Removals			$0.00	
Landscaping and Maintenance Improvements			$0.00	
Special Items (User Defined)			$1,545,000.00	
Subtotal Capital Improvement Costs			**$1,545,000.00**	
Additional Capital Improvement Costs				
Dewatering	$15,450.00	L.S.	$15,450.00	
Mobilization	5%		$77,250.00	
Traffic Control	$38,625.00	L.S.	$38,625.00	
Utility Coordination/Relocation	$38,625.00	L.S.	$38,625.00	
Stormwater Management/Erosion Control	5%		$77,250.00	
Subtotal Additional Capital Improvement Costs			**$247,200.00**	
Land Acquisition Costs				
ROW/Easements			$0.00	
Subtotal Land Acquisition Costs			**$0.00**	
Other Costs (percentage of Capital Improvement Costs)				
Engineering	15%		$268,830.00	
Legal/Administrative	5%		$89,610.00	
Contract Admin/Construction Management	10%		$179,220.00	
Contingency	25%		$448,050.00	
Subtotal Other Costs			**$985,710.00**	
Total Capital Improvement Costs			**$2,777,910.00**	

2B South of County Road 20 1/2

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Modify Diversion for Aquatic Passage	<----User Defined Items	1	L.S.	$205,000.00	$205,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$205,000.00	
Subtotal Capital Improvement Costs					**$205,000.00**	
Additional Capital Improvement Costs						
Dewatering		$2,050.00	L.S.		$2,050.00	
Mobilization		5%			$10,250.00	
Traffic Control		$5,125.00	L.S.		$5,125.00	
Utility Coordination/Relocation		$5,125.00	L.S.		$5,125.00	
Stormwater Management/Erosion Control		5%			$10,250.00	
Subtotal Additional Capital Improvement Costs					**$32,800.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$35,670.00	
Legal/Administrative		5%			$11,890.00	
Contract Admin/Construction Management		10%			$23,780.00	
Contingency		25%			$59,450.00	
Subtotal Other Costs					**$130,790.00**	
Total Capital Improvement Costs					**$368,590.00**	

2C South of County Road 20 1/2

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Modify Ditch for Aquatic & Habitat Passage	<----User Defined Items	1	L.S.	$250,000.00	$250,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$250,000.00	
Subtotal Capital Improvement Costs					**$250,000.00**	
Additional Capital Improvement Costs						
Dewatering		$2,500.00	L.S.		$2,500.00	
Mobilization		5%			$12,500.00	
Traffic Control		$6,250.00	L.S.		$6,250.00	
Utility Coordination/Relocation		$6,250.00	L.S.		$6,250.00	
Stormwater Management/Erosion Control		5%			$12,500.00	
Subtotal Additional Capital Improvement Costs					**$40,000.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$43,500.00	
Legal/Administrative		5%			$14,500.00	
Contract Admin/Construction Management		10%			$29,000.00	
Contingency		25%			$72,500.00	
Subtotal Other Costs					**$159,500.00**	
Total Capital Improvement Costs					**$449,500.00**	

2D North of County Road 16 1/2

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Modify Ditch for Aquatic & Habitat Passage	<----User Defined Items	1	L.S.	$250,000.00	$250,000.00	

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$250,000.00	
Subtotal Capital Improvement Costs					**$250,000.00**	
Additional Capital Improvement Costs						
Dewatering		$2,500.00	L.S.		$2,500.00	
Mobilization		5%			$12,500.00	
Traffic Control		$6,250.00	L.S.		$6,250.00	
Utility Coordination/Relocation		$6,250.00	L.S.		$6,250.00	
Stormwater Management/Erosion Control		5%			$12,500.00	
Subtotal Additional Capital Improvement Costs					**$40,000.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$43,500.00	
Legal/Administrative		5%			$14,500.00	
Contract Admin/Construction Management		10%			$29,000.00	
Contingency		25%			$72,500.00	
Subtotal Other Costs					**$159,500.00**	
Total Capital Improvement Costs					**$449,500.00**	

2E County Road 16 1/2

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
180 ft span bridge	<----User Defined Items	5400	SF	$250.00	$1,350,000.00	30 ft width bridge
Removal of old bridge	<----User Defined Items	3900	SF	$50.00	$195,000.00	130 ft x 30 ft

Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$1,545,000.00	
Subtotal Capital Improvement Costs					**$1,545,000.00**	
Additional Capital Improvement Costs						
Dewatering		$15,450.00	L.S.		$15,450.00	
Mobilization		5%			$77,250.00	
Traffic Control		$38,625.00	L.S.		$38,625.00	
Utility Coordination/Relocation		$38,625.00	L.S.		$38,625.00	
Stormwater Management/Erosion Control		5%			$77,250.00	
Subtotal Additional Capital Improvement Costs					**$247,200.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$268,830.00	
Legal/Administrative		5%			$89,610.00	
Contract Admin/Construction Management		10%			$179,220.00	
Contingency		25%			$448,050.00	
Subtotal Other Costs					**$985,710.00**	
Total Capital Improvement Costs					**$2,777,910.00**	

2F Between County Road 16 1/2 and County Road 20 1/2						
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
Riverbank Spillway	**<----User Defined Items**	20	L.S.	$225,000.00	$4,500,000.00	
Lateral Spillway	**<----User Defined Items**	1	L.S.	$225,000.00	$225,000.00	
Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$4,725,000.00	
Subtotal Capital Improvement Costs					**$4,725,000.00**	
Additional Capital Improvement Costs						
Dewatering		$47,250.00	L.S.		$47,250.00	
Mobilization		5%			$236,250.00	
Traffic Control		$118,125.00	L.S.		$118,125.00	
Utility Coordination/Relocation		$118,125.00	L.S.		$118,125.00	
Stormwater Management/Erosion Control		5%			$236,250.00	
Subtotal Additional Capital Improvement Costs					**$756,000.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$822,150.00	
Legal/Administrative		5%			$274,050.00	
Contract Admin/Construction Management		10%			$548,100.00	
Contingency		25%			$1,370,250.00	
Subtotal Other Costs					**$3,014,550.00**	
Total Capital Improvement Costs					**$8,495,550.00**	

2G Between County Road 16 1/2 and County Road 20 1/2						
DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	USER COMMENTS
Special Items (User Defined)						
ERC Stream Restoration	**<----User Defined Items**	2000	L.F.	$133.00	$266,000.00	
ERC Riparian Restoration	**<----User Defined Items**	18	AC	$35,000.00	$642,792.00	200 ft. on each side of river
Master Plan Capital Improvement Cost Summary						
Capital Improvement Costs						
Pipe Culverts and Storm Drains					$0.00	
Concrete Box Culverts					$0.00	
Hydraulic Structures					$0.00	
Channel Improvements					$0.00	
Detention/Water Quality Facilities					$0.00	
Removals					$0.00	
Landscaping and Maintenance Improvements					$0.00	
Special Items (User Defined)					$908,792.00	
Subtotal Capital Improvement Costs					**$908,792.00**	
Additional Capital Improvement Costs						
Dewatering		$9,087.92	L.S.		$9,088.00	
Mobilization		5%			$45,440.00	
Traffic Control		$22,719.80	L.S.		$22,720.00	
Utility Coordination/Relocation		$22,719.80	L.S.		$22,720.00	
Stormwater Management/Erosion Control		5%			$45,440.00	
Subtotal Additional Capital Improvement Costs					**$145,408.00**	
Land Acquisition Costs						
ROW/Easements					$0.00	
Subtotal Land Acquisition Costs					**$0.00**	
Other Costs (percentage of Capital Improvement Costs)						
Engineering		15%			$158,130.00	
Legal/Administrative		5%			$52,710.00	
Contract Admin/Construction Management		10%			$105,420.00	
Contingency		25%			$263,550.00	
Subtotal Other Costs					**$579,810.00**	
Total Capital Improvement Costs					**$1,634,010.00**	

End of Cost Estimates for Improvements from Boulder MP: Costs Determined in Boulder MP

Appendix I. Implementation and Funding Evaluation Documentation

Table I.1: Town of Frederick OSP Project Implementation and Prioritization Plan

Prioritization Category Scoring Definition (Higher Scores Indicates a Higher Preference/Priority for Implementation of Project by Community)

Risk = Impact to property and community if improvement is not made. Scores 1-5: 1 = low impact; 2 = minor impact, 3 = moderate impact; 4 = high impact, 5 = very high impact

