Town of Mammoth Lakes

Stormwater Master Plan

2015

Town of Mammoth Lakes
Stormwater Master Plan
2015

NCE Project No.: 220.11.14

Prepared for
Town of Mammoth Lakes
P.O. Box 1609
Mammoth Lakes, CA 93546

and

Mono County Local Transportation District
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List of Acronyms

BLM	Bureau of Land Management
BMP	Best Management Practice
CASQA	California Stormwater Quality Association
CGP	Construction General Permit
CIP	Capital Improvement Program
CWA	Clean Water Act
DWR	California Department of Water Resources
E&O	Education and Outreach
EPA	United States Environmental Protection Agency
GDB	Geodatabase
GI	Green Infrastructure
GIS	Geographic Information System
IRWMP	Integrated Regional Water Management Plan
LADWP	Los Angeles Department of Water and Power
LID	Low Impact Development
MCWD	Mammoth Community Water District
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation District
O&M	Operations and Maintenance
ROW	Right of Way
RWQCB	Regional Water Quality Control Board
USFS	United States Forest Service

List of Abbreviations

Caltrans - California Department of Transportation
Stormwater Infrastructure – Town of Mammoth Lakes stormwater collection, conveyance and treatment facilities
Town – Town of Mammoth Lakes, California

Overview and Background

The Town of Mammoth Lakes (Town) welcomes approximately 2.8 million visitors a year and is home to more than 8,000 full time residents who choose the area for the scenic alpine setting and world class recreation. The Town recognizes the importance of providing quality services to its residents and visitors, and understands how infrastructure supports the tourism based economy. A key asset for the Town is the stormwater infrastructure and its ability to handle stormwater runoff to keep roads clear, minimize flooding and protect local streams. The latter is particularly important because all the stormwater runoff from the Town is ultimately conveyed to Mammoth/Hot Creek.

The creek begins upland in the Lakes Basin, traverses through Town and ultimately discharges to the Owens River and Crowley Lake. The creek is a critical surface water resource and an important recreational asset to the Town. While a portion of the creek is designated as a Wild Trout Creek, other segments are listed as impaired on the Clean Water Act (CWA) 303(d) list, indicating a need to improve water quality. These designations are another reason why stormwater and the Town's infrastructure are a priority.

The Town has identified key issues related to stormwater including aging and inadequate stormwater infrastructure and a variety of erosion, drainage and flooding issues that are inextricably linked. Many of the roads and stormwater infrastructure was built before the Town was incorporated and at a time when minimal emphasis was placed on erosion control, water quality, or facility design. As a result, the Town is currently dealing with the following issues:

- Highly connected drainage pathways do not attenuate flows and quickly lead to high volume, high velocity runoff which causes erosion
- Areas with inadequate drainage facilities direct stormwater runoff onto steep, unprotected slopes and across bare or unpaved areas which are easily eroded
- Erosion of these areas generates significant sediment loads deposited at lower elevations which clog stormwater infrastructure and increase the potential for flooding
- Existing stormwater infrastructure, like open channels, have little capacity to attenuate stormwater runoff, increasing erosion and the potential for flooding
- Erosion and flooding compromises roadway and stormwater infrastructure which requires more frequent and costly maintenance and repair

The Town recognizes the impact stormwater runoff has on water resources; has identified erosion, drainage and flooding issues affecting Town infrastructure; and is in need of a focused strategy for dealing with stormwater. Recently, the Town

received a Proposition 84 Integrated Regional Water Management (IRWM) Planning Grant from the California Department of Water Resources (DWR) through the Inyo-Mono IRWM Program to develop a Stormwater Master Plan (SMP) to provide a strategy for dealing with the most pressing stormwater priorities.

Document Organization

The SMP is organized into six components to address stormwater priorities identified by the Town and noted in the IRWMP grant. The SMP components include:

- Component 1: Program Management
- Component 2: Stormwater Capital Improvement Program
- Component 3: Stormwater Operations and Maintenance Plan
- Component 4: Public Education and Outreach
- Component 5: Commercial, Industrial and Residential Retrofit Program
- Component 6: Construction Site Program

The SMP provides an introduction and overview of each component. For components with more in-depth analysis, appendices are provided. The appendices serve as stand-alone documents which can be pulled out of the SMP by appropriate staff for ease of use. Supporting material, such as large tables or figures, are provided as attachments within the appendices.

Component 1 - Program Management

In many California communities stormwater is regulated by the US Environmental Protection Agency (EPA) and the Regional Water Quality Control Boards (RWQCB) under CWA National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permits. In general, U.S. census designated areas with a population of 10,000 or more are required to obtain a permit for stormwater discharges from the MS4. Due to the size of the Town, municipal stormwater discharges are not currently regulated under the MS4 program. The Town has entered into a Memorandum of Understanding (MOU) with the RWQCB assigning the Town responsibilities to control erosion and stormwater from construction sites. The absence of NPDES MS4 permit requirements provides flexibility in implementing the MOU and provides an opportunity to focus on local priorities, rather than just pre-specified EPA or RWQCB requirements.

1.1. Stormwater Management Priorities

The Town is in a unique position to establish priorities for stormwater management and implementation. The Town is taking a proactive approach and developing this SMP to address the following priorities:

1. Minimize drainage issues and erosion
2. Protect creeks and streams from stormwater pollution
3. Effectively manage and operate the Town's stormwater infrastructure
4. Engage the public to participate in the solution to address stormwater
5. Build on existing Code to provide support for SMP implementation
6. Establish regional partnerships and collaboration

1.2. Stormwater Management Approach

The Town views the SMP as a collaborative effort and does not see itself as the sole implementer of this SMP. Stormwater impacts originate and extend outside of the Town's limits, ultimately impacting other jurisdictions who benefit from effective stormwater management. Going forward, the Town plans to work with local stakeholders, public agencies and enable the public to participate in stormwater management.

Implementation of the SMP will be spearheaded by the Town through an extension of existing staff across multiple Town departments (e.g., Public Works, Finance, Road and Maintenance, GIS, etc.). Overall program management and inter-departmental efforts will be coordinated by the Public Works Director, or other Public Works personnel as identified by the Public Works Director. The Town may wish to rotate

the inter-department coordination role among different department heads on an annual or multi-year basis. The Public Works and Finance Departments will be responsible for implementing the Capital Improvement Program (CIP) component of the SMP. The Public Works and Road and Maintenance Departments will share responsibilities to implement the Operations and Maintenance (O&M) component. The Education and Outreach (E&O) component will be implemented by all participating departments by disseminating outreach information as applicable. The retrofit program will be implemented by the Public Works and Community and Economic Development Departments to ensure conditions of approval related to stormwater management are met. In addition, the Public Works Department will continue inspections to confirm erosion control and Best Management Practices (BMPs) are implemented and will ensure the construction site program is implemented and meets MOU requirements.

1.3. Regional Partnership

As stormwater management evolves, the Town will explore opportunities for collaboration with regional partners. Particularly for issues originating outside of the Town limits that ultimately impact the Town's stormwater infrastructure. The Town will seek input and participation from partners including, but not limited to: IRWMP, the United States Forest Service (USFS), Mono County, Mammoth Community Water District (MCWD), Bureau of Land Management (BLM), Los Angeles Department of Water and Power (LADWP), Mammoth Mountain, Caltrans, local businesses and non-profits. Regional partners provide expertise, resources and varied perspectives on stormwater management issues. Regional partnerships ensure stormwater management is integrated with regional planning activities and priorities.

1.4. General Plan and Local Codes

Municipal codes and general plans contain legal authorities and standards supporting the implementation of the SMP. Without adequate legal authority the Town's ability to implement the SMP is limited. Therefore, the Town reviewed the Municipal Code and Town General Plan to identify existing language to support the implementation of the SMP. The Town also identified opportunities for additions to the code to provide support for the SMP.

The Town General Plan, specifically the community goals, were reviewed and found to be consistent with the goals and priorities of this SMP. Many community goals focus on being stewards of natural resources and the environment, while meeting service needs for the Town and tourism industry. Implementation of the SMP supports this effort by helping address erosion, drainage and flooding related impacts to the Town's stormwater infrastructure and creeks.

The following sections of the Town of Mammoth Lakes Municipal Code were reviewed:

- Title 12 – Streets Sidewalks and Public Places
  - Ch. 12.04 Construction and Encroachments in Right of Way
  - Ch. 12.08 Land Clearing, Earthwork, and Drainage Facilities
  - Ch. 12.10 Floodplain Management
- Title 13 – Public Services
  - Ch. 13.20 Storm Drainage Utility
- Title 15 – Building and Construction
  - 15.04 Building Regulations and Codes
  - 15.08 Construction Site Regulations
  - 15.16 Special Fees
  - 15.24 Design Requirements
- Title 17 – Zoning
  - 17.08 Development and Land Use Approval Requirements
  - 17.20 Residential Zoning Districts
  - 17.24 Commercial Zoning Districts
  - 17.28 Industrial Zoning Districts
  - 17.32 Special Purpose Zoning Districts
  - 17.36 Standards for All Development and Land Use
  - 17.40 Water Efficient Landscape Regulations
  - 17.44 Parking and Loading Standards
  - 17.52 Standards for Specific Land Uses and Activities
  - 17.88 Design review

The code does not currently address stormwater management in one cohesive chapter. Instead, code language currently exists in various chapters and sections which the Town can capitalize on when implementing the SMP. The existing code is summarized below in chronological order.

- Construction and Encroachments in the Public Right of Way (12.04) establishes encroachment permit requirements which are subject to enforcement procedures. The requirements help stabilize construction sites and reduce runoff velocities by preventing erosion and sedimentation.
- Land Clearing, Earthwork, and Drainage Facilities (12.08) establishes requirements for earthwork on private and public property. The standards require protection of drainage paths and installation of devices capturing stormwater runoff at select sites. These requirements help prevent erosion of sediment and reduce runoff velocities.
- Floodplain Management (12.10) establishes requirements for flood hazard areas in the Town. The code requires use of construction methods and

practices within the floodplain, which if implemented can minimize erosion and flooding.

- Storm Drainage Utility (Chapter 13.20) establishes a Storm Drainage Utility and fund operated by the Public Works Director in coordination with the Town Manager and Town Council. The fund is intended to be sustained by service charges, as well as connection, impact and permit fees. Powers and duties are assigned to the Storm Drainage Utility and serve to protect and repair the stormwater infrastructure, respond to impacts from flood events and assign responsibility for water quality entering into and discharging from the stormwater infrastructure. Authority is provided to establish rules, regulations and standards related to construction and the use of stormwater infrastructure on private and public property.
- Building Regulations and Codes, Driveway Modification Permit and Driveway Encroachments (15.04.100) requires all driveway encroachments to be installed in accordance with the Town's driveway standards for a certificate of occupancy to be issued. This procedure helps ensure private driveways do not contribute to erosion, drainage and flooding issues within the Town.
- Construction Site Regulations (15.08) require construction sites to protect drainage paths and control erosion from areas cleared of vegetation during construction. These requirements support the implementation of the SMP by providing authority to regulate erosion and sedimentation from construction sites.
- Special Fees, Storm Drainage Collection Facilities (15.16.081.C) establishes a development impact fee for drainage collection facilities upon the issuance of building permits for development. These fees are deposited into the drainage fund. This supports SMP implementation by establishing a revenue generating mechanism to support maintenance of the Town's stormwater infrastructure.
- Standards for All Development and Land Use, Grading and Clearing (17.08.020) requires a grading permit for any lot graded or cleared of vegetation. This section requires all construction and uses to comply with the RWQCB requirements. This supports SMP implementation by promoting compliance with the MOU and providing a mechanism to enforce erosion control and runoff quality requirements at construction sites.
- Special Purpose Zoning Districts, Open Space/Stream Corridor Protection Overlay Zone (OSSC) (17.32.040) establishes an overlay zone near streams aligning with SMP priorities to prevent erosion and to protect the streams and creeks in Town.
- Special Purpose Zoning Districts, Planned Residential Development Zone (PRD) (17.32.090) establishes requirements for planned residential developments to preserve watercourses, drainage areas, topography and natural features on a

site. SMP implementation is supported by preventing and mitigating erosion near surface waters.

- Standards for All Development and Land Use, Creation or Modification of Lots (17.36.020) requires the Town to consider drainage and erosion control as a factor in lot density and proposed use. This consideration provides a mechanism to identify whether a proposed project would cause or contribute to erosion, drainage and flooding.
- Standards for All Development and Land Use, Screening and Buffer (17.36.090) requires buffers to be landscaped between retail and residential land uses. This supports SMP implementation by providing an opportunity where stormwater runoff could be treated with landscaped features like bioswales or rain gardens.
- Standards for All Development and Land Use, Setback requirements and exceptions (17.36.100.C) requires permanent lake or stream setbacks. This supports SMP implementation by protecting the riparian zone crucial to protecting water quality and preventing erosion within the stream corridor.

In order to capitalize on this existing language, the Town may wish to form an internal stormwater team to determine whether the various departments are implementing existing code and how implementation may be improved to better support the goals of the SMP. Certain language may be developed and included in the Town municipal Code to implement or enforce the goals of the SMP including language to:

- Prohibit non-permitted discharges in waterways, drainage courses, or the Town's drainage system
- Establish authority and procedures to inspect BMP implementation
- Establish enforcement protocols for BMP implementation

To fully realize the value of the SMP this new language would apply to new developments, retrofit projects, and properties which do not comply with the Storm Drainage Utility Code, regardless of whether a retrofit is in progress. The Town will build on existing code in order to implement the SMP. This priority is described in more detail under Priority 5 in Section 1.5.

1.5. Priorities and Goals

In developing the SMP, the following near-term goals were established for each of the stormwater management priorities. The goals are based on the Inyo-Mono IRWMP grant and the Town's interest to proactively manage stormwater.

Priority 1 - Minimize drainage issues and erosion

- Goal 1: Identify up to eight priority projects to address erosion and flooding
- Goal 2: Integrate the identified priority areas in the Town's Capital Improvement Program (CIP) beginning in the 2016/17 fiscal year

Priority 2 - Protect creeks and streams from stormwater runoff

- Goal 1: Plan for and execute CIP projects to address priority areas contributing excess sediment loads to streams
- Goal 2: Review and recommend improvements to Town procedures related to the grading permit and construction site erosion control requirements
- Goals 3: Update the grading permit and construction site erosion control requirements based on recommended improvements

Priority 3 - Effectively manage and operate the Town's stormwater infrastructure

- Goal 1: Develop an operations and maintenance plan (O&M) for maintaining stormwater infrastructure
- Goal 2: Update a Geographic Information System (GIS) inventory of known stormwater infrastructure
- Goal 3: Integrate O&M actions with GIS to improve tracking
- Goal 4: Minimize deferred maintenance needed on existing stormwater infrastructure

Priority 4 - Increase public awareness of the impacts of stormwater and actions the public can take to mitigate impacts

- Goal 1: Develop an outreach package on stormwater issues for distribution to property owners
- Goal 2: Disseminate key messages to increase public awareness of stormwater as a factor affecting water quality, erosion and flooding
- Goal 3: Disseminate key messages to increase public awareness of actions the public can take to reduce erosion from bare areas
- Goal 4: Disseminate key messages to increase public awareness of actions the public can take to mitigate the negative impacts from large impervious areas

Priority 5 – Build on existing code to provide support for SMP implementation

- Goal 1: Identify opportunities for additions to the code
- Goal 2: Identify opportunities for more fully implementing existing code

Priority 6 – Establish regional partnerships and collaboration

- Goal 1: Identify priorities to address through regional partnerships and collaboration
- Goal 2: Present SMP and priorities to potential partners identified in Section 1.3 of the SMP
- Goal 3: Begin addressing regional-scale issues through regional partnerships and/or collaboration

1.6. Next Steps

Several of the goals identified in Section 1.5 are met through development of this SMP. Additional goals will be achieved through the implementation of the SMP and are identified as next steps. **Table 1** summarizes goals achieved through development of the SMP and next steps to address remaining priorities and goals.

Stormwater Priorities & Goals	SMP Component	Goals achieved by SMP	Next Steps - Goals to achieve	Description of Next Steps
Priority 1 - Minimize drainage issues and erosion				
Goal 1: Identify up to eight priority projects to address drainage issues and erosion	Component 2	•		
Goal 2: Integrate the identified priority areas in the Town's Capital Improvement Program (CIP) beginning in the 2016/17 fiscal year	Component 2		•	Present Stormwater CIP to Town Council to include priority projects in the 2016/2017 CIP
Priority 2 - Protect creeks and streams from stormwater runoff				
Goal 1: Plan for and execute CIP projects to address priority areas contributing excess sediment loads to streams	Component 2		•	Present Stormwater CIP to Town Council to include priority projects in the 2016/2017 CIP
Goal 2: Review and recommend improvements to Town procedures related to the grading permit and construction site erosion control requirements	Component 6	•		
Goal 3: Update the grading permit and construction site erosion control requirements based on recommended improvements	Component 6		•	Review NCE memo on grading permit application and incorporate revisions to the grading permit and construction site erosion control requirements

Stormwater Priorities & Goals	SMP Component	Goals achieved by SMP	Next Steps - Goals to achieve	Description of Next Steps
Priority 3 - Effectively manage and operate the Town's stormwater infrastructure				
Goal 1: Develop an operations and maintenance (O&M) plan for maintaining stormwater infrastructure	Component 3	•		
Goal 2: Update a Geographic Information System (GIS) inventory of known stormwater infrastructure	Component 3	•		
Goal 3: Integrate O&M actions with GIS to improve tracking	Component 3	•		
Goal 4: Minimize deferred maintenance needed on existing stormwater infrastructure	Component 3		•	Use the O&M plan to prioritize maintenance of stormwater infrastructure for a given fiscal year
Priority 4 - Increase public awareness of the impacts of stormwater and actions the public can take to mitigate impacts				
Goal 1: Develop an outreach package on stormwater issues for distribution to property owners	Component 5	•		
Goal 2: Disseminate key messages to increase public awareness of stormwater as a factor affecting water quality, erosion and flooding	Component 5		•	Disseminate Retrofit Program Outreach Materials from July 2015-2016. See Component 5 of the SMP for details
Goal 3: Disseminate key messages to increase public awareness of actions the public can take to reduce erosion from bare areas	Component 5		•	Disseminate Retrofit Program Outreach Materials from July 2015-2016. See Component 5 of the SMP for details

Stormwater Priorities & Goals	SMP Component	Goals achieved by SMP	Next Steps - Goals to achieve	Description of Next Steps
Goal 4: Disseminate key messages to increase public awareness of actions the public can take to mitigate the negative impacts from large impervious areas	Component 5		•	Disseminate Retrofit Program Outreach Materials from July 2015-2016. See Component 5 of the SMP for details
Priority 5 – Build on existing code to provide support for SMP implementation				
Goal 1: Identify opportunities for additions to the code	Component 1	•		
Goal 2: Identify opportunities to implement existing code	Component 1		•	Form an internal work group to assess how existing code supporting the SMP is implemented
Priority 6 – Establish regional partnerships and collaboration				
Goal 1: Identify priorities to address through regional partnerships and collaboration	Component 1		•	Internally identify stormwater related issues which impact the Town but require collaboration or partnership to address
Goal 2: Present SMP and priorities to potential partners identified in Section 1.3 of the SMP	Component 1		•	Organize a meeting with interested partners to discuss the SMP and identify possible format for a regional partnership or collaboration
Goal 3: Begin addressing regional-scale issues through regional partnerships and/or collaboration	Component 1		•	Organize a meeting with interested partners to identify format and objective(s) of a regional partnership or collaboration

Component 2 – Stormwater Capital Improvement Program

Capital improvement is an important component of every comprehensive stormwater program. The purpose of this Stormwater Capital Improvement Program (CIP) is to address stormwater infrastructure deficiencies and improve upon the Town's ability to manage and prevent erosion, sedimentation and drainage problems. The Stormwater CIP helps address the following priorities and select goals:

Priority 1 - Minimize drainage issues and erosion

- Goal 1: Identify up to eight priority projects to address erosion and flooding
- Goal 2: Integrate the identified priority areas in the Town's Capital Improvement Program (CIP) beginning in the 2016/17 fiscal year

Priority 2 - Protect creeks and streams from stormwater runoff

- Goal 1: Plan for and execute CIP projects to address priority areas contributing excess sediment loads to streams

In order to understand current problem areas, NCE staff interviewed Town engineering and maintenance staff and reviewed existing information on site conditions, potential developments, and recent development costs. Following a field investigation, NCE delineated eight erosion control, drainage improvement and flood control projects within the priority areas identified in the 2007 Existing Conditions Report. Detailed descriptions, figures and cost estimates for each of the eight Stormwater CIP projects are included in the **Stormwater Capital Improvement Program Appendix**. These Stormwater CIP projects are intended to be integrated into the Town's CIP and may occur in areas of re-development and future development. The Town will consider the connection between high priority areas and development activities when integrating specific projects into the CIP. Through the implementation of CIP projects, the Town will address existing problem areas, prevent potential problems in downstream areas and reduce recurring maintenance costs.

Component 3 – Stormwater Operations & Maintenance Plan

Operations & Maintenance is essential to achieving the goals of the SMP. This Operations & Maintenance Plan (O&M) helps address the following priorities and goals:

Priority 3 - Effectively manage and operate the Town's stormwater infrastructure

- Goal 1: Develop an operations and maintenance plan (O&M) for maintaining stormwater infrastructure
- Goal 2: Update a Geographic Information System (GIS) inventory of known stormwater infrastructure
- Goal 3: Integrate O&M actions with GIS to improve tracking
- Goal 4: Minimize deferred maintenance needed on existing stormwater infrastructure

The O&M Plan updates stormwater infrastructure data, develops a workflow for inspection and maintenance and improves the Town's ability to minimize erosion, sedimentation and drainage problems. The Town engineering and maintenance staff worked with the County's GIS staff to update existing data and make it compatible with County databases. After GIS updates were completed, the Town developed the O&M plan using a storm drain GIS linked to stormwater facility inspections and work order forms. This linkage allows the Town to prioritize maintenance of stormwater infrastructure.

Detailed descriptions, maps, tables of the data and work order process are provided in the **Stormwater Operations and Maintenance Plan Appendix**. The O&M is intended to add value and functionality to the Town and County's existing process for identifying necessary repairs in the stormwater infrastructure and prioritizing operations and maintenance work. By using the O&M Plan to prioritize maintenance, the Town will address existing problem areas and reduce recurring maintenance costs.

Component 4 - Public Education and Outreach

In the future, the Town will develop a comprehensive education and outreach (E&O) campaign about stormwater to keep the public aware of stormwater related issues, highlight the Town's current management activities, and emphasize what the public can do to prevent and minimize stormwater impacts. A comprehensive E&O campaign will help address the following priorities and goals:

Priority 4 - Increase public awareness of the impacts of stormwater and actions the public can take to mitigate impacts

- Goal 1: Develop an outreach package on stormwater issues for distribution to property owners
- Goal 2: Disseminate key messages to increase public awareness of stormwater as a factor affecting water quality, erosion and flooding
- Goal 3: Disseminate key messages to increase public awareness of actions the public can take to reduce erosion from bare areas
- Goal 4: Disseminate key messages to increase public awareness of actions the public can take to mitigate the negative impacts from large impervious areas

Increased awareness of stormwater among residents, property owners, and site operators will increase the Town's ability to address stormwater related priorities. Within the Town, the three target audiences for an E&O program include:

- Construction site operators, owners and contractors
- Commercial and residential property owners and operators
- Industrial property owners and operators

E&O materials have been developed to educate and raise awareness on key stormwater issues among commercial and residential property owners and construction site operators. The E&O materials are provided in Component 5 and Component 6 and their respective appendices, the **Retrofit Program Outreach Appendix** and the **Construction Site Program Appendix**. The E&O materials developed for this SMP are the first step in developing a comprehensive E&O program.

Component 5 - Commercial, Industrial and Residential Retrofit Program

5.1 Need for Retrofit Program

As outlined in the 2007 Final Existing Conditions Report, there are two major stormwater related issues requiring coordination with private property owners. The first is the extent of sediment from unpaved driveways and dirt parking areas mobilized and transported by stormwater runoff into the Town ROW. This sediment clogs stormwater infrastructure and increases the potential for flooding. The second major impact is the significant runoff generated from large unmitigated impervious areas (e.g. multifamily developments and commercial parking lots). The increased runoff volumes and peak flows from these impervious areas overwhelm stormwater infrastructure, exacerbate erosion and increase the potential for flooding.

5.2 Retrofit Education and Outreach

The first step in addressing the major issues described above is developing and launching a public E&O program to increase awareness among residents and property owners. As part of this SMP, E&O materials were developed for specific target audiences to highlight existing issues and provide affordable and practical solutions to the issues of unpaved areas and large unmitigated impervious sites. These materials are presented in the **Retrofit Program Outreach Appendix** and help address the following priorities and goals:

Priority 4 - Increase public awareness of the impacts of stormwater and actions the public can take to mitigate impacts

- Goal 1: Develop an outreach package on stormwater issues for distribution to property owners
- Goal 2: Disseminate key messages to increase public awareness of stormwater as a factor affecting water quality, erosion and flooding
- Goal 3: Disseminate key messages to increase public awareness of actions the public can take to reduce erosion from bare areas
- Goal 4: Disseminate key messages to increase public awareness of actions the public can take to mitigate the negative impacts from large impervious areas

The key to increasing awareness is consistent exposure of the target audience to key messages. For this effort the primary target audience is residential and commercial property owners, property managers and local developers. The key message is "Protect Your Property, Protect Your Town" which highlights the importance of each property owner and their connection to the Town. The outreach materials will be distributed through many methods including U.S. mail, e-mail alerts, the Town website, Town meetings or public events and provided as attachments to permit

applications in an effort to reach as much of the target audience as possible. **Table 2** summarizes the outreach materials developed, the target audience(s), methods of distribution and milestones during the first year of the outreach program. **Table 3** provides an estimated timeline for distribution of outreach materials.

Table 2. Outreach Material Target Audiences, Distribution Methods and Annual Milestones

Outreach Material	Audience			Distribution Methods & Annual Milestones						
	General Public	Agency officials	Property Owners	Post on Website	Provide with Driveway or Grading Permit Application	Hand Delivery at Site Visits or Inspections	Direct Mailings	Notify-me	Public Events	Council Meetings
Brochure on Unpaved/Bare Areas			X	30 Unique Downloads	90% of Permit Applications	20 Distributed			50 Distributed	
Brochure on Impervious Areas			X	30 Unique Downloads	90% of Permit Applications	20 Distributed			50 Distributed	
Letter on Erosion and Flood Control			X				Mail 200 Letters 2X/yr.			
Presentation on Key Messages	X	X							Present 3 events/yr.	Present in Sep 2015
Talking Point Content	X	X	X					6 total alerts/yr.		

Table 3. Timeline for Distributing Outreach Material in Year 1 of SMP implementation

Outreach Material	Distribution Schedule											
	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16
Brochure on Unpaved and Bare Areas		Continuous										
Brochure on Impervious Areas		Continuous										
Letter on Erosion and Flood Control				X	X			X	X			
Presentation on Key Messages				X						X		X
Talking Point Content												
• *Keep Mammoth Creek Clean*				X							X	
• *Protect your Property - Residential (1/2)*									X			
• *Protect your Property - Residential (2/2)*										X		
• *Protect your Property - Commercial (1/1)*									X			
• *The Town is taking on stormwater - SMP out for comment*	X											
• *The Town is taking on stormwater - Announcing SMP*			X									

5.3 Retrofit Program Next Steps

Typical retrofit programs require more than just education and outreach to be successful. Retrofit programs often include changes in management approach and specific design standards or development codes requiring infrastructure improvements on new or redeveloped sites. Other retrofit program elements include cost sharing programs, technical assistance and or low impact development programs and guidelines. As part of the development of this SMP, the Town will evaluate the feasibility of a more formalized retrofit program. This process will include:

- Evaluating existing retrofit programs in other communities
- Determining if a more formalized retrofit program is appropriate for the Town
- Identifying retrofit program options appropriate for Mammoth Lakes

Component 6 – Construction Site Program

Two efforts were completed under Component 6 to create a comprehensive construction site program. First, a review of the grading permit application and related code was conducted to ensure the intent of the MOU is being met. Recommendations were made on how to improve the grading permit application and related code. This effort addressed Priority 2, Goal 2: *Review and recommend revisions to Town procedures related to the grading permit and construction site erosion control requirements.* Second, a brochure was developed to provide guidance to construction site operators on methods to control sediment and erosion from constructions sites with BMPs. The results of these two efforts are provided in the **Construction Site Program Appendix**.

STORMWATER CAPITAL IMPROVEMENT PROGRAM

APPENDIX

Stormwater Capital Improvement Program
Town of Mammoth Lakes



Prepared for
Town of Mammoth Lakes
P.O. Box 1609
Mammoth Lakes, CA 93546

NCE Project No.: 220.11.14

Stormwater Capital Improvement Program

The purpose of this Stormwater Capital Improvement Program (CIP) is to address stormwater infrastructure deficiencies and improve the Town's ability to manage and minimize erosion, sedimentation and drainage problems. In order to gain an understanding of current problem areas NCE staff interviewed Town engineering and maintenance staff and reviewed existing documents including the 2008 Final Recommendations Report, the 2007 Existing Conditions Report and the 2005 Storm Drain Master Plan. Following a field investigation, NCE delineated eight erosion control, drainage improvement and flood control projects within the seven high priority areas of the Town, as identified in the 2007 Existing Conditions Report. These projects will be integrated into the Town's overall CIP at an appropriate time in the future.

The proposed CIP projects were delineated based on the following criteria:

- Projects addressing the highest priority erosion control, storm drainage and flooding problem areas;
- Projects typically constructed within one building season (May 1 through October 15);
- Project construction cost of approximately $1.5 million or less (Does not include survey, planning, design and permitting fees or Right of Way [ROW] acquisition)

Table 1 lists the proposed CIP projects and estimated costs for construction, planning, design and permitting. The projects are listed in order of recommended priority and sequence of construction.

Table 1. Proposed CIP Projects and Estimated Costs

Project Number	Project Title	Estimated Cost
1	Upper John Muir Slope Protection	$1.7 M
2	Upper John Muir Storm Drain	$1.5 M
3	Lower John Muir Slope Protection	$1.9 M
4	Lower John Muir Storm Drain	$1.0 M
5	Davison Road Storm Drain	$2.0 M
6	Majestic Pines Storm Drain	$1.3 M
7	Forest Trail Slope Protection	$1.4 M
8	Forest Trail Storm Drain	$1.3 M

The first six projects address issues identified along a generally continuous flow path. The path begins with slope stability and erosion issues at the top of John Muir Road and runs eastward across Lake Mary Road, through the Majestic Pines

neighborhood, deposits accumulated sediment in the Sierra Star Golf Course, and increases the potential for flooding in the Sierra Valley residential area. Although no projects are proposed in the Sierra Valley residential area, the Town anticipates improvements occurring upstream will alleviate some of the previous flooding issues. Projects 7 and 8 address drainage and erosion issues identified in the North Village and the Forest Trail residential area.

Detailed descriptions, figures and cost estimates for each project are included herein (see Attachments 1 and 2). Construction cost estimates for the proposed CIP projects were based primarily on bid tabulations provided by Town Engineering Staff for projects recently constructed in the Town. These bid tabs were supported by recent bid tabs obtained by NCE for work performed in other locations in the Sierra Nevada including the Lake Tahoe area. For the purposes of estimating construction costs and delineating project improvements, the following generalized set of project components was used. Final locations, design and details will be determined by the Design Engineer at a later stage in project development:

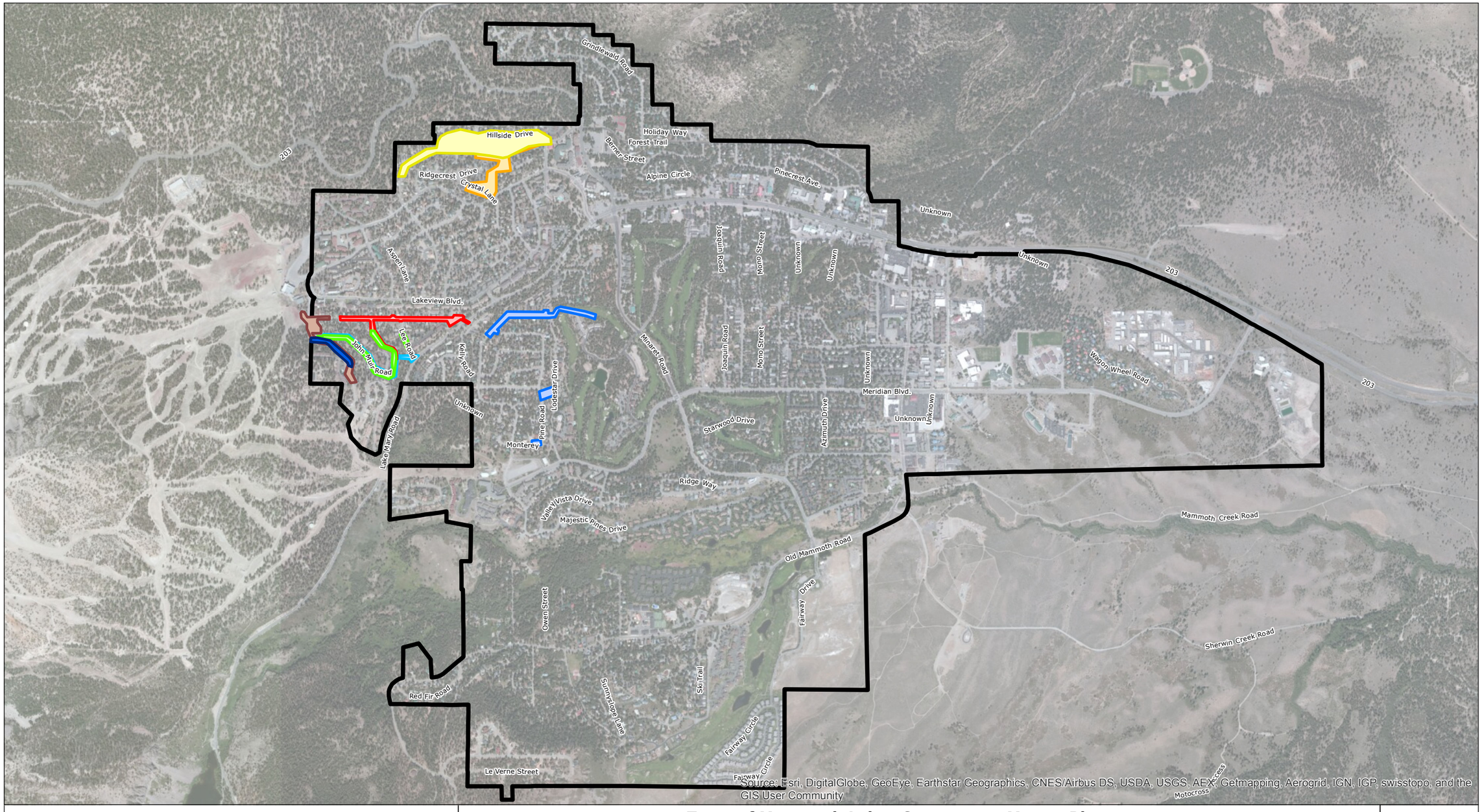
- Cut Slope Protection – including retaining walls, toe walls and rock slope protection. Due to the relatively large quantity and significant cost of slope protection required in the proposed projects, the recommendation is to perform this work separately from the storm drainage improvements, preferably by a specialized contractor.
- Revegetation – some slopes within the project areas are good candidates for less costly erosion control through revegetation.
- Surface Conveyance – including concrete curb and gutter, concrete valley gutter, asphalt dike, concrete, asphalt, vegetated or rock swales. These improvements are located along the edge of streets and roadways to minimize runoff from impervious surfaces leaving the public right of way and causing erosion issues on private property. Surface conveyance features allow for channelized flow without the installation or maintenance costs associated with subsurface storm drain piping.
- Storm Drain Pipe – although proposed pipe sizes have not been recommended in the attached project descriptions, the unit price is based on pipe diameters of 18 to 24 inches.
- Storm Drain Manhole – included at pipe junctions and angle points.
- Storm Drain Inlet – including curb inlets, grated inlets and standpipes for detention basin overflow.
- Rock Lined Channel – for channelized conveyance of concentrated storm flows, generally occurring at the outfall of a storm drain pipe system.
- Detention/Infiltration Basin – a number of potential locations for small scale detention and infiltration of storm flows have been identified. These features

help to reduce peak flows, flooding and sedimentation in downstream drainage systems.

- General Conditions – an average of 12% General Conditions cost was calculated based on bid tabs for mobilization, construction storm water controls (SWPPP), traffic controls, permitting, quality controls, etc.

A 15% design contingency was included in the project cost estimates to cover unanticipated complications likely to arise during the design and construction process. Planning, design and permitting fees were estimated as 15% of the construction cost, and ROW acquisition was estimated at $500,000 per acre.

Annual maintenance costs are based on estimates of typical unit costs and frequencies for maintenance of similar facilities in other alpine communities. Many of the proposed facilities, such as storm drain pipe and cut slope protection, should require minimal maintenance if properly designed and constructed. Following construction these projects and associated improvements will reduce the overall maintenance burden for the Town. However, the absence of any current maintenance records and associated costs for the Town's existing infrastructure make it impossible to quantify this net savings.



Legend

- Town Boundary

CIP Areas

- Davison Road Storm Drain
- Forest Trail Slope Protection
- Forest Trail Storm Drain
- Lower John Muir Slope Protection
- Lower John Muir Storm Drain
- Majestic Pines Storm Drain
- Upper John Muir Slope Protection
- Upper John Muir Storm Drain

Town of Mammoth Lakes Stormwater Master Plan

CIP Overview

1 in. = 2,000 ft.

0 1,000 2,000 ft.