Cost = cost of improvement. Scores 1-3: 1 = More than $1,000,000 2 = between $1,000,000 and $500,000, 3 = less than $500,000

Alternative Funding Availability = cost sharing/grant opportunities. Scores 1-3: 1 = unlikely alternative funding availability (community funding only), 2 = potential cost sharing between communities/grant opportunities, 3 = high likelihood of cost sharing/grant opportunities

Community Implementation Timeframe = when does community plan to implement project. Scores 1-3: 1 = long-term time horizon (> 20 years), 2 = mid-term time horizon (between 10-20 years), 3 = short-term time horizon (< 10-years)

Basin	Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)
							Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe	
Tri-Town	Frederick	TT-C14*	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	29" H x 45" W HERCP/ 36" HDPE	-	$ 221,000	5	3	2	3	13
Tri-Town	Frederick/Firestone	TT-C15*	Colorado Blvd, South of County Road 20/Bella Rosa Parkway	(4) 36" RCP 3' H x 11' W RCBC	Frederick Portion (Half of Crossing[1])	$ 155,000	5	3	2	3	13
Godding Hollow	Frederik/Dacono	GH-C4	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC	Frederick Portion (Half of Crossing[2])	$ 1,371,000	5	1	3	3	12
Tri-Town	Fredrick/Dacono	TT-C9	Highway 52 - Main Channel	3' H x 10' W RCBC	Frederick Portion (Half of Crossing[3])	$ 248,000	5	2	3	2	12
Tri-Town	Fredrick/Dacono	TT-C23	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvements[4])	$ 411,000	5	2	3	2	12
Tri-Town	Frederick	TT-C8	Access Road Crossing North of Highway 52	Existing Crossing Proposed to be Removed and Replaced With Low Flow Crossing	-	$ 59,000	5	3	1	2	11
Tri-Town	Frederick	TT-C2*	County Road 20/Bella Rosa Parkway	(3) 5' H x 9' W RCBC	-	$ 1,057,000	5	1	2	3	11
Idaho Creek	Frederick/Erie	IC-C13	HWY 52, East of County Road 5	8'H X 10'W RCBC	Frederick Portion (Half of Crossing and Downstream Channel Improvemets[5])	$ 606,000	5	2	2	2	11
Tri-Town	Frederick	TT-C28	County Road 15/Ridgeway Blvd and Leyden Creek Blvd Intersection	24" RCP 36" RCP	-	$ 137,000	4	3	1	3	11
Tri-Town	Frederick/Firestone	TT-C16*	Colorado Blvd, North of Majestic Street/McClure Avenue	(2) 19" H x 30" W HERCP	Frederick Portion (Half of Crossing[6])	$ 59,000	3	3	2	2	10
Idaho Creek	Frederick	IC-C9	Boulder and Weld County Ditch	(3) 4'H X 7'W RCBC	-	$ 1,354,000	4	1	2	2	9
Tri-Town	Frederick	TT Ponds 667 & 668*	Prairie Green Ponds 2 & 3	Raise Spillway and Embankment of Pond 2 Remove Orifice Plate on Pond 2 and Enlarge Orifice Plate Area on Pond 3	-	$ 108,000	3	3	1	2	9
Tri-Town	Frederick	TT-C29*	Frederick Way, South of Sixth Street (Outflow of Prairie Green Pond 3 and Storm Sewer South of Thunder Valley K-8 School)	36" RCP Pond 3 Outlet with Orifice Plate to tie into proposed upsized 36" RCP outfall	-	$ 417,000	3	3	1	2	9
Godding Hollow	Frederick	GH-C3	County Road 16/Tipple Parkway	(3) 7' H x 14' W RCBC 7' H X 11 W RCBC	-	$ 434,000	3	3	1	2	9
Godding Hollow	Fredrick	GH-C12	Highway 52 - Erie Tributary	(3) 4' H x 12' W RCBC	-	$ 762,000	5	2	1	1	9
Godding Hollow	Frederick/Erie	GH-C29	Highway 52, West of County Road 7	(3) 3' H x 5' W RCBC	Frederick Portion (Half of Crossing[7])	$ 276,000	3	2	3	1	9
Little Dry Creek	Frederick/Weld County**	LDC-37	County Road 19, North of County Road 14	(2) 3' H x 7' W RCBC	-	$ 452,000	3	3	2	1	9
Little Dry Creek	Frederick/Weld County**	LDC-36	County Road 19, North of County Road 14	(3) 24" RCP	-	$ 198,000	3	3	2	1	9
Little Dry Creek	Frederick/Weld County**	LDC-35	County Road 14, West of County Road 19	(3) 36" RCP	-	$ 199,000	3	3	2	1	9
Idaho Creek	Frederick	IC-C10*	HWY 52, West of County Road 5	6'H X 12'W RCBC	-	$ 1,054,000	5	1	1	2	9
Boulder Creek	Frederick/Weld County**	2A*	County Road 20 1/2	Bridge Replacement	-	$ 2,778,000.00	5	1	2	1	9
Boulder Creek	Frederick/Weld County**	2E*	County Road 16 1/2	Bridge Replacement	-	$ 2,778,000.00	5	1	2	1	9
Idaho Creek	Frederick	IC-C8	Wetland Pond Embankment	(4) 5'H X 10'W RCBC	-	$ 2,110,000	4	1	1	2	8
Godding Hollow	Frederick	GH-C2	County Road 18/Godding Hollow Parkway	(9) 6' H x 10' W RCBC	-	$ 606,000	3	2	1	2	8
Idaho Creek	Frederick	IC-C12	Lower Boulder Ditch	8'H X 10'W RCBC	Channel	$ 2,522,000	3	1	2	2	8
Idaho Creek	Frederick	IC-C11	County Road 5/Boulder and Weld County Ditch	(3) 5'H X 11'W RCBC	Channel	$ 1,609,000	3	1	2	2	8
Idaho Creek	Frederick	IC-C16	County Road 18, East of County Road 7	3'H X 7'W RCBC	-	$ 642,000	3	2	1	2	8
Idaho Creek	Frederick	IC-C17	County Road 18, West of County Road 7	3'H X 9'W RCBC	-	Combined with IC-C16	3	2	1	2	8
Sump Basin	Frederick	SB-1	County Road 16/Tipple Parkway	4' H x 6' W RCBC	Channel	$ 1,228,000	3	1	2	2	8