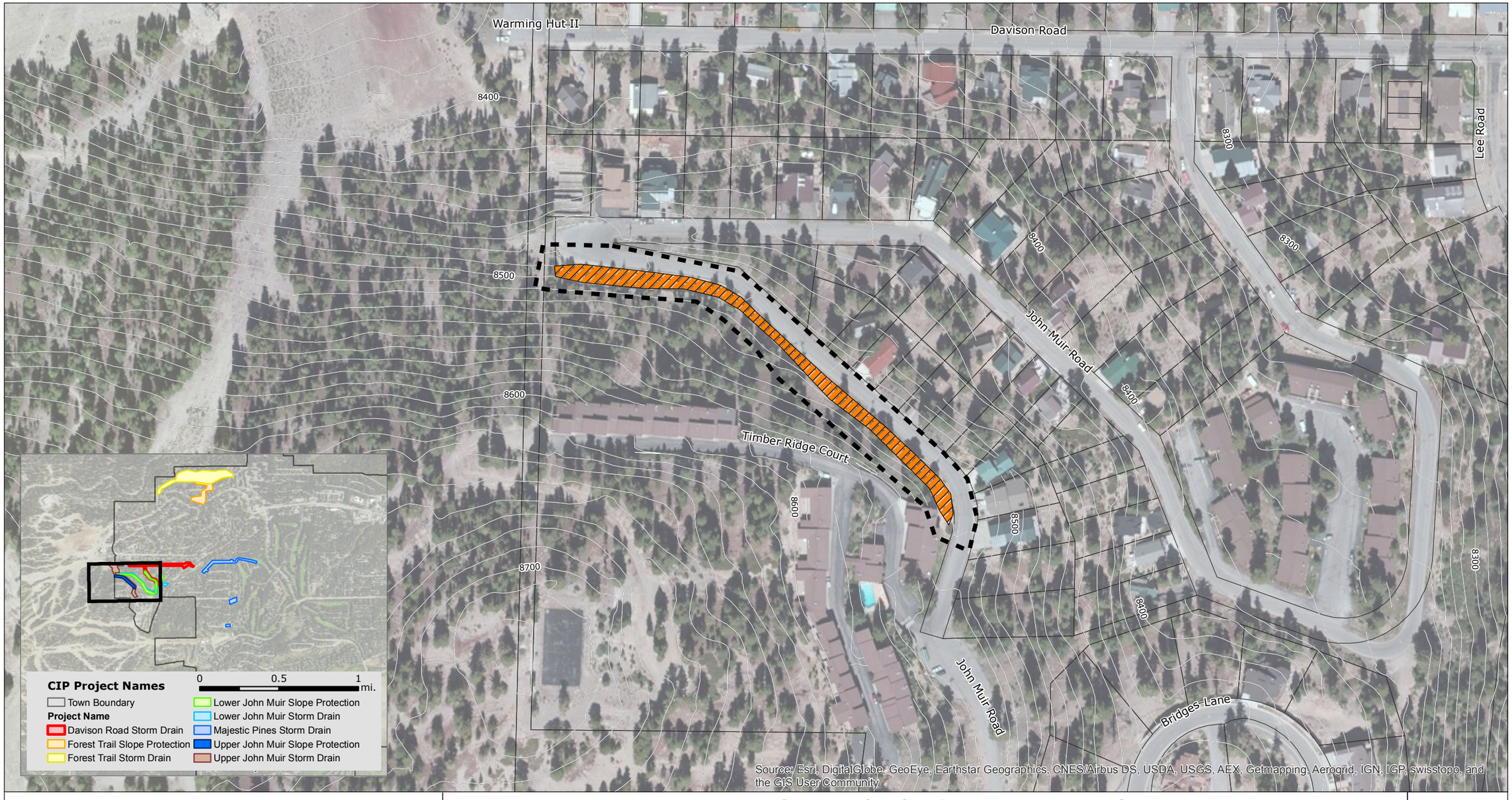
N

Credits: Town of Mammoth Lakes; ESRI

Date: 6/23/2015 Author: jhall

NCE

Mammoth Lakes CALIFORNIA



CIP Project Detail

Project Boundary · Manhole · Inlet · Rock Lined Channel · SD Pipe · Surface Conveyance · Cutslope Protection · Infiltration Basin · Revegetation

Town of Mammoth Lakes Stormwater Master Plan

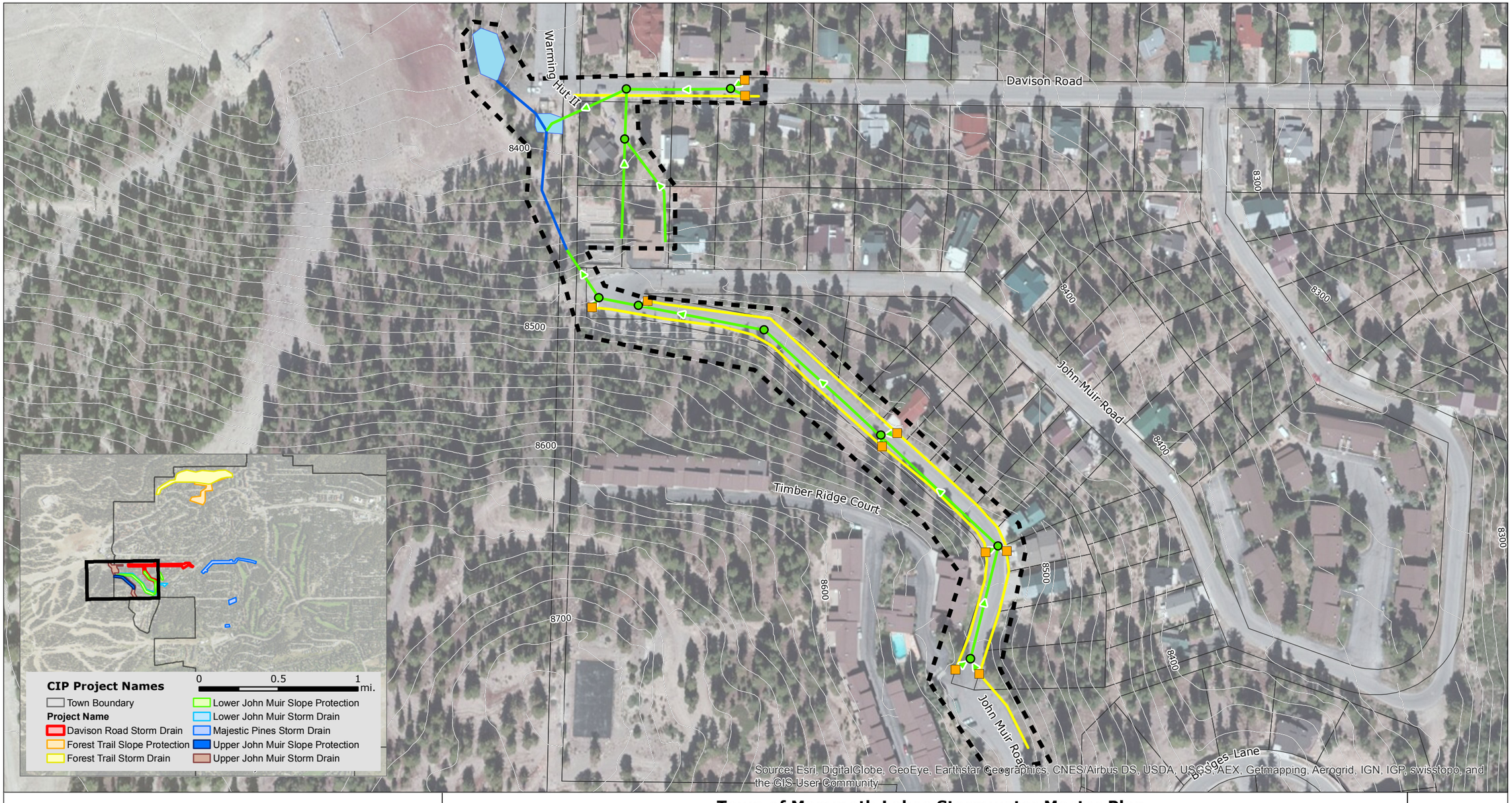
CIP Project: Upper John Muir Slope Protection

1 in. = 200 ft.
0 200 400 ft.
N

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 1



CIP Project Detail

Project Boundary · Manhole · Inlet · Rock Lined Channel · SD Pipe · Surface Conveyance · Cutslope Protection · Infiltration Basin · Revegetation

1 in. = 200 ft.
0 200 400 ft.
N

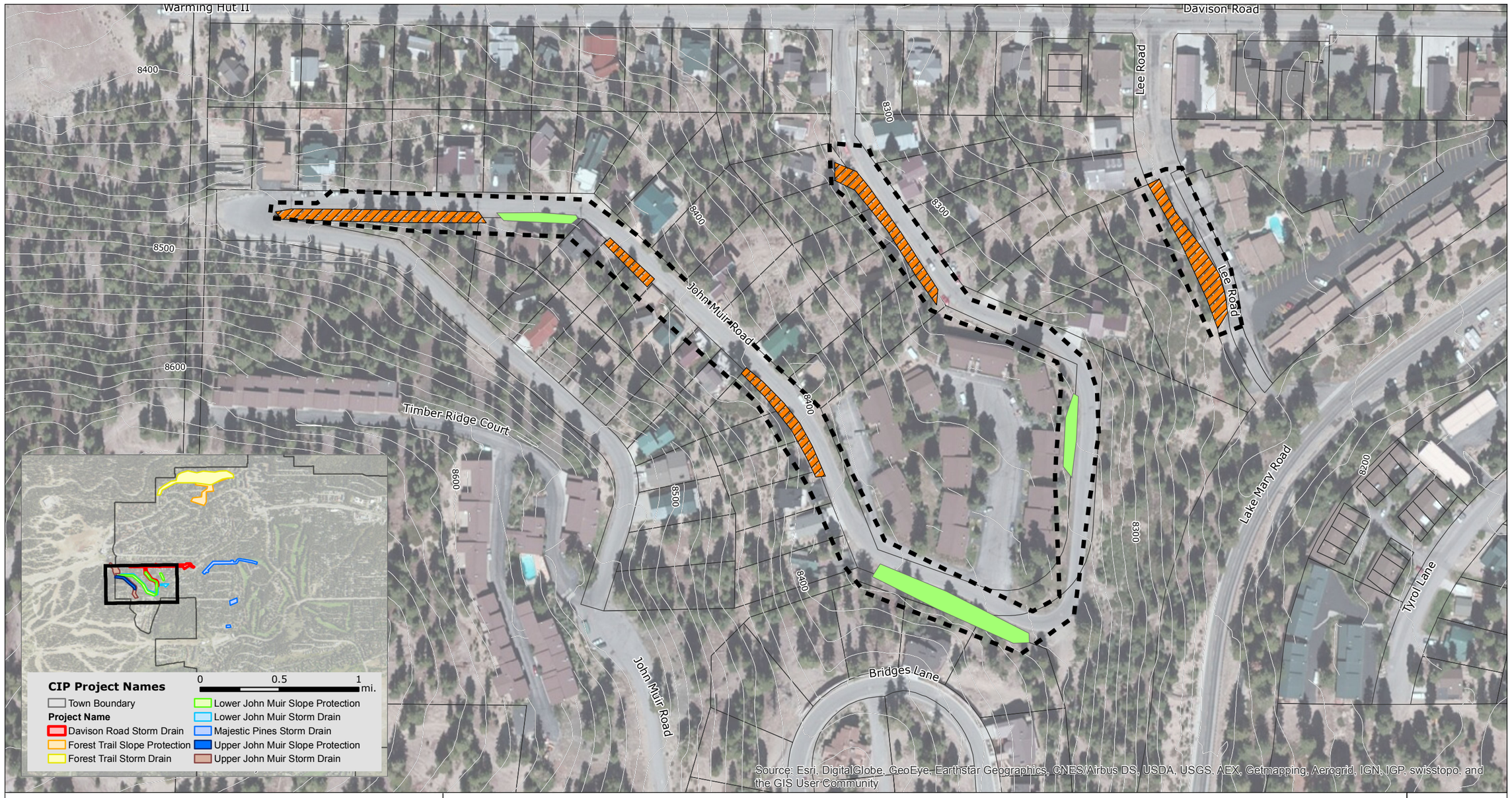
Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Upper John Muir Storm Drain

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 2



CIP Project Detail

Project Boundary · Manhole · Inlet · Rock Lined Channel · SD Pipe · Surface Conveyance · Cutslope Protection · Infiltration Basin · Revegetation

1 in. = 200 ft.
0 200 400 ft.
N

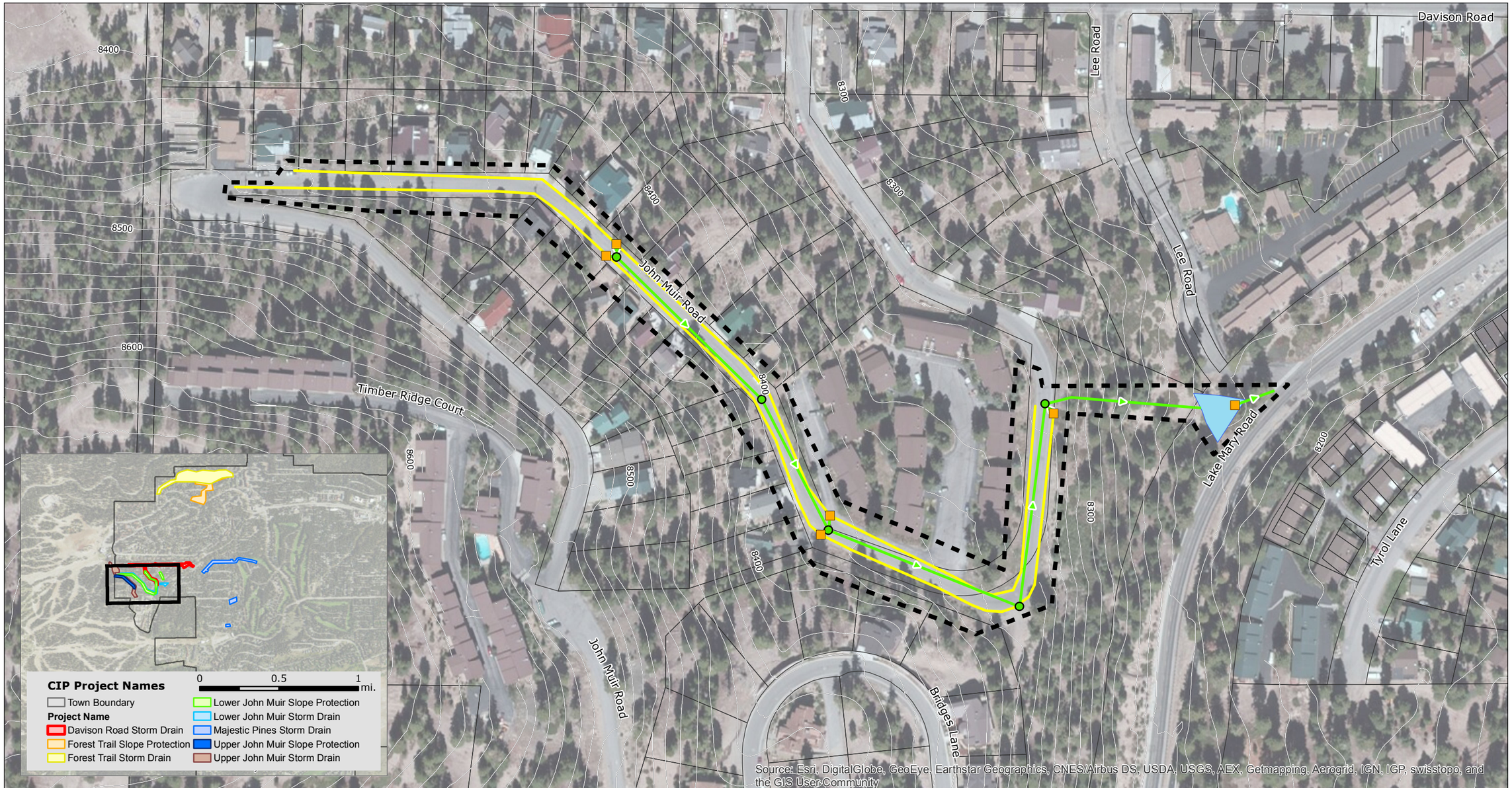
Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Lower John Muir Slope Protection

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 3



CIP Project Detail

Project Boundary · Manhole · Inlet · Rock Lined Channel · SD Pipe · Surface Conveyance · Cutslope Protection · Infiltration Basin · Revegetation

Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Lower John Muir Storm Drain

1 in. = 200 ft.
0 200 400 ft.
N

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 4

CIP Project Detail

Project Boundary
Manhole
Inlet
Rock Lined Channel
SD Pipe
Surface Conveyance
Cutslope Protection
Infiltration Basin
Revegetation

Town of Mammoth Lakes Stormwater Master Plan

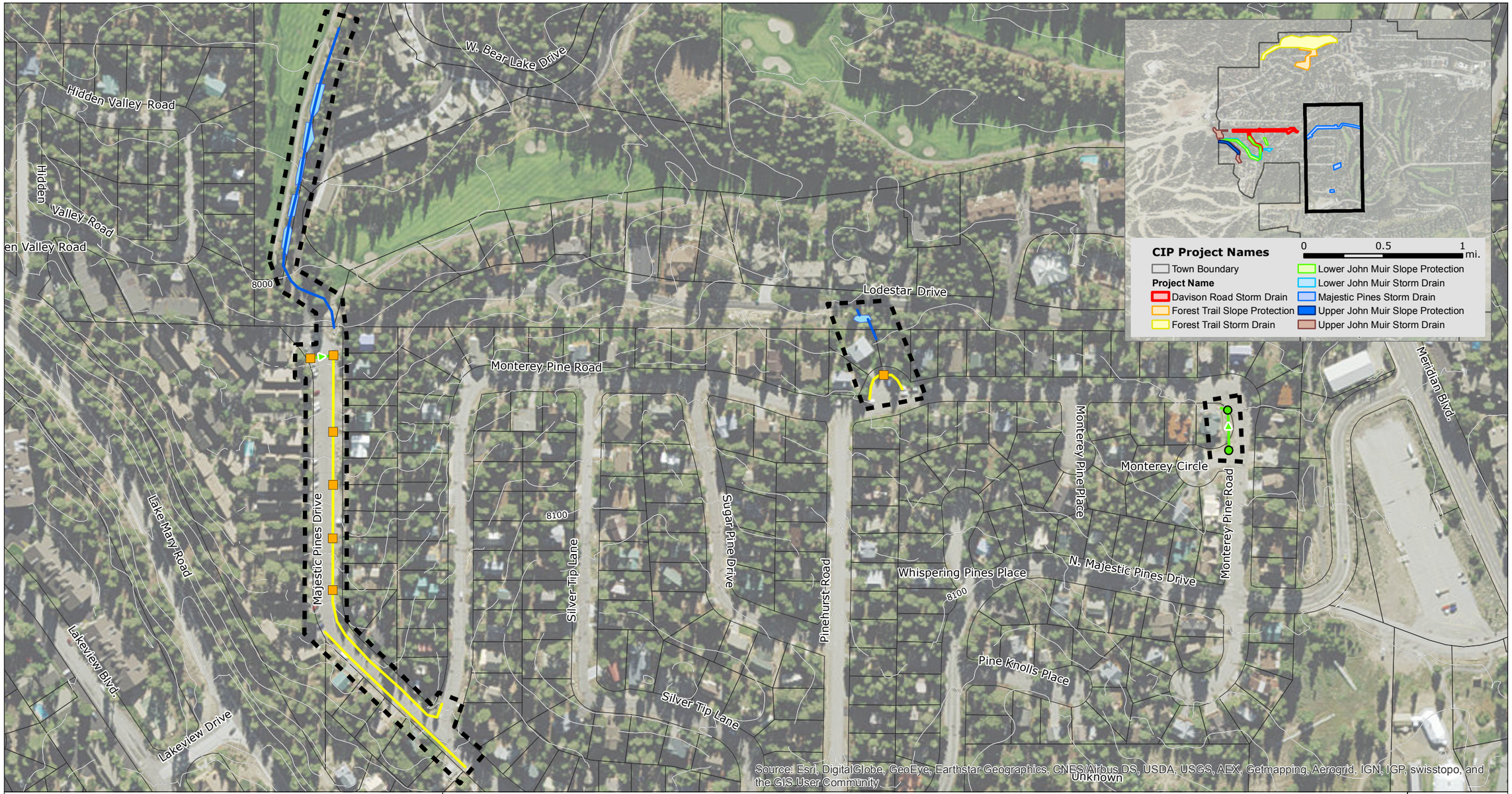
CIP Project: Davison Road Storm Drain

1 in. = 200 ft.
0 200 400 ft.
N

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 5



CIP Project Detail

Project Boundary
Manhole
Inlet
Rock Lined Channel
SD Pipe
Surface Conveyance
Cutslope Protection
Infiltration Basin
Revegetation

1 in. = 300 ft.
0 150 300 ft.