Table I.1: Town of Frederick OSP Project Implementation and Prioritization Plan

Prioritization Category Scoring Definition (Higher Scores Indicates a Higher Preference/Priority for Implementation of Project by Community)

Risk = Impact to property and community if improvement is not made. Scores 1-5: 1 = low impact; 2 = minor impact, 3 = moderate impact; 4 = high impact, 5 = very high impact

Cost = cost of improvement. Scores 1-3: 1 = More than $1,000,000 2 = between $1,000,000 and $500,000, 3 = less than $500,000

Alternative Funding Availability = cost sharing/grant opportunities. Scores 1-3: 1 = unlikely alternative funding availability (community funding only), 2 = potential cost sharing between communities/grant opportunities, 3 = high likelihood of cost sharing/grant opportunities

Community Implementation Timeframe = when does community plan to implement project. Scores 1-3: 1 = long-term time horizon (> 20 years), 2 = mid-term time horizon (between 10-20 years), 3 = short-term time horizon (< 10-years)

Basin	Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement	Cost	Prioritization Categories				Total Score (14 Max. - 4 Min.)
							Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe	
Boulder Creek	Frederick/Weld County**	2C*	Approximately 1.5 miles downstream of County Road 16 1/2 Along Boulder Creek	Rural Ditch Modification	-	$ 451,000.00	2	3	2	1	8
Boulder Creek	Frederick/Weld County**	2D*	County Road 16 1/2	Idaho Creek Diversion Modification	-	$ 451,000.00	2	3	2	1	8
Boulder Creek	Frederick/Weld County**	C26	North of Highway 52, west of County Road 3 1/4	Proposed Channel for 100 Year Conveyance	-	$ 322,000.00	2	3	2	1	8
Boulder Creek	Frederick/Weld County**	C239	South of County Road 16 1/2, west of County Road 3 1/4	4' RCP	-	$ 177,000.00	2	3	2	1	8
Idaho Creek	Frederick	IC-C14	County Road 7, South of County Road 20	(2) 3'H X 12'W RCBC	-	$ 8,582,000	3	1	1	2	7
Idaho Creek	Frederick	IC-C15	County Road 20, West of County Road 7	(5) 4'H X 12'W RCBC	Channel	Combined with IC-C14	3	1	1	2	7
Idaho Creek	Frederick	IC-C18	County Road 18, East of County Road 5	(4) 3'H X 11'W RCBC	Channel	$ 1,799,000	3	1	1	2	7
Idaho Creek	Frederick	IC-C7	Decommissioned Railroad Embankment	(5) 4'H X 12'W RCBC	Channel	$ 2,820,000	3	1	1	2	7
Idaho Creek	Frederick	IC-C3	County Road 20.5	(5) 4'H x 12' W RCBC	-	$ 762,000	3	2	1	1	7
Little Dry Creek	Frederick/Weld County**	LDC-34	County Road 19, North of Highway 52	(8) 5' H x 8' W RCBC	-	$ 1,036,000	3	1	2	1	7
Idaho Creek	Frederick	IC-C21	Godding Ditch Crossing	Proposed Channel Improvements 6' RCP Siphon for Ditch Crossing	Channel	$ 734,000	2	2	1	2	7
Tri-Town	Frederick	TT-C17*	Colorado Blvd, North of Hurt Street	Channel Improvement		$ 33,000	2	3	1	1	7
Tri-Town	Frederick	TT-C25*	Majestic Street, West of Colorado Blvd	14" H x 23" W HERCP 24" H x 38" W HERCP	-	$ 137,000	2	3	1	1	7
Tri-Town	Frederick/Firestone	TT-C24*	McClure Avenue Storm Sewer	36" RCP	Frederick Portion (Half of Storm Sewer Improvements[8])	$ 452,000	2	2	2	1	7
Boulder Creek	Frederick/Weld County**	2B*	Approximately 2.25 miles downstream of County Road 16 1/2 Along Boulder Creek	Replace Existing Grade Control	-	$ 369,000.00	2	3	1	1	7
Sump Basin	Frederick/Firestone	SB-2	Future McClure Avenue Crossing	4' H x 9' W RCBC	Frederick Portion (Half of Crossing[9])	$ 107,000	1	2	2	2	7
Little Dry Creek	Frederick	LDC-31	County Road 14 and County Road 17	(4) 36" RCP	-	$ 223,000	2	3	1	1	7
Little Dry Creek	Frederick	LDC-32	County Road 14, West of County Road 19	(2) 30" RCP	-	$ 152,000	2	3	1	1	7
Godding Hollow	Frederick	GH-C1	County Road 20/Bella Rosa Parkway	(10) 5' H x 12' W RCBC	-	$ 1,413,000	3	1	1	1	6
Idaho Creek	Frederick	IC-C2	County Road 7, South of Highway 119	(4) 3'H x 12' W RCBC (2) 3'H x 12' W RCBC	Channel	$ 1,638,000	3	1	1	1	6
Idaho Creek	Frederick	IC-C20	County Road 16.5, East of County Road 5	(2) 3'H X 10'W RCBC	Channel	$ 1,140,000	2	1	1	2	6
Idaho Creek	Frederick	IC-C19	County Road 16.5 at Decommissioned Railroad Embankment	(5) 2'H X 8'W RCBC	-	$ 1,143,000	2	1	1	2	6
Boulder Creek	Frederick/Weld County**	2G*	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Stream Restoration	-	$ 1,634,000.00	1	1	2	1	5
Little Dry Creek	Frederick	LDC-33*	North of Highway 52, West of County Road 19	(5) 4' H x 5' W RCBC	-	$ 1,077,000	1	1	1	1	4
Boulder Creek	Frederick/Weld County**	2F	Downstream of County Road 16 1/2 to County Road 20 1/2 Along Boulder Creek	Protection to Gravel Pond Inlets and Outlets	-	$ 8,495,000.00	1	1	1	1	4
					Total Costs for Frederick	**$ 58,998,000**					

*Projects where cost sharing opportunities with future development projects are not anticipated.

**All project costs allocated to Frederick for planning purposes. Potential cost sharing opportunity.

[1]Total Project Cost = $310,000. Other half of crossing costs ($155,000) allocated to Town of Firestone.