N

Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Majestic Pines Storm Drain

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 6

NCE

Mammoth Lakes CALIFORNIA

CIP Project Detail

Project Boundary
Manhole
Inlet
Rock Lined Channel
SD Pipe
Surface Conveyance
Cutslope Protection
Infiltration Basin
Revegetation

Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Forest Trail Slope Protection

1 in. = 200 ft.
0 200 400 ft.
N

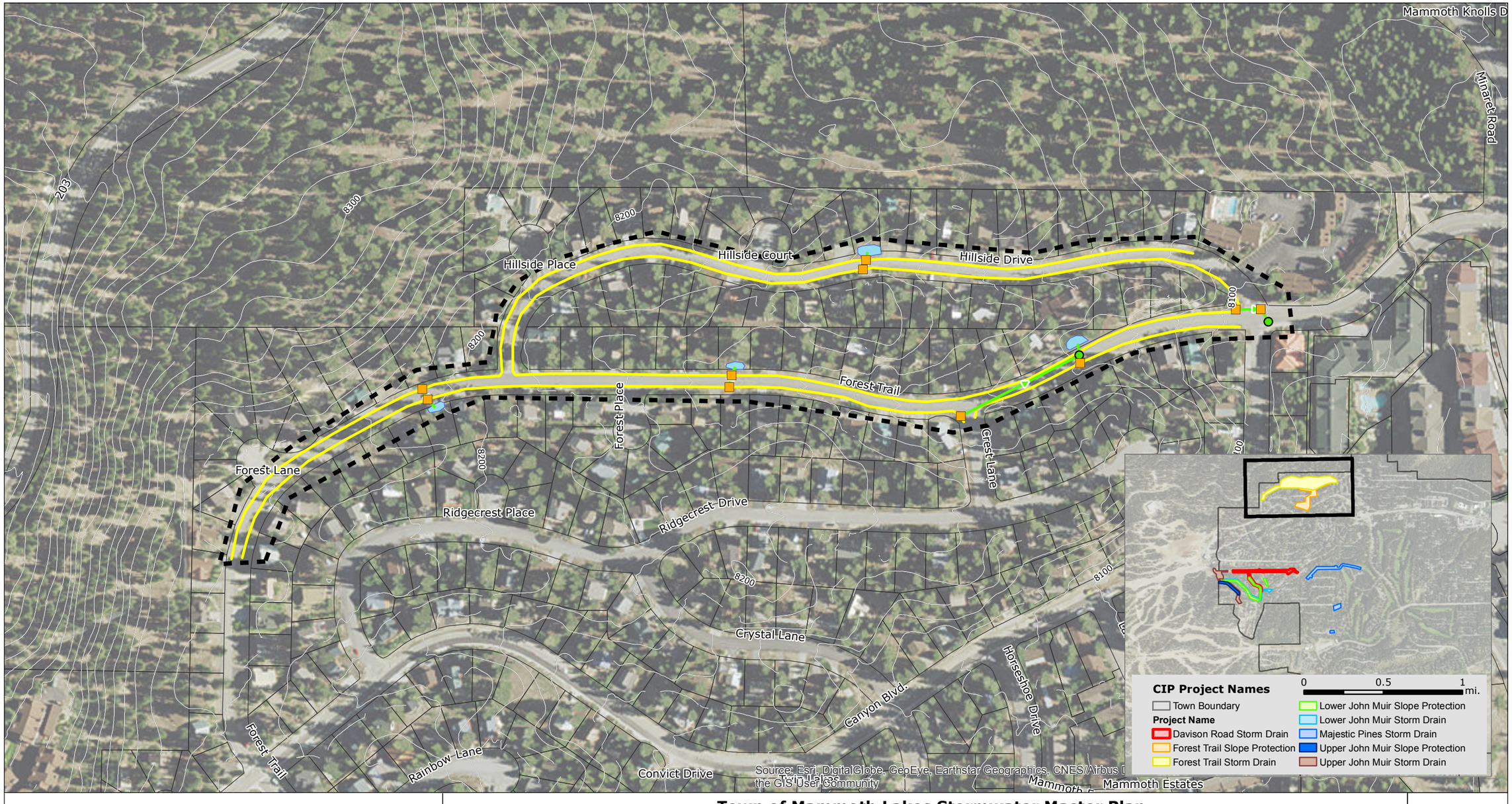
Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 7

NCE

Mammoth Lakes CALIFORNIA



CIP Project Detail

Project Boundary · Manhole · Inlet · Rock Lined Channel · SD Pipe · Surface Conveyance · Cutslope Protection · Infiltration Basin · Revegetation

Town of Mammoth Lakes Stormwater Master Plan

CIP Project: Forest Trail Storm Drain

1 in. = 300 ft.
0 150 300 ft.
N

Credits: ESRI; Town of Mammoth Lakes

Date: 8/31/2015 Author: jhall; mkamerath

Project 8

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Upper John Muir Slope Protection

Project # **1**

Location: John Muir Road between #504 and Timber Ridge Villas

Est. Days Required for Construction: 30

Project Priority Area*: 1

Expected Service Life: 50+ years

Program: Storm Drain Projects

Est. Project Cost: $1,709,000

Est. Annual Maintenance Cost: n/a

Project Description:

Existing cutslope located above the hairpin turn in John Muir Road is severly eroding. The proposed project will protect cutslope from erosion using retaining wall and/or rock slope protection. The slope is very steep, at least 1:1 H:V, and vertical to overhanging in many places. The area requiring mitigation extends horizontally about 35' from the edge of pavement and ranges from 15 to 50 feet in height.

Justification:

Excessive erosion on over-steepened cutslopes results in property loss, safety concerns, high maintenance costs, sediment deposition, and increase in potential flooding in downstream facilities.

Public Benefit:

Protecting erosive cutslopes will reduce sediment collecting in downstream drainage facilities, reducing maintenance needs and potential for flooding issues. The risk of catastrophic slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Constr. Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Cut Slope Protection	SF	30,000	$ 30	$ 900,000	N/A		See Note ◊
General Conditions			12%	$ 108,000			
Construction Contingency			15%	$ 152,000			
Construction Subtotal				**$ 1,160,000**			
Planning, Design, and Permitting			15%	$ 174,000			
ROW/Land Acquisitions	acre	0.75	$ 500,000	$ 375,000			
Project Total				**$ 1,709,000**			

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Upper John Muir Storm Drain

Project # **2**

Location: John Muir Road between #504 and Timber Ridge Villas, and Davison Road between #403 and #445

Project Priority Area*: 1

Program: Storm Drain Projects

Est. Project Cost: $1,508,600

Est. Days Required for Construction: 60

Expected Service Life: 25-50 years

Est. Annual Maintenance Cost: $ 5,000

Project Description:

John Muir Road above the hairpin turn lacks engineered drainage infrastructure. The proposed project would construct surface collection and conveyance (curb and gutter, AC swale, or PCC swale) along the edge of pavement and install inlets and storm drain piping. Detention/infiltration basins would be installed near the western terminus of Davison Road. Storm drain piping and rock lined channel would be installed to direct drainage from John Muir Road and Davison Road to these basins.

Justification:

Uncontrolled drainage from impervious surfaces on Upper John Muir Road causes erosion, increased maintenance costs, sediment deposition, and increased potential for flooding in downstream facilities.

Public Benefit:

An engineered drainage system will reduce erosion and sediment collecting in downstream drainage facilities, reducing maintenance needs and capacity issues. The risk of flooding and slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Surface Conveyance	LF	2,300	$ 45	$ 104,000	N/A		See Note ◊
Storm Drain Pipe	LF	2,000	$ 120	$ 240,000	N/A		See Note ◊
Storm Drain Manhole	EA	9	$ 7,000	$ 63,000	N/A		See Note ◊
Storm Drain Inlet	EA	10	$ 7,500	$ 75,000	$ 100.00	2	$ 2,000
Rock Lined Channel	LF	300	$ 100	$ 30,000	$ 6.00	0.25	$ 450
Detention/Infiltration Basin	SF	4,200	$ 40	$ 168,000	$ 1.20	0.5	$ 2,520
General Conditions			12%	$ 82,000			
Construction Contingency			15%	$ 115,000			
Construction Subtotal				**$ 877,000**			
Planning, Design, and Permitting			15%	$ 131,550			
ROW/Land Acquisitions	acre	1.00	$ 500,000	$ 500,000			
Project Total				**$ 1,508,600**	**Total Annual Maintenance**		**$ 5,000**

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Lower John Muir Slope Protection

Project # **3**

Location: John Muir Road between #32 and #49, and Lee Road opposite Discovery 4 Condos

Est. Days Required for Construction: 60

Project Priority Area*: 1

Expected Service Life: 50+ years

Program: Storm Drain Projects

Est. Project Cost: $1,924,400

Est. Annual Maintenance Cost: n/a

Project Description:

Existing cutslopes at eight (8) locations on John Muir Road and Lee Road are moderately to severly eroding. The proposed project will protect cutslopes from erosion using retaining walls, rock slope protection, and/or revegetation. Slopes vary between 0.5:1 and 2:1 H:V. The areas requiring mitigation extend 20 to 40 feet horizontally from the edge of pavement and range from 10 to 60 feet in height.

Justification:

Excessive erosion on over-steepened cutslopes results in property loss, safety concerns, high maintenance costs, sediment deposition, and increase in potential flooding in downstream facilities.

Public Benefit:

Protecting erosive cutslopes will reduce sediment collecting in downstream drainage facilities, reducing maintenance needs and potential for flooding issues. The risk of catastrophic slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Cut Slope Protection	SF	36,500	$ 30	$ 1,095,000	N/A		See Note ◊
Revegetation	SF	7,000	$ 5	$ 35,000			
General Conditions			12%	$ 136,000			
Construction Contingency			15%	$ 190,000			
Construction Subtotal				**$ 1,456,000**			
Planning, Design, and Permitting			15%	$ 218,400			
ROW/Land Acquisitions	acre	0.50	$ 500,000	$ 250,000			
Project Total				**$ 1,924,400**			

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Lower John Muir Storm Drain

Project # **4**

Location: John Muir Road from hairpin turn to Lake Mary Road

Est. Days Required for Construction: 60

Project Priority Area*: 1

Expected Service Life: 25-50 years

Program: Storm Drain Projects

Est. Project Cost: $951,900

Est. Annual Maintenance Cost: $ 2,900

Project Description:

John Muir Road generally lacks engineered drainage infrastructure. The proposed project would construct surface collection and conveyance (curb and gutter, AC swale, or PCC swale) along the edge of pavement and install inlets and storm drain piping. The proposed storm drain system would connect to the existing 36" storm drain which outfalls to an unprotected slope above Lake Mary Road. The 36" pipe would be extended to the bottom of the slope where a detention/infiltration basin would be installed near the intersection of Lee Road and Lake Mary Road.

Justification:

Uncontrolled drainage from impervious surfaces on John Muir Road causes erosion, high maintenance costs, sediment deposition, and increased potential for flooding in downstream facilities.

Public Benefit:

An engineered drainage system will reduce erosion and sediment collecting in downstream drainage facilities, reducing maintenance needs and capacity issues. The potential for flooding and slope failure will also be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Annual Freq.**	**Annual Maint.**
Surface Conveyance	LF	3,600	$ 45	$ 162,000	N/A		See Note ◊
Storm Drain Pipe	LF	1,600	$ 120	$ 192,000	N/A		See Note ◊
Storm Drain Manhole	EA	6	$ 7,000	$ 42,000	N/A		See Note ◊
Storm Drain Inlet	EA	5	$ 7,500	$ 37,500	$ 100.00	2	$ 1,000
Detention/Infiltration Basin	SF	3,100	$ 40	$ 124,000	$ 1.20	0.5	$ 1,860
General Conditions			12%	$ 67,000			
Construction Contingency			15%	$ 94,000			
Construction Subtotal				**$ 719,000**			
Planning, Design, and Permitting			15%	$ 107,850			
ROW/Land Acquisitions	acre	0.25	$ 500,000	$ 125,000			
Project Total				**$ 951,900**	**Total Annual Maintenance**		**$ 2,900**

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Davison Road Storm Drain

Project # **5**

Location: Davison Road from #362 to Lake Mary Road, and John Muir Road from #113 to Davison Road

Project Priority Area*: 1

Program: Storm Drain Projects

Est. Project Cost: $2,062,900

Est. Days Required for Construction: 60

Expected Service Life: 25-50 years

Est. Annual Maintenance Cost: $ 7,900

Project Description:

Davison Road generally lacks engineered drainage infrastructure. The proposed project would construct surface collection and conveyance (curb and gutter or swale) along the edge of pavement and install inlets and storm drain piping. The proposed SD system would discharge stormwater to detention/infiltration basins to be installed near the intersection of Davison Road and Lake Mary Road. Detention/Infiltration could also be installed in vacant parcels on the north side of Davison Road.

Justification:

Uncontrolled drainage from impervious surfaces on Davison Road causes erosion, high maintenance costs, sediment deposition, and increased potential for flooding in downstream facilities.

Public Benefit:

An engineered drainage system will reduce erosion and sediment collecting in downstream drainage facilities, reducing maintenance needs and drainage issues. The potential for flooding and slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Annual Freq.**	**Annual Maint.**
Surface Conveyance	LF	5,200	$ 45	$ 234,000	N/A		See Note ◊
Storm Drain Pipe	LF	2,300	$ 120	$ 276,000	N/A		See Note ◊
Storm Drain Manhole	EA	9	$ 7,000	$ 63,000	N/A		See Note ◊
Storm Drain Inlet	EA	8	$ 7,500	$ 60,000	$ 100.00	2	$ 1,600
Rock Lined Channel	LF	90	$ 100	$ 9,000	$ 6.00	0.25	$ 135
Detention/Infiltration Basin	SF	10,300	$ 40	$ 412,000	$ 1.20	0.5	$ 6,180
General Conditions			12%	$ 127,000			
Construction Contingency			15%	$ 178,000			
Construction Subtotal				**$ 1,359,000**			
Planning, Design, and Permitting			15%	$ 203,900			
ROW/Land Acquisitions	acre	1.00	$ 500,000	$ 500,000			
Project Total				**$ 2,062,900**	**Total Annual Maintenance**		**$ 7,900**

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Majestic Pines Storm Drain

Project # **6**

Location: Majestic Pines Rd. between #1537 and #1734, Monterey Pine Rd. #331, #343, and #500, and Sierra Star Golf Course

Project Priority Areas*: 3, 4

Program: Storm Drain Projects

Est. Project Cost: $1,324,200

Est. Days Required for Construction: 60

Expected Service Life: 25-50 years

Est. Annual Maintenance Cost: $ 6,200

Project Description:

Majestic Pines Road receives significant offsite flows from upstream development in addition to locally generated runoff. Existing drainage infrastructure requires improvement to adequately convey runoff and entrained sediment. The proposed project would construct curb and gutter or swale along the south side of Majestic Pines Road with inlets directing flows into an existing storm drain pipe. A series of check dams is recommended to create five (5) small infiltration basins along the channel receiving runoff from this system. Improvements are needed on Monterey Pine Road to relieve flooding issues.

Justification:

Drainage improvements on Majestic Pines and Monterey Pines Roads will reduce erosion, high maintenance costs, sediment deposition, and the potential for flooding in downstream facilities.

Public Benefit:

An engineered drainage system will reduce erosion and sediment collecting in downstream drainage facilities, reducing maintenance needs. The potential for flooding and slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Surface Conveyance	LF	1,600	$ 45	$ 72,000	N/A		See Note ◊
Storm Drain Pipe	LF	100	$ 120	$ 12,000	N/A		See Note ◊
Storm Drain Manhole	EA	2	$ 7,000	$ 14,000	N/A		See Note ◊
Storm Drain Inlet	EA	7	$ 7,500	$ 52,500	$ 100.00	2	$ 1,400
Rock Lined Channel	LF	800	$ 100	$ 80,000	$ 6.00	0.25	$ 1,200
Detention/Infiltration Basin	SF	6,000	$ 40	$ 240,000	$ 1.20	0.5	$ 3,600
General Conditions			12%	$ 57,000			
Construction Contingency			15%	$ 80,000			
Construction Subtotal				**$ 608,000**			
Planning, Design, and Permitting			15%	$ 91,200			
ROW/Land Acquisitions	acre	1.25	$ 500,000	$ 625,000			
Project Total				**$ 1,324,200**	**Total Annual Maintenance**		**$ 6,200**

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES

Stormwater Capital Improvement Program

Date: June 2015 Prepared By: NCE

Project Title: Forest Trail Slope Protection

Project # **7**

Location: Forest Trail, Hillside Drive, Crest Lane, and Crystal Lane

Est. Days Required for Construction: 45

Project Priority Area*: 7

Expected Service Life: 50+ years

Program: Storm Drain Projects

Est. Project Cost: $1,360,900

Est. Annual Maintenance Cost:

Project Description:

Existing cutslopes are severly eroding at five (5) locations. The proposed project will protect cutslopes from erosion using retaining walls and/or rock slope protection. Slopes vary between 1:1 and 2:1 H:V. The areas requiring mitigation extend 20 to 40 feet horizontally from the edge of pavement and range from 10 to 30 feet in height.

Justification:

Excessive erosion on over-steepened cutslopes result in property loss, safety concerns, high maintenance costs, sediment deposition, and increase in potential flooding in downstream facilities.

Public Benefit:

Protecting erosive cutslopes will reduce sediment collecting in downstream drainage facilities, reducing maintenance needs and the potential for flooding issues. The risk of catastrophic slope failure will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Cut Slope Protection	SF	25,000	$ 30	$ 750,000	N/A		See Note ◊
General Conditions			12%	$ 90,000			
Construction Contingency			15%	$ 126,000			
Construction Subtotal				**$ 966,000**			
Planning, Design, and Permitting			15%	$ 144,900			
ROW/Land Acquisitions	acre	0.50	$ 500,000	$ 250,000			
Project Total				**$ 1,360,900**			

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

TOWN OF MAMMOTH LAKES
Stormwater Capital Improvement Program

Date: June 2015 — Prepared By: NCE

Project Title: Forest Trail Storm Drain

Project # **8**

Location: Forest Trail between #1705 and Hillside Drive, and Hillside Drive between Forest Trail and Forest Trail

Project Priority Area*: 7

Program: Storm Drain Projects

Est. Project Cost: $1,296,500

Est. Days Required for Construction: 60

Expected Service Life: 25-50 years

Est. Annual Maintenance Cost: $ 4,100

Project Description:

Uncontrolled runoff from impervious surfaces around Hillside Drive and Forest Trail results in erosion and increased potential for flooding downstream. The proposed project will construct surface conveyance along Forest Trail and Hillside Drive with a series of inlets and infiltration/detention facilities designed to reduce peak flows from reaching downstream facilities.

Justification:

Drainage improvements on Forest Trail and Hillside Drive will reduce erosion, high maintenance costs, sediment deposition, and the potential for flooding in downstream facilities.

Public Benefit:

An engineered drainage system will reduce erosion and sediment collecting in downstream drainage facilities, reducing maintenance needs. The potential for flooding will be reduced, improving public safety and preventing property loss.

	CONSTRUCTION COST ESTIMATE				MAINTENANCE COST ESTIMATE		
Item	**Unit**	**Quantity**	**Unit Cost**	**Total**	**Unit Maint. Cost**	**Freq. per year**	**Annual Maint.**
Surface Conveyance	LF	9,000	$ 45	$ 405,000	N/A		See Note ◊
Storm Drain Pipe	LF	600	$ 120	$ 72,000	N/A		See Note ◊
Storm Drain Manhole	EA	2	$ 7,000	$ 14,000	N/A		See Note ◊
Storm Drain Inlet	EA	10	$ 7,500	$ 75,000	$ 100.00	2	$ 2,000
Detention/Infiltration Basin	SF	3,500	$ 40	$ 140,000	$ 1.20	0.5	$ 2,100
General Conditions			12%	$ 85,000			
Construction Contingency			15%	$ 119,000			
Construction Subtotal				**$ 910,000**			
Planning, Design, and Permitting			15%	$ 136,500			
ROW/Land Acquisitions	acre	0.50	$ 500,000	$ 250,000			
Project Total				**$ 1,296,500**	**Total Annual Maintenance**		**$ 4,100**

Notes:

◊ Assuming proper design and construction, maintenance cost should be negligible for these items.

* Refer to Town of Mammoth Lakes Erosion, Drainage, and Flooding Project Existing Conditions Report, prepared by NCE (December 2007), for project priority area description.

STORMWATER OPERATIONS & MAINTENANCE PLAN

APPENDIX

Stormwater Operations & Maintenance Plan
Town of Mammoth Lakes

Prepared for
Town of Mammoth Lakes
P.O. Box 1609
Mammoth Lakes, CA 93546

NCE Project No.: 220.11.14

SECTION I: INTRODUCTION FOR ADMINISTRATIVE STAFF

Purpose

The purpose of the Operations and Maintenance Plan (OMP) is to develop the necessary documentation to guide the inspection, maintenance and tracking of the Town of Mammoth Lakes' (Town) stormwater infrastructure. The OMP is intended to build on processes already in place and deliver an approach that establishes a practical and user-friendly means for effectively managing and operating the Town's stormwater infrastructure.

This OMP will be used by the Public Works, Roads and Maintenance, and Geographic Information System (GIS) Departments. As a result, it is important to establish and document a workflow leveraging the Town's current stormwater GIS, as well as, inspection and maintenance resources. To that end, much of the detailed processes developed and presented in this OMP are a result of input from Public Works staff who are managing this project, the GIS staff who will help to update and manage the stormwater geodatabase, and the inspection and maintenance staff. This input was crucial to understanding the Town's current approach to operations and maintenance (O&M), what resource limitations exist and how the approach to O&M may expand in the future.