[2]Total Project Cost = $2,877,000. Other half of crossing and detention pond costs ($1,506,000) allocated to City of Dacono.

[3]Total Project Cost = $549,000. Other half of crossing costs ($301,000) allocated to City of Dacono.

[4]Total Project Cost = $721,000. Other half of crossing costs ($310,000) allocated to City of Dacono.

[5]Total Project Cost = $824,000. Other half of crossing costs ($218,000) allocated to Town of Erie.

[6]Total Project Cost = $143,000. Other half of crossing costs ($84,000) allocated to Town of Firestone.

[7]Total Project Cost = $540,000. Other half of crossing costs ($264,000) allocated to Town of Erie.

[8]Total Project Cost = $904,000. Other half of storm sewer costs ($452,000) allocated to Town of Firestone.

[9]Total Project Cost = $549,000. Other half of crossing and downstream channel costs ($442,000) allocated to Town of Firestone.

[9]Costs are for stormwater improvements only. Future road construction costs assumed to be part of another capital improvement project.

Table I.2: City of Dacono OSP Project Implementation and Prioritization Plan

Prioritization Category Scoring Definition (Higher Scores Indicates a Higher Preference/Priority for Implementation of Project by Community)

Risk = Impact to property and community if improvement is not made. Scores 1-5: 1 = low impact; 2 = minor impact, 3 = moderate impact; 4 = high impact, 5 = very high impact

Cost = cost of improvement. Scores 1-3: 1 = More than $1,000,000 2 = between $1,000,000 and $500,000, 3 = less than $500,000

Alternative Funding Availability = cost sharing/grant opportunities. Scores 1-3: 1 = unlikely alternative funding availability (community funding only), 2 = potential cost sharing between communities/grant opportunities, 3 = high likelihood of cost sharing/grant opportunities

Community Implementation Timeframe = when does community plan to implement project. Scores 1-3: 1 = long-term time horizon (> 20 years), 2 = mid-term time horizon (between 10-20 years), 3 = short-term time horizon (< 10-years)