Summary of Stormwater Infrastructure GIS Data

Since 2007, a single GIS coordinator and team of GIS staff have collectively managed the GIS resources for Mono County (County) and the Town. This arrangement aims to capitalize on a single point of access for GIS products, ensure consistent data management and leverage GIS resources within each respective entity. Recently, the Town hired a GIS technician to help collect additional stormwater infrastructure attribute data and verify existing data. These updated shapefiles, derived from the County's enterprise geodatabase (GDB), were the basis for a further refinement to the Town's stormwater GDB.

As received, the authoritative stormwater GIS data was stored in a single polyline shapefile entitled "Storm_Drains.shp" containing 954 records. For more effective management, it was determined to convert the geometry of several records (i.e., catch basins, drop inlets). The resulting GDB contains all the existing data migrated into a series of three point feature classes including CollectionDevice, StormFitting and StormStructure, one line feature class entitled Conveyance, and three temporary feature classes (each preceded by an underscore) retained for the Town's review and advisement. The temporary feature classes include _Recommend_Drop, _Curb_Gutters and _Unknown_Type. The Town will handle curbs and gutters as part of a separate effort apart from this project; therefore, this feature class has not been modified from its original state.

Table 1 provides a summary of the Town's stormwater GDB as it currently exists. Attachment 1, an oversized map of the Town, displays all currently known stormwater facilities. The discrepancy between the total count of facilities in the table (962) compared to the original shapefile (954) is due to "exploding" a few multipart features into single part features. The GDB structure, design and associated details are described in **Section III** below.

Table 1. Stormwater Facility Summary

Feature Class	Facility	Count
CollectionDevice	Catch Basin	71
	Drop Inlet	176
	Curb Inlet	4
	Subtotal	***251***
StormFitting	Inlet	5
	Outlet	5
	Subtotal	***10***
StormStructure	Junction Structure	16
	Storm Vault	1
	Detention Basin	1
	Manhole	6
	Other	4
	Subtotal	***28***
Conveyance	Open Channel	135
	Culvert	21
	Storm Drain Pipe	451
	Slotted Drain	9
	Subtotal	***616***
_Recommend_Drop	Bridge	12
	Lake	24
	Tunnel	1
	Subtotal	***37***
_Unknown_Type	CONSPAN	2
	CURB OUTLET STRUCTURE	2
	ENTRANCE STRUCTURE	2
	HEADWALL	2
	REDUCER	1
	RIM	11
	Subtotal	***20***
	TOTAL	962

Current Approach to Operations & Maintenance

Maintenance service areas (**Figure 1**; also see **Attachment 1**) have been established by the Town's maintenance staff to avoid duplicating efforts and structure their maintenance activities by sending crews out to focus on specific communities. These service areas provide an effective means for tracking O&M as described in **Section III** below.

For high elevation communities like the Town, maintenance activities vary depending on the time of year. For example, during the winter months, most of the Town's maintenance staff is focused on snow removal, street sweeping and responding to infrastructure issues such drainage problems, flooding or facilities in need of maintenance. In contrast, during the summer months, maintenance staff is focused on cleaning and maintaining facilities and responding to any issues arising from intense summer thunderstorm activity.

Currently, the Town does not inspect its facilities as part of a formal or planned program. Due to the recurring and numerous high priority maintenance issues within the stormwater infrastructure, facility inspections remain a low priority to staff as their time is consumed with other maintenance activities. As a result, the Town maintenance activities are primarily reactive based on public requests, cleaning out known problem areas following storm events, or responding to flooding or other issues arising periodically.

Maintenance activities are not currently documented in a formal way. Therefore, the Town relies on the institutional knowledge of its maintenance staff to make operational decisions on the maintenance of the stormwater infrastructure. The current methodology limits the Town's ability to be proactive and creates a knowledge-void when staff retires or leaves the Town.

Proposed Approach to Operations & Maintenance

The proposed approach aims to build on the Town's current activities with the added benefit of tracking inspections and maintenance of stormwater infrastructure through time. To establish an effective and efficient process to manage the Town's O&M of stormwater infrastructure, a simple workflow cycle, or feedback loop, is recommended (described in detail in Section III).

To briefly summarize the recommended approach, the Town's facilities first need to be examined by a qualified Inspector. The Inspector will fill out hard copy inspection forms providing information on maintenance needs of particular stormwater facilities. Inspection forms are then provided to qualified GIS staff, where inspection data is entered into a GIS database and subsequent hard copy work order forms are generated. Next, these work order forms are given to O&M staff describing the maintenance requirements of particular stormwater facilities. Maintenance is performed and required information on the work order form is filled out. Finally, work order forms are given back to GIS staff to input the maintenance information into the GIS database, which closes the workflow cycle. The workflow cycle begins again when inspections are performed.

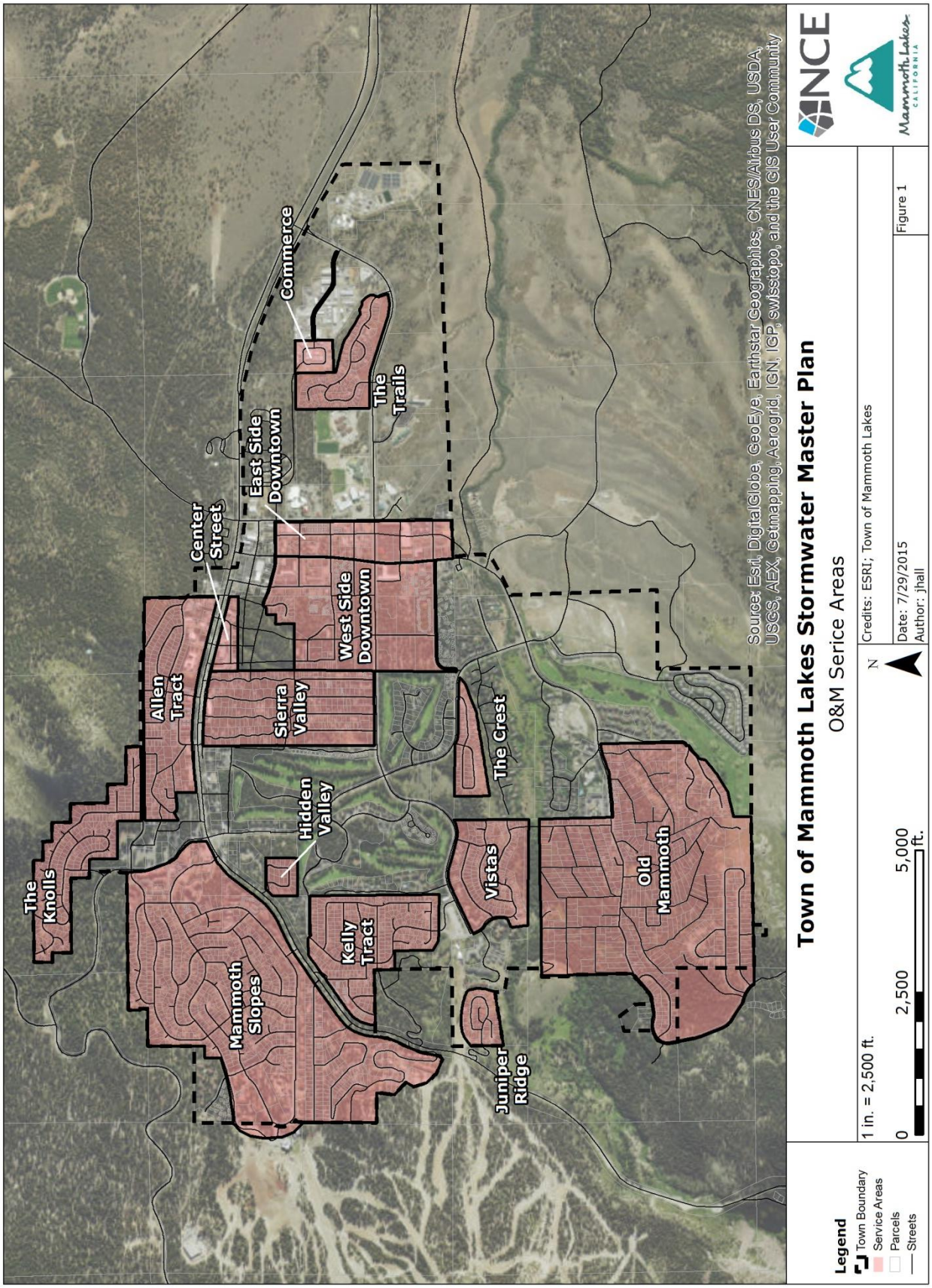


Figure 1. O&M Service Areas.

SECTION II: OPERATIONS & MAINTENANCE DETAILS FOR O&M STAFF

The specific details for operating and maintaining the Town's stormwater infrastructure are summarized in **Table 2** and detailed in the following sub-sections. Provided below are facility descriptions including sample photograph(s) of each facility type, general descriptions of each facility and specific items to focus on during inspections. To better outline inspection needs, the recommended inspection frequency, typical maintenance activity and equipment required are described. Collected information will be used to guide inspection and maintenance staff in conducting their work and will orient new staff to the Town's approach when operating and maintaining their stormwater infrastructure.

Industry maintenance standards established within O'Brien et al. (2014), the *Stormwater Management Manual for Western Washington, Volume V: Runoff Treatment BMPs*, prepared by the Washington State Department of Ecology Water Quality Program. Section 4.6 and Table 4.5.2 of this manual (referred to hereafter as the Western Washington Manual), can be found in Attachment 2. This information guided the maintenance standards prepared for the Town's OMP, detailed below.

Table 2. Town of Mammoth Lakes, CA Stormwater Infrastructure Maintenance Recommendations.

Storm Water Facility	Description	Visual Inspection	Frequency	Maintenance	Equipment
Drop Inlets & Catch Basins	Drop inlets are a point of entry for stormwater to enter into stormwater infrastructure. They are located away from curb and gutter, generally found in low spots, and are covered by a grate or slotted manhole. Catch basins are located in-line with curb and gutter and may include a sump to capture sediment, debris, and pollutants.	Check drop inlet and catch basin grates to ensure sediment or trash are not blocking flow, check for adequate sump capacity, and ensure grates are in place and are not damaged to the point being unsafe.	Twice annually (Spring and Fall) and after significant storm events.	Remove any sediment and/or trash as needed and repair or replace grates to ensure proper working order.	Hand crew and/or vactor truck
Culverts & Inlet/Outlet Structures	A culvert is a conduit such as a pipe or concrete box structure which drains open channels, swales, or ditches under a roadway or embankment. Catch basins or manholes are typically absent along the entire length of the culvert. Culvert size and material will vary depending on the function of the culvert. Shapes can include round, elliptical, flat-bottomed, arch pipe, and box. Culvert materials may include steel, precast concrete, or polymer. Hybrid designs are also common which combine two or more materials.	Check culverts for debris that would limit the capacity of the culvert, and verify that inlet/outlet structures are in place, not eroding, and properly convey stormwater into/out of the culverts. A good rule of thumb is to clean culverts/inlets/outlets if 30% of the flow capacity is blocked.	Twice annually (Spring and Fall) and after significant storm events.	Jet debris out of culvert and remove, re-grade if necessary. Fill eroded area and repair if needed.	Vactor truck, handwork, or backhoe.
Curb & Gutter	Curb and gutter are two elements of a single physical feature designed to convey runoff from impervious surfaces such as streets, driveways or parking lots to the stormwater infrastructure via catch basins or other collection devices. Curb and gutter are found where the unraised roadway or street meets the raised pavement, sidewalk, footpath, road median, or road shoulder. Basic curb can be designed without a gutter, be rolled traversable or a barrier with both a curb and gutter, or be constructed integrally as a part of the concrete pavement.	Check curb/gutters for debris buildup, check for breakdown of curb, and check for erosion behind curb if placed at base of dirt cut slope.	Twice annually (Spring and Fall) and after significant storm events.	Clear debris from curb/gutter as necessary.	Varies, but may include brooms or street sweeper, handwork, or backhoe.
Storm Drain	Storm drain pipes are primary conveyance elements of the stormwater infrastructure. This network conveys stormwater runoff from points of entry at catch basins, curb inlets, or drop inlets to treatment facilities or detention facilities and eventually to the outfall. Storm drain pipes, unlike culverts, will typically be connected to the stormwater infrastructure through catch basins or other collection devices. These features are designed to convey stormwater from source areas to the outfall and not simply convey water under another feature such as a road (culvert). The shape of storm drain pipes varies and can include rectangular, square, oval, or circular.	Check storm drain pipes for debris buildup and check capacity of the storm drain. When possible identify any root intrusion from adjacent trees. This type of inspection may be limited by how far into the inlet and outlet one can view with a flashlight. If significant pipe damage is suspected, videoing the system may be needed.	Twice annually (Spring and Fall) and after significant storm events.	Jet/Vacuum debris out of storm drain pipe and if storm drain capacity is frequently exceeded contact the engineering department.	Varies, but may include vactor truck.
Dry Wells & Infiltration Galleries	A dry well, infiltration gallery, or basin is a shallow impoundment designed to infiltrate stormwater into the soil by achieving reduced peak flows, event volumes and removing pollutants. These facilities may have an outlet riser, but most of the infiltrated water will drain into the soil or through an under drain pipe. Therefore, minimal flow is expected to leave these basins or galleries. Vegetation will not be a primary component of the basin because water is temporarily impounded.	Check dry wells and infiltration galleries for sediment or trash buildup limiting capacity, particularly at the entry point. In addition, these facilities should not have standing water for excessive periods of time following storm events. For each specific facility, the design storm volume (e.g., volume of water the facility is designed to infiltrate without bypass) should infiltrate within 48 hours of a storm event (refer to the Western Washington Manual; Attachment 2).	Twice annually (Spring and Fall) and after significant storm events.	Remove any sediment and trash and ensure facilities is meeting design standards for drawdown time.	Vactor truck or hand crew with shovels.
Sand/Oil Separators & Water Quality Treatment Vaults	These facilities are typically located underground or under pavement and provide stormwater treatment through physical detention, separation, screening, and settling. Numerous proprietary units are available. These vaults are constructed from concrete, steel, or plastic materials and can be identified by pulling manhole covers.	Pull lids and visually check for sediment buildup in bottom of unit to ensure nothing is blocking proper operation of the unit. This may be accomplished using a rod to estimate sediment or water depth. In some cases, facilities are designed to have standing water and it may be advantageous to install reflective tape along the wall of the unit to visually determine water and sediment depth. A quick visual flashlight inspection can save valuable inspection time.	Twice annually (Spring and Fall) and after significant storm events.	Remove any sediment and trash in order to remove blockage. Follow manufacture recommended maintenance.	Vactor truck or by hand. Follow appropriate confined entry regulations.
Detention & Retention Basins	Detention basins are designed to detain stormwater runoff for some given period of time and to allow stormwater pollutants to settle; however, these features are not typically used for primary water quality treatment. Retention basins may include a permanent impoundment or pool of water, even during non-event conditions. Additional stormwater runoff may be temporarily stored above this permanent depth for storm or flood control purposes.	Please refer to the Western Washington Manual (see Attachment 2).			
Open Channels or Earthen Ditches	Open channels and earthen ditches are conveyance structures designed to intercept, divert, and convey surface runoff. Earthen ditches can be found below steep grades where runoff begins to concentrate, along roadways for flood drainage, at the top of slopes to divert runoff from adjacent or undisturbed slopes, or at the bottom and at mid-slope to intercept sheet flow and convey concentrated flows.	Check to see if debris, garbage, snow or ice is blocking drainage channel.	Twice annually (Spring and Fall) and after significant storm events.	Remove debris, garbage, ice and snow, especially when flow is impeded.	Backhoe and hand crew.

Drop Inlets & Catch Basins

Figure 2. Catch basin (left) and drop inlet (right) examples.

Description: Drop inlets are a point of entry for stormwater to enter into stormwater infrastructure. They are located away from curb and gutter, generally found in low spots, and are covered by a grate or slotted manhole. Catch basins are located in-line with curb and gutter and may include a sump to capture sediment, debris, and pollutants.

Visual Inspection: Check drop inlet and catch basin grates to ensure sediment or trash are not blocking flow, check for adequate sump capacity and ensure grates are in place and are not damaged to the point of being unsafe.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Remove any sediment and/or trash as needed and repair or replace grates to ensure proper working order.

Equipment: Hand crew and/or vactor truck.

Culverts & Inlet/Outlet Structures


Figure 3. Box culvert (left) and arch pipe (right) examples

Description: A culvert is a conduit such as a pipe or concrete box structure draining into open channels, swales, or ditches under a roadway or embankment. Catch basins or manholes are typically absent along the entire length of the culvert. Culvert size and material will vary depending on the function of the culvert. Shapes can include round, elliptical, flat-bottomed, arch pipe and box. Culvert materials may include steel, precast concrete, or polymer. Hybrid designs, which combine two or more materials, are also common.

Visual Inspection: Check culverts for debris that would limit the capacity of the culvert, verify inlet/outlet structures are in place, not eroding, and properly convey stormwater into/out of the culverts. A good rule of thumb is to clean culverts/inlets/outlets if 30% of the flow capacity is blocked.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Jet debris out of culvert and remove material, re-grade if necessary. Fill eroded area and repair if needed.

Equipment: Vactor truck, handwork, or backhoe.

Curb & Gutter

Figure 4. Curb and gutter examples

Description: Curb and gutter are two elements of a single physical feature designed to convey runoff from impervious surfaces such as streets, driveways or parking lots to the stormwater infrastructure via catch basins or other collection devices. Curb and gutter are found where the unraised roadway or street meets the raised pavement, sidewalk, footpath, road median, or road shoulder. Basic curb can be designed without a gutter, be rolled traversable or a barrier with both a curb and gutter, or be constructed integrally as a part of the concrete pavement.

Visual Inspection: Check curb/gutters for debris buildup, check for breakdown of curb and check for erosion behind curb if placed at base of dirt cut slope.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Clear debris from curb/gutter as necessary.

Equipment: Varies, but may include brooms or street sweeper, handwork, or backhoe.

Storm Drain

Figure 5. Storm drain examples

Description: Storm drain pipes are primary conveyance elements of the stormwater infrastructure. This network conveys stormwater runoff from points of entry at catch basins, curb inlets, or drop inlets to treatment facilities or detention facilities and eventually to the outfall. Storm drain pipes, unlike culverts, will typically be connected to the stormwater infrastructure through catch basins or other collection devices. These features are designed to convey stormwater from source areas to the outfall and not simply convey water under another feature such as a road (culvert). The shape of storm drain pipes varies and can include rectangular, square, oval, or circular. Within the Mammoth Lakes Storm Drainage and Erosion Control Design Manual (Brown and Caldwell and Triad Engineering 1984:2-7 – 2-12), design specifications for storm drainage, pipes, channels, and culverts are identified.

Visual Inspection: Check storm drain pipes for debris buildup and check capacity of the storm drain. When possible identify any root intrusion from adjacent trees. This type of inspection may be limited by how far into the inlet and outlet one can view with a flashlight. If significant pipe damage is suspected, videoing the system may be needed.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Jet/Vacuum debris out of storm drain pipe. If storm drain capacity is frequently exceeded, contact the Engineering Department.

Equipment: Varies, but may include vactor truck.

Dry Wells & Infiltration Galleries

Figure 6. Infiltration facility example

Description: A dry well, infiltration gallery, or basin is a shallow impoundment designed to infiltrate stormwater into the soil by achieving reduced peak flows, event volumes and removing pollutants. These facilities may have an outlet riser, but most of the infiltrated water will drain into the soil or through an under drain pipe. Therefore, minimal flow is expected to leave these basins or galleries. Vegetation will not be a primary component of the basin because water is temporarily impounded.

Visual Inspection: Check dry wells and infiltration galleries for sediment or trash buildup limiting capacity, particularly at the entry point. In addition, these facilities should not have standing water for excessive periods of time following storm events. For each specific facility, the design storm volume (e.g., volume of water the facility is designed to infiltrate without bypass) should infiltrate within 48 hours of a storm event (refer to the Western Washington Manual; Attachment 2).