Basin	Jurisdiction	Crossing	Location	Proposed Improvement	Additional Improvement	Cost	Prioritization Categories				Total Score (12 Max. - 4 Min.)
							Risk	Total Project Cost	Alternative Funding Availability	Community Timeframe	
Godding Hollow	Dacono/Frederick	GH-C4 GH Pond 718	Highway 52 - Main Channel	(2) 8' H x 8' W RCBC 121 AC-FT Detention Pond	Dacono Portion (Half of Crossing and Detention Ponds[1])	$ 1,506,000	5	1	3	3	12
Godding Hollow	Dacono	GH-C5 GH Pond 819	Lower Boulder Ditch	45 AC-FT Detention Pond	Pond	Combined with GH-C4	5	1	3	3	12
Tri-Town	Dacono/Frederick	TT-C9*	Highway 52 - Main Channel	3' H x 10' W RCBC	Dacono Portion (Half of Crossing[2])	$ 301,000	5	2	3	2	12
Tri-Town	Dacono	TT-C10*	Eighth Street	3' H x 10' W RCBC	-	Combined with TT-C9	5	2	3	2	12
Tri-Town	Dacono/Frederick	TT-C23*	Highway 52, West of Forest Avenue	(2) 3' H x 12' W RCBC	Dacono Portion (Half of Crossing[3])	$ 310,000	5	2	3	2	12
Tri-Town	Dacono	TT-C37*	Carbondale Drive Storm Sewer	78" RCP	-	$ 1,793,000	5	1	3	3	12
Tri-Town	Dacono	TT-C38*	Forest Avenue Storm Sewer	(2) 3' H x 12' W RCBC	-	$ 1,420,000	5	1	3	3	12
Little Dry Creek	Dacono	LDC-6	County Road 11, South of Summit Blvd	(5) 4' H x 9' W RCBC	-	$ 1,103,000	5	1	3	3	12
Little Dry Creek	Dacono	LDC-21	Colorado Blvd, North of Summit Blvd	36" RCP		$ 101,000	5	3	1	3	12
Godding Hollow	Dacono	GH-C6	County Road 12/Grandview Blvd	(3) 4' H x 12' W RCBC	-	$ 612,000	4	2	1	3	10
Godding Hollow	Dacono	GH-C7	County Road 10/Speedway Blvd	(2) 5' H x 7' W RCBC	-	$ 560,000	4	2	1	3	10
Godding Hollow	Dacono	GH-C32	County Road 12/Grandview Blvd, East of Panoram Circle	34" H x 53" W HERCP	Channel Improvement	$ 459,000	3	2	2	3	10
Godding Hollow	Dacono	GH-C33	County Road 7/York Street, North of County Road 12/Grandview Blvd	(3) 18" RCPS	-	$ 143,000	3	3	1	3	10
Little Dry Creek	Dacono	LDC-7	Summit Blvd, East of County Road 11	(3) 4' H x 13' W RCBC	-	$ 850,000	4	2	1	3	10
Little Dry Creek	Dacono	LDC-11	Colorado Blvd, North of Summit Blvd	(4) 4'H x 8' W RCBC	-	$ 2,437,000	5	1	1	3	10
Godding Hollow	Dacono	GH-C30	County Road 12/Grandview Blvd, West of County Road 7/York Street	(3) 3' H x 6' W RCBC	-	$ 1,322,000	4	1	1	3	9
Godding Hollow	Dacono	GH-C31	County Road 7/York Street, South of County Road 12/Grandview Blvd	(3) 3' H x 6' W RCBC	-	Combined with GH-C30	4	1	1	3	9
Tri-Town	Dacono	TT Pond 784	East of Glenn Creighton Drive, South of Highway 52	3.7 AC-FT Detention Pond	Pond	$ 296,000	2	3	1	3	9
Little Dry Creek	Dacono	LDC-12	County Road 15, North of County Road 10	(5) 6'H x 11' W RCBC	-	$ 1,020,000	4	1	1	2	8
Little Dry Creek	Dacono	LDC-14	County Road 19, North of County Road 12	(6) 6' H x 10' W RCBC	-	$ 2,109,000	4	1	1	2	8
Godding Hollow	Dacono	GH Pond 885	County Road 11/York St, South of Grandview Boulevard	66 AC-FT Detention Pond	Pond	$ 2,044,000	3	1	2	2	8
Little Dry Creek	Dacono	LDC-23	County Road 15 and County Road 10	24" RCP	-	$ 91,000	3	3	1	1	8
Little Dry Creek	Dacono	LDC-27	County Road 12, East of County Road 19	24" RCP	-	$ 73,000	3	3	1	1	8
Little Dry Creek	Dacono	LDC-28	County Road 12, East of County Road 19	24" RCP	-	$ 68,000	3	3	1	1	8
Little Dry Creek	Dacono	LDC-29	County Road 19, South of Highway 52	42" RCP	-	$ 127,000	3	3	1	1	8
Godding Hollow	Dacono	GH Pond 728	I-25, North of County Road 10/ Speedway Boulevard	46 AC-FT Detention Pond	Pond	$ 1,520,000	3	1	1	2	7
Godding Hollow	Dacono	GH Pond 783	County Road 11/York St, North of County Road	48 AC-FT Detention Pond	Pond	$ 1,290,000	3	1	1	2	7
Little Dry Creek	Dacono	LDC-22	County Road 15, South of County Road 10	24" RCP	-	$ 79,000	2	3	1	1	7
Little Dry Creek	Dacono	LDC-24	County Road 10, East of County Road 15	(2) 30" RCP	-	$ 104,000	2	3	1	1	7
Little Dry Creek	Dacono	LDC-25	County Road 10, West of County Road 19	(2) 30" RCP	-	$ 124,000	2	3	1	1	7
Little Dry Creek	Dacono	LDC-26	County Road 19, North of County Road 10	24" RCP	-	$ 93,000	2	3	1	1	7
					Total Costs for Dacono	**$ 21,955,000**					

*Projects where cost sharing opportunities with future development projects are not anticipated.

[1]Total Project Cost = $2,877,000. Other half of crossing costs ($1,371,000) allocated to Town of Frederick.

[2]Total Project Cost = $549,000. Other half of crossing costs ($248,000) allocated to Town of Frederick.

[3]Total Project Cost = $721,000. Other half of crossing and downstream channel costs ($411,000) allocated to Town of Frederick.

Appendix J. Digital Information