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Remove any sediment and trash. Ensure facilities are meeting design standards for drawdown time.

Equipment: Vactor truck or hand crew with shovels.

Sand/Oil Separators & Water Quality Treatment Vaults


Figure 7. Treatment vault examples

Description: These facilities are typically located underground or under pavement and provide stormwater treatment through physical detention, separation, screening and settling. Numerous proprietary units are available. These vaults are constructed from concrete, steel, or plastic materials and can be identified by pulling manhole covers.

Visual Inspection: Pull lids and visually check for sediment buildup in bottom of unit to ensure nothing is blocking proper operation of the unit. This may be accomplished using a rod to estimate sediment or water depth. In some cases, facilities are designed to have standing water and it may be advantageous to install reflective tape along the wall of the unit to visually determine water and sediment depth. A quick visual flashlight inspection can save valuable inspection time.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Remove any sediment and trash to remove blockage. Follow the Manufacturer's recommended maintenance procedures.

Equipment: Vactor truck or by hand. Follow appropriate confined entry regulations.

Detention & Retention Basins


Figure 8. Detention basin (left) and retention basin (right) examples

Description: Detention basins are designed to detain stormwater runoff for some given period of time and to allow stormwater pollutants to settle; however, these features are not typically used for primary water quality treatment. These basins can be designed to provide flood control by allowing for additional stormwater storage. Identifying features for detention basins may include the presence of a fore bay, an irregular shape (maximized flow path), trash rack, a standpipe, or other outlet feature. Vegetation may be present, but because these features are dry except during and immediately after storm events, they may not sustain substantial vegetation growth depending on soil and climate conditions.

Retention basins may include a permanent impoundment or pool of water, even during non-event conditions. Additional stormwater runoff may be temporarily stored above this permanent depth for storm or flood control purposes. Retention basins retain and do not discharge water except during emergency high flows. Because of the permanent water source, vegetation should be present along the perimeter and possibly within the basin. Retention basins may also include a fore bay, vegetated buffer and riser for a controlled discharge during flood events.

Visual Inspection: Refer to the Western Washington Manual (see Attachment 2).

Inspection Frequency: Refer to the Western Washington Manual (see Attachment 2).

Maintenance: Refer to the Western Washington Manual (see Attachment 2).

Equipment: Refer to the Western Washington Manual (see Attachment 2).

Open Channels or Earthen Ditches

Figure 9. Earthen ditch example

Description: Open channels and earthen ditches are conveyance structures designed to intercept, divert and convey surface runoff. Earthen ditches can be found below steep grades where runoff begins to concentrate, along roadways for flood drainage, at the top of slopes to divert runoff from adjacent or undisturbed slopes, or at the bottom and at mid-slope to intercept sheet flow and convey concentrated flows.

Visual Inspection: Check to see if debris, garbage, snow or ice is blocking drainage channel.

Inspection Frequency: Twice annually (Spring and Fall) and after significant storm events.

Maintenance: Remove debris, garbage, ice and snow, especially when flow is impeded.

Equipment: Backhoe and hand crew.

SECTION III: INSPECTION & WORK ORDER PROCESS FOR GIS STAFF

Introduction

To establish an effective and efficient process for O&M of stormwater infrastructure in the Town, a simple workflow cycle (or feedback loop) requiring four steps is necessary (**Figure 10**). In Step 1, the Town's facilities need to be examined by a qualified Inspector. The Inspector fills out hard copy ***Inspection Forms*** providing information pertaining to the maintenance needs of particular stormwater facilities. In Step 2, inspection forms are provided to qualified GIS staff, where inspection data is entered into the geodatabase and subsequent hard copy ***Work Order Forms*** are generated. For Step 3, the work order forms are given to O&M staff describing the maintenance requirements of particular stormwater facilities. Maintenance is performed on stormwater facilities and required information on the work order form is filled out. Finally, in Step 4, work order forms are given back to GIS staff to input the maintenance information into the geodatabase, whereby the work order is then closed. The workflow cycle begins again when inspections are performed.

Figure 10. O&M workflow cycle.

The geodatabase (GDB) is the foundation of the O&M workflow described above. Before a more detailed description of the workflow can be presented, a description is provided of how the GDB is organized and the different components of the GDB.

Geodatabase Design

The provided file GDB, entitled "Stormwater_Infrastructure.gdb", is derived from existing data originally stored in the Mono County enterprise GDB, converted to shapefile, and presumably manipulated or edited in some fashion. As such, NCE treated the shapefiles as authoritative. The new GDB is configured with feature classes and subtypes, attribute domains, relationship classes and a table of work orders. The delivered file GDB will be integrated back into the County's enterprise GDB for subsequent management.

Feature Classes and Subtypes

Existing data was migrated to one of four feature classes including CollectionDevice (point), Conveyance (line), StormFitting (point) and StormStructures (point). Administrative feature classes included in the GDB include Mammoth_Sub_Basins, Municipal_Boundaries and Service_Areas. Several fields were retained for the Town's complete review of new and existing data. **Table 3** outlines the associated fields for the stormwater infrastructure feature classes.

Table 3. Stormwater Infrastructure Feature Class Fields and Subtypes.

Field Name	Data Type	Length	Domain	Description
OBJECTID	Object ID			
Shape	Geometry			
RIMEL	Double		Dimension	Rim Elevation - retained from the original data
INVIN	Double		Dimension	Invert In - retained from the original data
INVIN2	Double		Dimension	Invert In 2 - retained from the original data
INVOUT	Double		Dimension	Invert Out - retained from the original data
COMMENT	Text	254		Retained from the original data
UniqueID	Text	7		Unique identifer for each storm water facility
LegacyID	Long			Old unique identifier. Retained from the original data but no longer used.
Subtype	Long			The field contains defined subtypes for each feature class
CD_Type				Collection Device Subtypes: Catch Basin (CB) Drop Inlet (DI) Curb Inlet (CI) Curb Cut (CC) Other (OCD)
CV_Type				Conveyance Subtypes: Open Channel (OC) Culvert (CU) Earthen Ditch (ED) Curb Gutter (CG) Storm Drain Pipe (PI) Swale (SW) Slotted Drain (SD) Other (OCV)
SF_Type				Storm Fitting Subtypes: Outfall (OF) Inlet (IN) Outlet (OUT) Other (OSF)
SS_Type				Storm Structure Subtypes: Manhole (MH) Detention Basin (DB) Storm Vault (SV) Junction Structure (JS) Other (OSS)
TYPE	Text	254		Storm drain feature type. Retained from the original data.
Material	Text	50	Material	Material type (new control through domain values)
Material2	Text	50		Material type - retained from the original data (inconsistent)
DataSource	Text	50	DataSource	Source of the data (existing vs. new). Currently all have been calculated as "Existing".
FlowStatus	Text	50	FlowStatus	Status of the flow when recorded or inspected. Currently blank. May need to move to the Work Orders table as this could have multiple values over time.
FlowDirection	Short		FlowDirection	Direction as bearing in degrees of flow. Currently blank.
Depth	Double		Dimension	Depth of feature. Pertains to collection device, storm structure, and conveyance. Currently blank.
Diameter	Double		Dimension	Diameter of feature. Pertains to storm fitting. Currently blank.
Length	Double		Dimension	Length of feature. Pertains to storm fitting and storm structure. Currently blank.
Width	Double		Dimension	Width of feature. Pertains to storm fitting, storm structure, and conveyance. Currently blank.
Shape_Length	Double			Auto-generated length field for line geometries. Pertains to conveyance.
SeqNbr	Short			Sequential number for each feature subtype

Several temporary feature classes, preceded by an underscore have been retained for the Town's review before deletion or integration with a different feature class. Based on NCE's understanding, the "_Curb_Gutters" feature class is not part of this project and will be dealt with as part of a separate effort. The "_Recommend_Drop" feature class contains records that are not considered a stormwater facility like a lake or a bridge. These records should be retained, but not within one of the main stormwater infrastructure feature types. The records within the "_Unknown_Type" feature class can likely be integrated with one of the four main feature types, but before doing so, guidance from the Town is required.

Attribute Domains

To establish data input control and validation, several attribute domains have been created for the GDB. **Table 4** outlines pertinent information for each domain – name, properties, assignment, and associated values.

Relationship Classes

To facilitate ease of data acquisition, a relationship class has been created between each feature class and the work orders table (described below in the Work Order Generation section). **Table 5** provides the relationship class properties established.

The primary properties of concern are the relationship class type and the cardinality. In order to create multiple relationship classes using a single source for the destination object class (work orders table), a simple type was used. A simple relationship class means that related objects can exist independently of one another. For example, if a table record for Unique ID CB-0001 is deleted, the feature class record for that catch basin is not affected (not deleted). The opposite is also true; table records remain intact if a feature class record is deleted.

Cardinality is a data modeling term that defines record relationships, that is, "one-to-one", "one-to-many", or "many-to-many". For this data structure, a one-to-many relationship was created between the origin object (the feature class) and the destination object (the work orders table). As such, many records can exist in the work orders table that are tied to the feature class record.

Workflow Cycle

Step 1 – Facility Inspection

To initiate the workflow, the Town intends to hire an Inspector to collect baseline stormwater infrastructure data. Ideally, this person will have knowledge of the system's history and associated issues to optimize the inspection process with well-informed and subsequent work orders. As requested by the Town, a paper-based approach was developed to track inspection and maintenance activities. In the future, this method will be replaced with a data collection method using mobile devices and applications capable of collecting spatial and attribute information. The fields on the paper form will help develop a future mobile application.

Until mobile devices are used to collect stormwater infrastructure data, the provided paper form must be coupled with a map to locate stormwater facilities. A map book is provided

with gridded index sheets dividing up the urban extent of the Town, as well as, individual service areas (Attachment 3).

Table 4. Geodatabase Attribute Domains.

Domain Name	Description	Type	Assignment	Values
DataSource	Source of the data	Text	Storm drain feature classes*	Existing New Other
Dimension	Storm drain feature dimension (decimal feet)	Number	Storm drain feature classes	No limitation
FeatureType	Storm drain feature type (same as subtype)	Text	Work Orders table	Catch Basin Culvert Curb Cut Curb Gutter Curb Inlet Detention Basin Drop Inlet Earthen Ditch Inlet Junction Structure Manhole Open Channel Outfall Outlet Slotted Drain Storm Drain Pipe Storm Vault Swale Other
FlowDirection	Flow direction (bearing in degrees) of storm drain discharge	Number	Storm drain feature classes	0-360
FlowStatus	Flow status at the time of recording	Text	Storm drain feature classes	Dry Weather Flow Wet Weather Flow No Flow Perennial Flow Unknown Other
MaintenanceCode	Maintenance type code	Text	Work Orders table	01 - Accumulated Sediment 02 - Accumulated Trash 03 - Accumulated Debris 04 - Vegetation Concerns 05- Water Quality Concerns 06 - Impeded Water Flow 07 - Erosion Concerns 08 - Structural Repairs Needed 09 - Cover/Frame/Grate Issues 10 - Damaged Pipes 11 - Mosquito Breeding 12 - Could Not Locate 13 - Access Issue OTR - Other
MaintenancePerformed	Maintenance performed according to inspection	Text	Work Orders table	Cleaned Repaired Replaced Other
Material	Material type of storm drain feature	Text	Storm drain feature classes	Asphalt Concrete Asbestos Clay Pipe Brick Corrugated Metal Pipe

Table 4. Continued.

Domain Name	Description	Type	Assignment	Values
				High Density Polyethylene
				Iron
				Plastic (general)
				Polyvinyl Chloride
				Rock
				Reinforced Concrete Pipe
				Steel
				Vitrified Clay Pipe
				Wood
				Concrete
				Earthen
				Unknown
				Other
ServiceArea	O&M service areas	Text	Work Orders table	Allen Tract
				Center Street
				Commerce
				East Side Downtown
				Hidden Valley
				Juniper Ridge
				Kelly Tract
				Mammoth Slopes
				Old Mammoth
				Sierra Valley
				The Crest
				The Knolls
				The Trails
				Vistas
				West Side Downtown
				Other
Status	Work order status	Text	Work Orders table	Open
				Closed
YesNo	Yes or No	Text	Work Orders table	Yes
				No

* Stormwater Feature Classes: CollectionDevice, Conveyance, StormFitting, and StormStructures.

Table 5. Relationship Class Properties

Property Name	Property Value	Comment
Name	**Feature class name*_WorkOrders	e.g., CollectionDevice_WorkOrders
Origin object class	**Feature class name**	CollectionDevice, Conveyance, StormFitting, StormStructure
Destination object class	Work_Orders (table)	
Type	Simple	Related feature class and table records exist independently (deleting one does not affect the other). Composite type not possible in this setup.
Forward Path Label	Work_Orders (table)	
Backward Path Label	**Feature class name**	CollectionDevice, Conveyance, StormFitting, StormStructure
Message Propagation	None	
Cardinality	one to many	One feature class record can be related to many work order records for a particular UniqueID
Has attributes	No	
Origin Primary Key	UniqueID	
Origin Foreign Key	UniqueID	

The map book is limited due to the nature of the existing data. To provide labels for visible features (i.e., not underground), it was determined to not label linear conveyance features such as pipes or channels. Only point features (collection devices, storm fittings and storm structures) are labeled. If during inspection, an issue is observed for a linear feature, the issue will be noted by referencing an adjacent point feature. For example, if during the inspection of catch basin CB-0001, it is observed that the inlet pipe is damaged, then the inspector will note, "inlet pipe damaged" in the notes entry for CB-0001.

The inspection form (Attachment 4) has six fields requiring entry for each stormwater facility inspected including: Unique ID, Feature Type, Priority Feature, Maintenance Required, Photo and Notes. In addition, Date and Inspector Initials, located at the top of the form, require entry for effective tracking.

Unique ID

The prefix (e.g., CB) is a feature subtype abbreviation and the suffix is a four digit sequential number. It should be noted that leading zeros (0001) are required for proper tabular sorting. See **Table 3** for the list of feature subtype abbreviations used in the Unique ID prefix.

Feature Type

The Unique ID field is the link between the paper form and the spatial data retained in the GIS, becoming the single-most important attribute collected. To avoid typological and illegibility issues, the Feature Type field is intended as a check against the Unique ID prefix. As such, a Unique ID prefaced with "CB" should correspond with a Feature Type entry of "Catch Basin". Entry in

this field will be most effective if the subtype is spelled out (Catch Basin) rather than just repeating the abbreviation from the Unique ID (CB).

Priority Feature

Entry in this field requires a simple yes or no. This field is envisioned to be used in one of two ways: 1) to denote historically problematic features, or 2) to call attention to features requiring immediate service due to damage, completely clogged, etc. If the former option is chosen, it is recommended to conduct inspection utilizing an experienced O&M staff person who has knowledge of the problem spots in the Town's stormwater infrastructure. If the latter option is used, entry is more dynamic and can double as another tracking mechanism to identify features requiring frequent maintenance.

Maintenance Required

Part of the inspection process is to assess the condition of each stormwater facility to provide a protocol for subsequent work orders informing the O&M worker what needs to be accomplished for each facility. See **Table 4** for the current maintenance codes. These codes are provided as a starting place; this list should not be considered final. Redundancies should be removed and additional maintenance activities should be added to the list of codes.

Photo

The collection of photos for stormwater facilities is a useful analytical tool. Photos assist in training, comparison with other facilities, or visual assessment of structural integrity over time. Photographic records shall be taken during the initial or "bench-marking" inspection and at each instance the facility requires maintenance. Regardless of the interval at which photos are taken, photo collection will be implemented into the inspection and work order workflow.

Effective management of photos will be streamlined when mobile device collection is in place. Until such time, the following process is recommended to manage photos with the paper-based approach:

- When a photo is taken, it should be emailed (or otherwise transferred) to the GIS specialist with the Unique ID in the subject line.
- The GIS specialist responsible for data management should set up a file naming and storage convention to link photos to spatial data. For example, when a photo of CB-0001 is emailed, the GIS specialist could save the photo in an "Inspection Photos" folder and rename it using a concatenation of the date, the Unique ID and an "i" suffix for inspection (the thought being that a maintenance photo could occur on the same day). In this case, the file would be renamed "CB-0001_20150505_i.jpg" or "20150505_CB-0001_i.jpg".

Notes

The notes field is important and O&M staff will be encouraged to use it in order to provide additional observations not covered by the other fields in the form. In other instances, notes that become consistent entries could drive future versions of the form. For example, the addition of check boxes or additional fields may be more efficient than repeatedly recording the same note. Currently, the field is intended to capture information pertaining to the required maintenance and/or photo details.

Step 2 – Work Order Generation

Work orders are built off inspection data, whether the data is collected using a mobile device or a paper form, the data must be integrated into the "Work_Orders" table residing in the GDB. The work order table contains all the inspection fields plus fields associated with work order execution, as described below. To generate a work order, the GIS specialist is responsible for entering data provided on the inspection form (described above) plus one additional attribute – Service Area (important for selection purposes). All fields with a limited set of attributes are controlled through attribute domains; these fields can be entered individually from associated picklists or in batch using field calculation. **Table 6** lists and describes all the fields within the work order table.

When a new record is created in the work order table resulting from an inspection, the Status entry is defaulted to "Open". Once a feature has been serviced and the work order returned to the GIS specialist, the status is changed to "Closed". The actual work order form is generated by running a report in ArcMap using the provided report layout file (WorkOrder_Report.rlf). Attachment 5 provides an example output of the work order form generated. This report layout file only contains the information necessary for O&M staff to perform the required maintenance of particular facilities. An example form is attached. The first half of the information on the form is derived from the inspection and the second half (blank fields) requires hand entry by the O&M technician performing the maintenance.

Work orders can be generated several ways, through definition query (e.g., "Status" = 'Open', "ServiceArea" = 'The Crest', or "PriorityFeat" = 'Y') or by selecting feature class records and displaying the related records in the work order table. After the application of a given definition query or record selection, the work order form is generated by running the report. In ArcMap, go to View > Reports > Run Report > browse to the RLF file > the report view opens > Print.

Table 6. Work Orders Table Fields.

Field Name	Data Type	Length	Domain Name	Associated Form	Description
OBJECTID (alias WorkOrder)	Object ID				This field is auto-incremented and could potentially be used for tracking other than with Unique ID
UniqueID	Text	7		Inspection	Unique identifer for each storm water facility
Status	Text	6	Status	Inspection	Status of the work order. Open upon inspection data entry, closed upon maintenance data entry
FeatType	Text	20	FeatureType	Inspection	Facility subtype. Used as a check with the Unique ID prefix for possible typos and illegible handwriting
ServiceArea	Text	20	ServiceArea	Inspection	The service area that the facility is located. Use "Other" if the feature is outside a defined service area
PriorityFeat	Text	6	YesNo	Inspection	Enter Y if the feature is known to have issues after a storm event or commonly requires additional attention
Inspect_Ini	Text	15		Inspection	Initials of the inspector
InspectDate	Date			Inspection	Inspection date
InspectPhoto	Text	6		Inspection	Photo of facility during inspection (email photo to GIS specialist)
MaintCode	Text	50	MaintenanceCode	Inspection, Work Order	Maintenance required code
InspectNotes	Text	254		Inspection	Additional notes from inspection - maintenance required notes and photo details
MaintPerf	Text	8	MaintenancePerformed	Work Order	Maintenance activity performed
Maint_Ini	Text	15		Work Order	Initials of the O&M technician
MaintDate	Date			Work Order	Maintenance date
MaintPhoto	Text	6	YesNo	Work Order	Photo of facility during required maintenance (email photo to GIS specialist)
MaintNotes	Text	254		Work Order	Additional notes from maintenance - maintenance activity notes and photo details

Step 3 – Work Order Execution

Once a work order form has been created, it can be given to O&M staff for execution. Using the provided map book, features (conceivably grouped by service area) will be navigated to and the required maintenance activity conducted. Upon completion of the maintenance activity, the O&M technician need only fill out three fields on the work order form: Maintenance Performed, Photo and Maintenance Notes.

Maintenance Performed

Please enter Cleaned, Repaired, Replaced, or Other (described other in the notes).

Photo

As with the inspection form, a photo field is provided. If a photo is taken of a particular feature, email it to the GIS specialist with the Unique ID in the subject line.

Maintenance Notes

Additional information about the action performed or details about the photo can be inputted here.

Step 4 – Database Update

Once the necessary maintenance has been performed by O&M staff on stormwater facilities called out from a work order form, the form is returned to GIS staff to update the database. Once the data has been entered, the status of the feature can be changed to "Closed" and the workflow cycle is complete. The workflow cycle begins again when inspections are performed.

Attachment 1 – Stormwater Infrastructure Overview Map

View or print in larger size (44 x 34 in.) from "Stormwater Infrastructure Overview Map.pdf"

Town of Mammoth Lakes
Stormwater Infrastructure Overview

0 1,000 2,000 ft.

Service Areas
- Allen Tract
- Center Street
- Commerce
- East Side Downtown
- Hidden Valley
- Juniper Ridge
- Kelly Tract
- Mammoth Slopes
- Old Mammoth
- Sierra Valley
- The Crest
- The Knolls
- The Trails
- Vistas
- West Side Downtown

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other

- Town Boundary
- Parcels
- Roads

N

Attachment 2 – Western Washington Standards Manual Excerpts

4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table 4.5.2 Maintenance Standards

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	~~No contaminants or pollutants present.~~
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Emergency Overflow/ Spillway and Berms over 4 feet in height.	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway	Emergency Overflow/ Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See “Side Slopes of Pond”	

No. 8 – Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

No. 9 – Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See "Detention Ponds" (No. 1).	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

No. 10 – Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

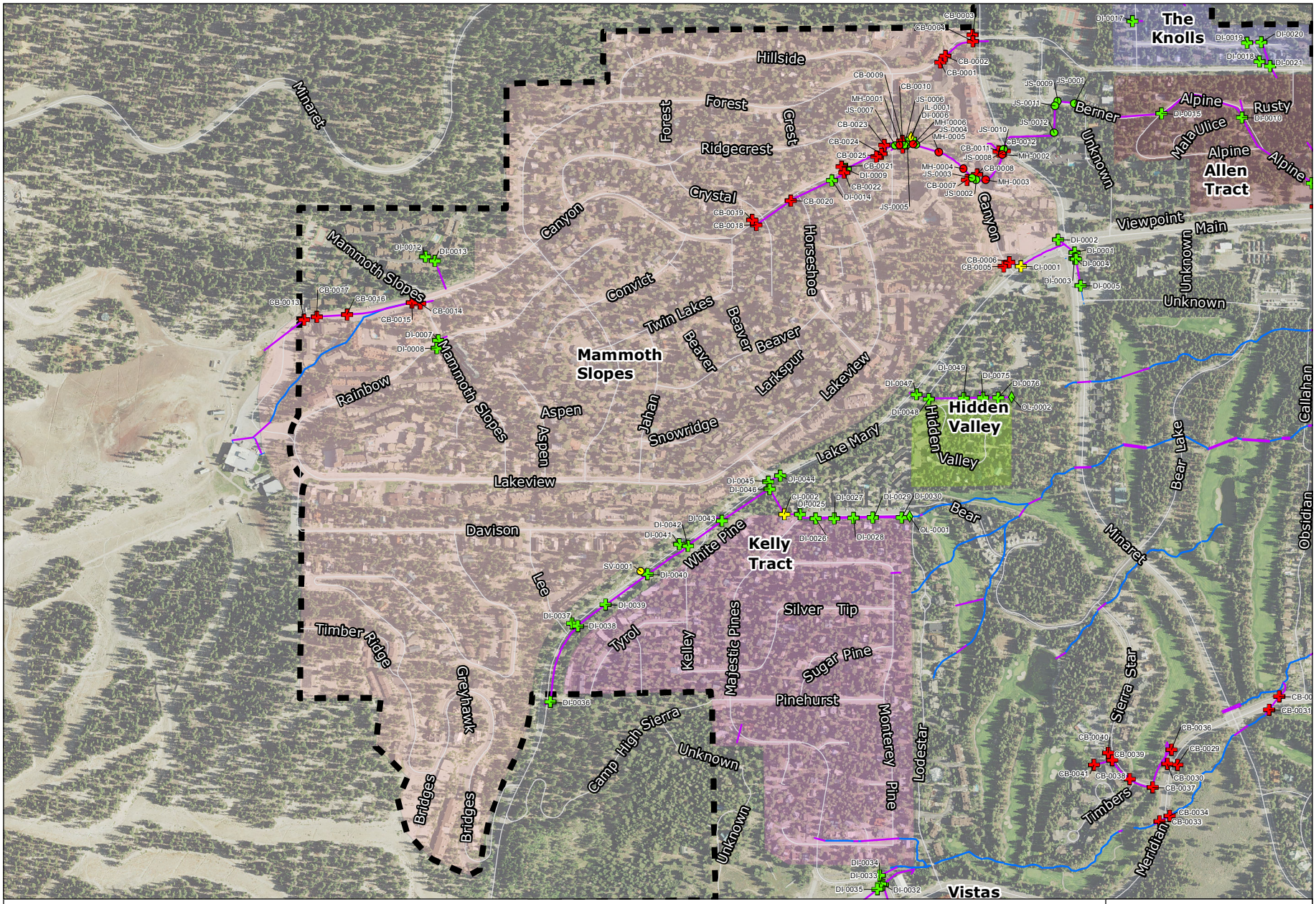
No. 11 – Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Attachment 3 – Map Book with Facility Index

Facilities by Service Area


The Knolls
St. Lecht
Zurs
Moritz
Garmish
Kitzbuhel
Chamonix
Davos
Sestriere
Mammoth Knolls
Cortina
Grindlewald
Megeve
St. Anton
St. Anton
Minaret
Zermatt
Val D'isere
Vacation
Hillside
Hillside
Forest
Holiday
Mammoth Slopes
Crest
Unknown
Alpine
Allen Tract
Rusty
Rusty
Knob Hill
Berner
CB-0003
CB-0004
CB-0002
CB-0001
CB-0009
CB-0010
CB-0023
CB-0024
CB-0012
MH-0001
JS-0006
IL-0001
JS-0007
DI-0006
MH-0006
JS-0004
MH-0005
JS-0010
JS-0009
JS-0001
JS-0011
JS-0012
DI-0017
DI-0019
DI-0020
DI-0018
DI-0021
DI-0015
DI-0010
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
The Knolls
0 200 400
ft.
N



Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

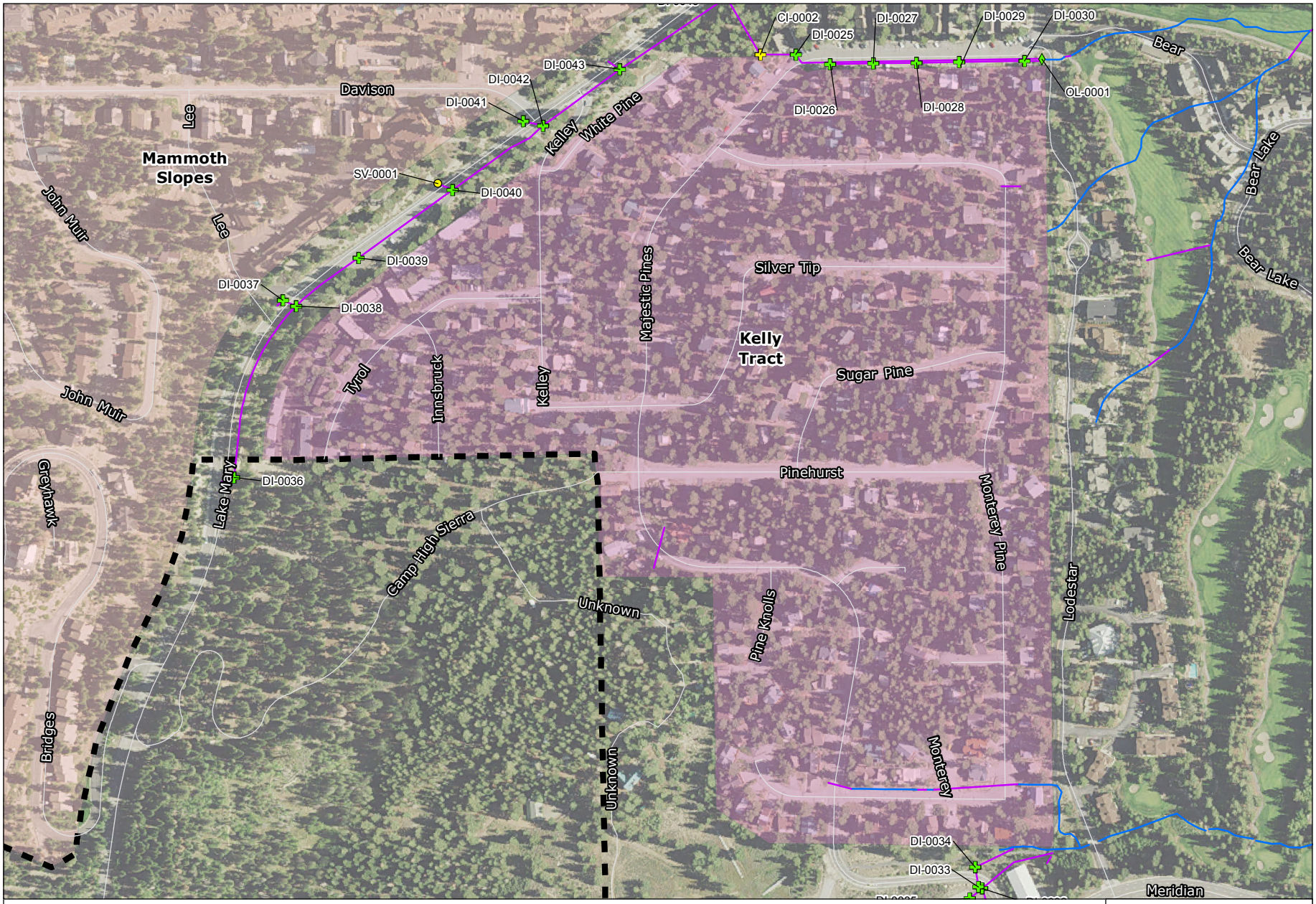
Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

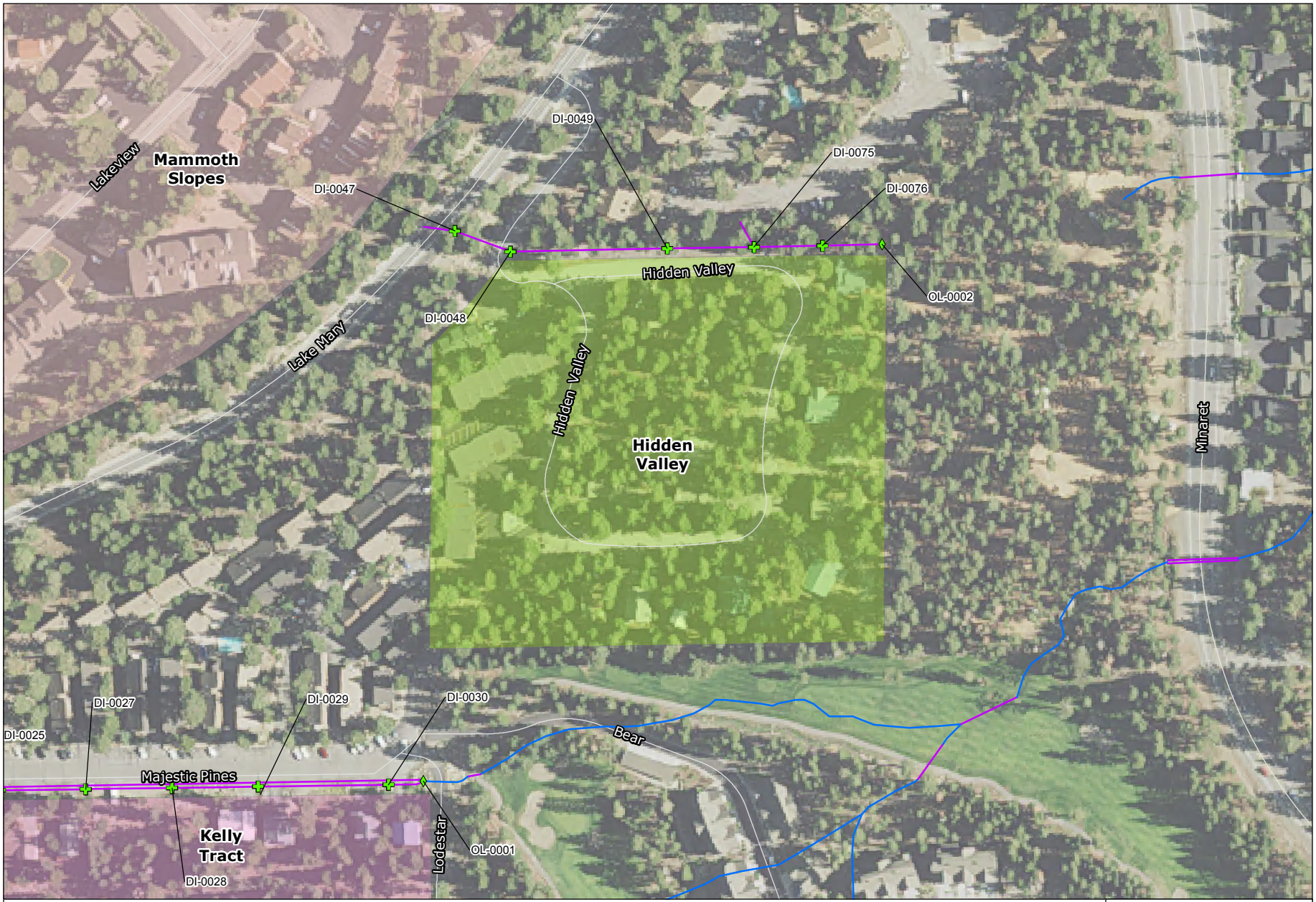
Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes Stormwater Facilities By Service Area

Mammoth Slopes

0 200 400 ft.


CI-0002
DI-0025
DI-0027
DI-0029
DI-0030
DI-0043
DI-0042
DI-0041
DI-0026
DI-0028
OL-0001
Davison
Lee
Kelley
White Pine
Bear
Mammoth Slopes
SV-0001
DI-0040
John Muir
Lee
Bear Lake
DI-0039
DI-0037
DI-0038
Majestic Pines
Silver Tip
Kelly Tract
Tyrol
Innsbruck
Kelley
Sugar Pine
John Muir
Greyhawk
Lake Mary
DI-0036
Pinehurst
Monterey Pine
Camp High Sierra
Unknown
Pine Knolls
Lodestar
Bridges
Unknown
Monterey
DI-0034
DI-0033
Meridian
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Kelly Tract
0
200
400
ft.
N



Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

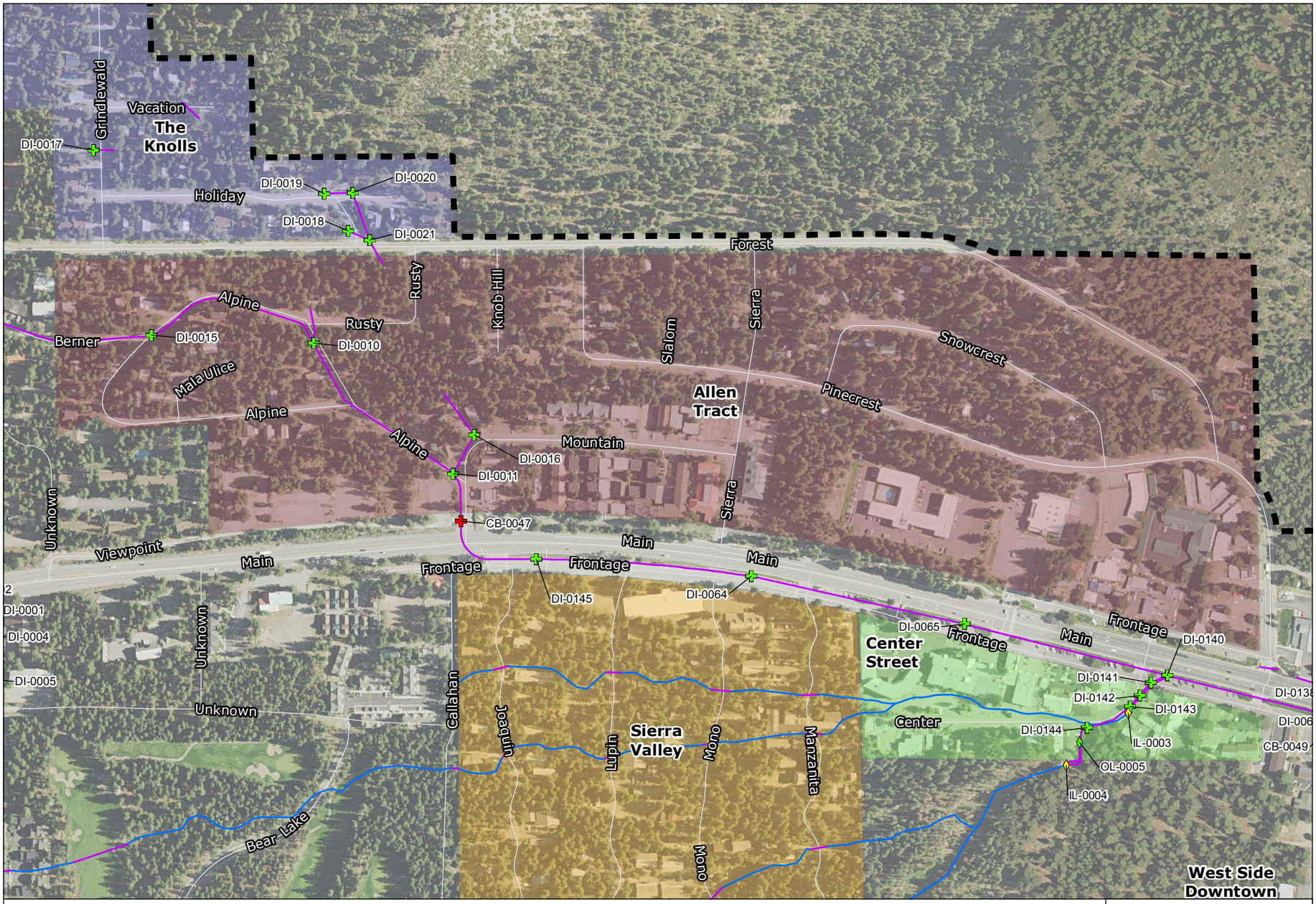
Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes Stormwater Facilities By Service Area

Hidden Valley

0 200 400 ft.

N



Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

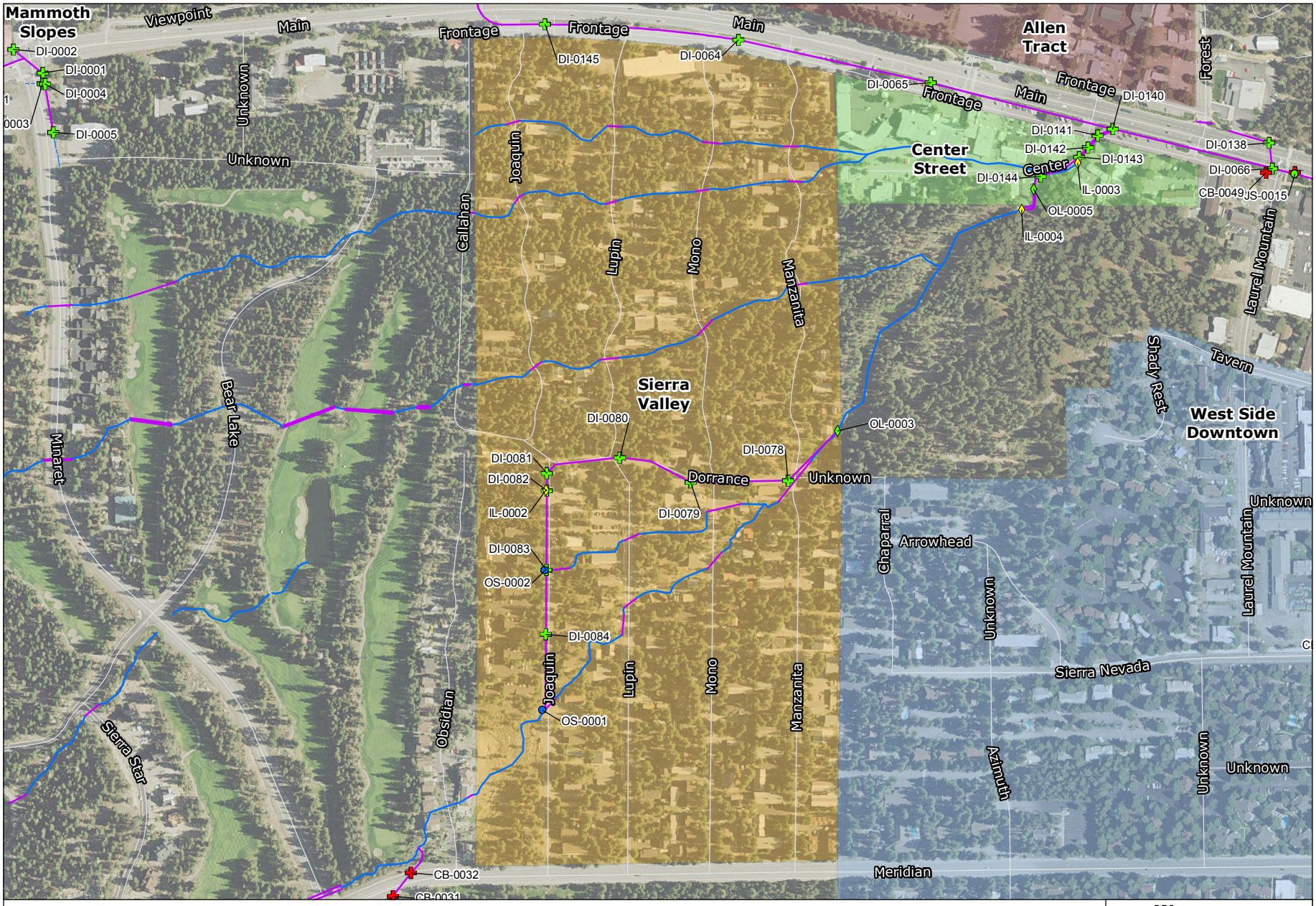
Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

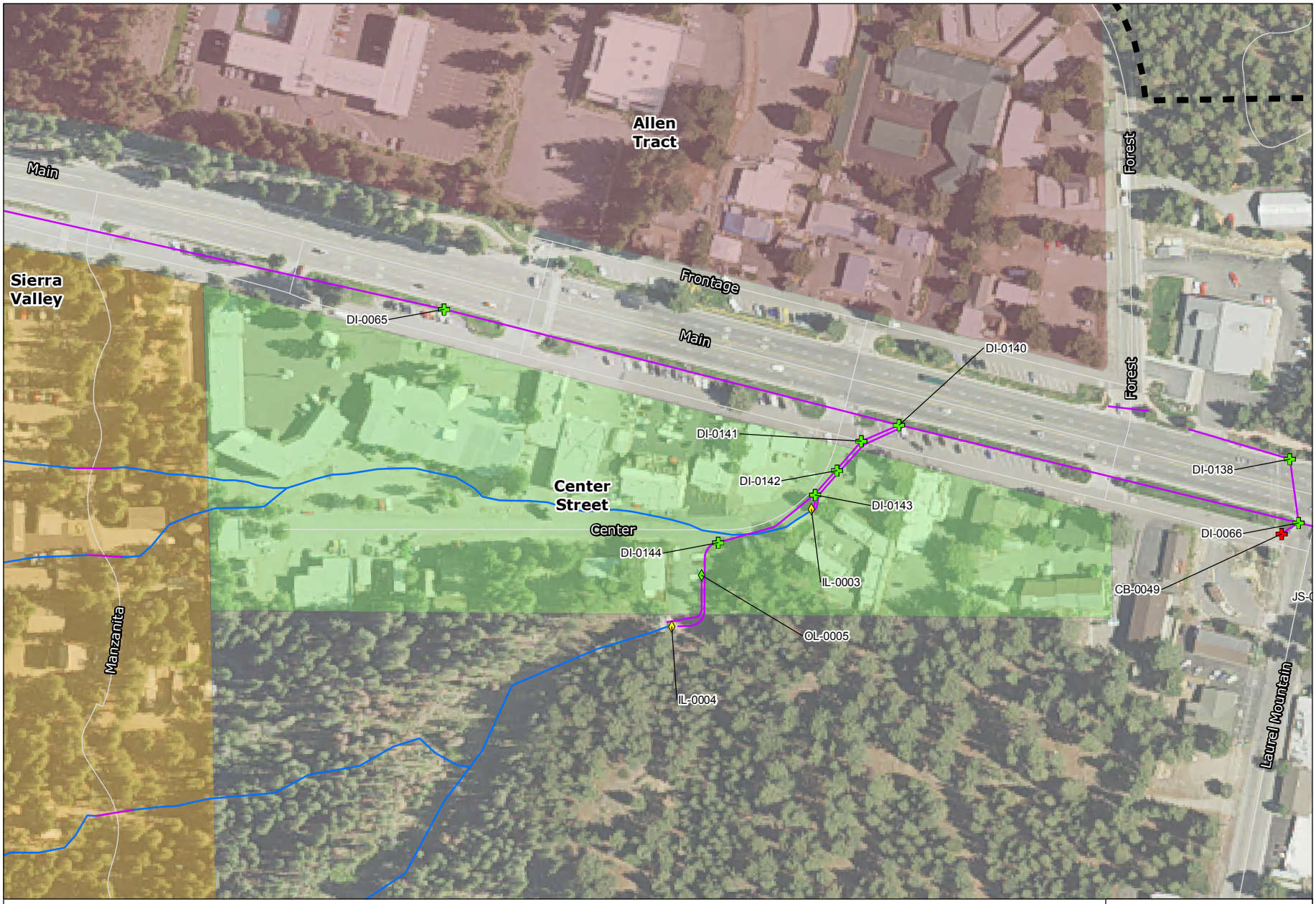
Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

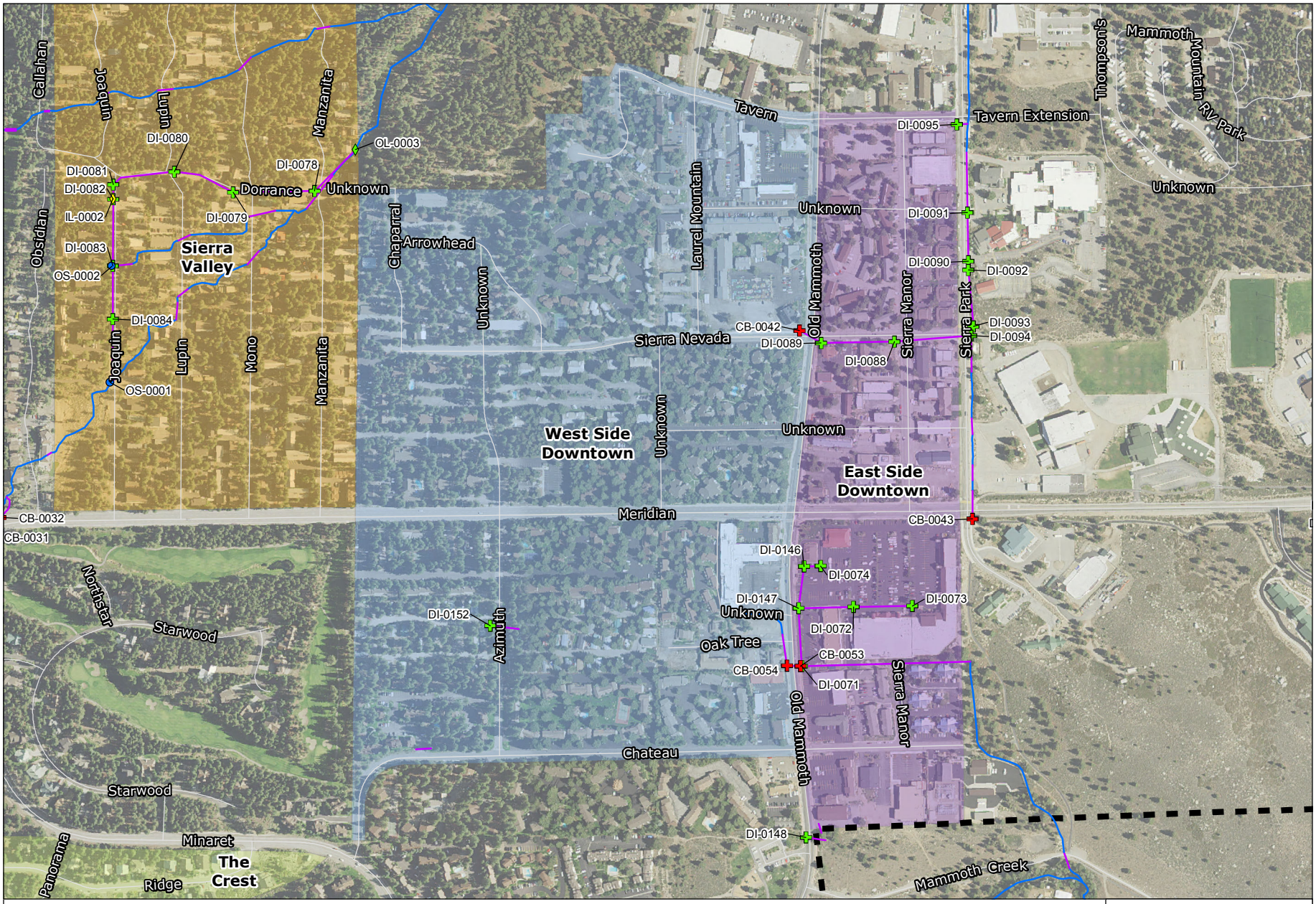
Town of Mammoth Lakes Stormwater Facilities By Service Area

Allen Tract

0 200 400 ft.


Mammoth Slopes
Viewpoint
Main
Frontage
Frontage
Main
Allen Tract
Forest
DI-0002
DI-0001
DI-0004
DI-0005
DI-0145
DI-0064
DI-0065
Frontage
Main
Frontage
DI-0140
DI-0141
DI-0142
DI-0143
DI-0138
DI-0066
CB-0049
JS-0015
Center Street
Center
DI-0144
IL-0003
OL-0005
IL-0004
Unknown
Unknown
Joaquin
Callahan
Lupin
Mono
Manzanita
Laurel Mountain
Tavern
Shady Rest
West Side Downtown
Bear Lake
Minaret
Sierra Valley
DI-0080
DI-0081
DI-0082
IL-0002
DI-0083
OS-0002
DI-0084
OS-0001
DI-0078
Dorrance
DI-0079
Unknown
OL-0003
Chaparral
Arrowhead
Unknown
Laurel Mountain
Unknown
Sierra Nevada
Obsidian
Sierra Star
Azimuth
Unknown
Unknown
CB-0032
CB-0031
Meridian
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Sierra Valley
0 200 400
ft.
N


Allen Tract
Main
Forest
Sierra Valley
Frontage
Main
Forest
DI-0065
DI-0140
DI-0141
DI-0138
DI-0142
DI-0143
Center Street
Center
DI-0066
DI-0144
IL-0003
CB-0049
JS-0
Manzanita
OL-0005
IL-0004
Laurel Mountain
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Center Street
0
200
400
ft.
N



Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
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- Other

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- Open Channel
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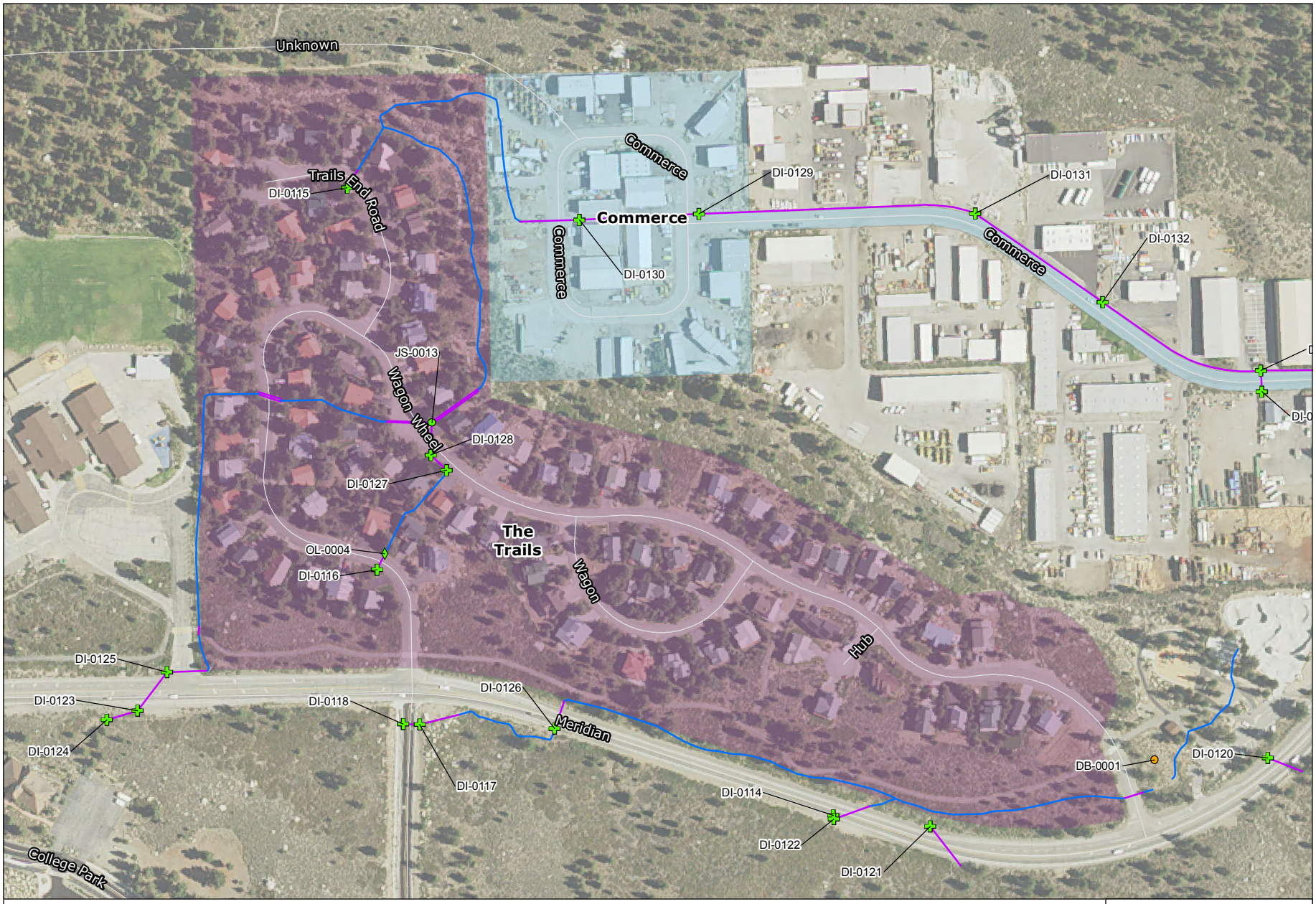
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes
Stormwater Facilities
By Service Area

East and West Side Downtown

0 200 400 ft.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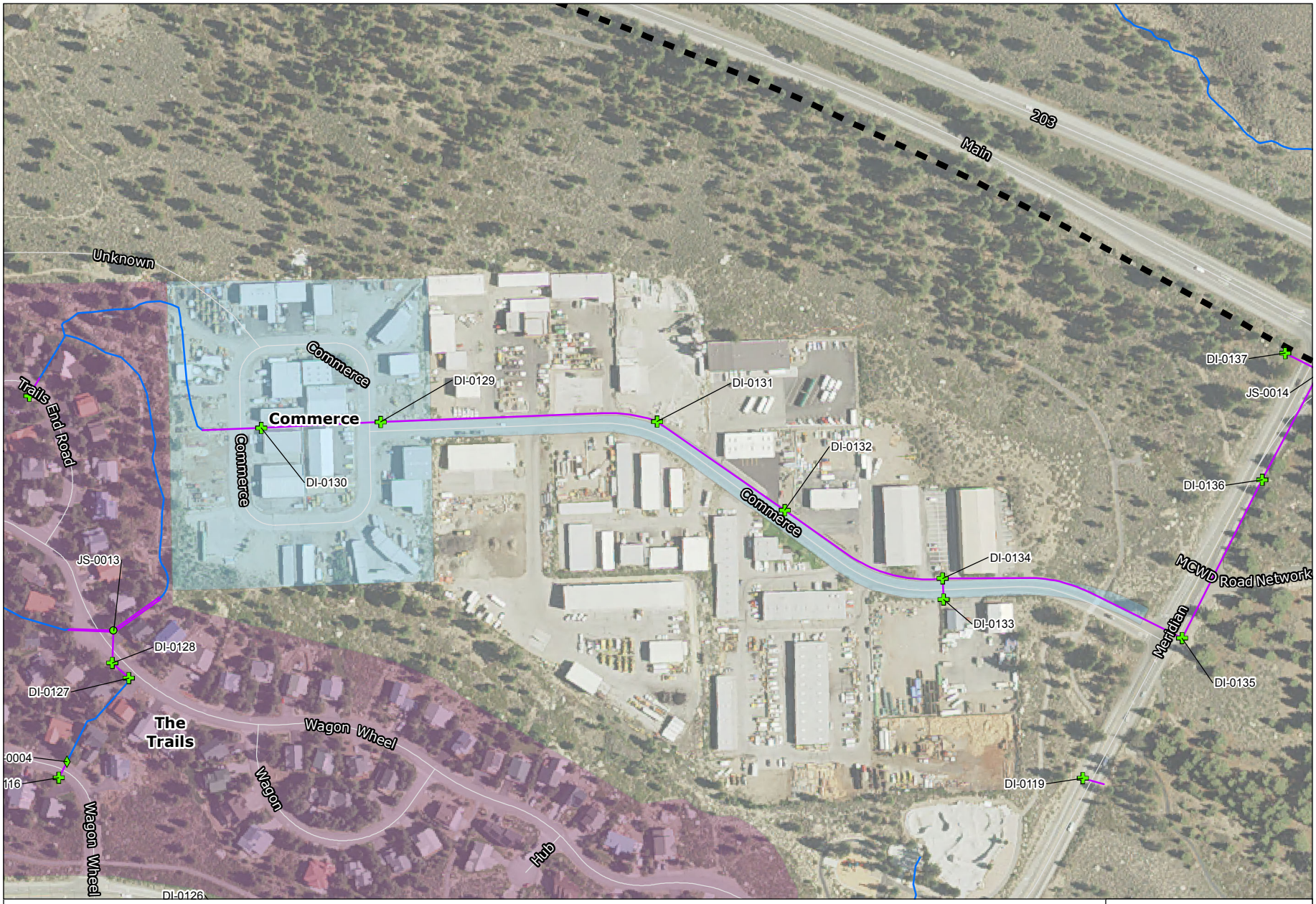
Trails End Road
DI-0115
Commerce
DI-0129
DI-0131
Commerce
Commerce
DI-0130
Commerce
DI-0132
JS-0013
Wagon Wheel
DI-0128
DI-0127
The Trails
OL-0004
DI-0116
Wagon
Hub
DI-0125
DI-0123
DI-0124
DI-0118
DI-0126
Meridian
DI-0117
DB-0001
DI-0120
DI-0114
DI-0122
DI-0121
College Park
NCE
Mammoth Lakes
CALIFORNIA
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
The Trails
0
200
400
ft.
N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Main
Unknown
Commerce
Commerce
Commerce
Commerce
DI-0129
DI-0130
DI-0131
DI-0132
DI-0133
DI-0134
DI-0135
DI-0136
DI-0137
JS-0014
JS-0013
DI-0128
DI-0127
DI-0126
DI-0119
Trails End Road
The Trails
Wagon Wheel
Wagon
Wagon Wheel
Hub
Meridian
MCWD Road Network
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Commerce
0
200
400
ft.
N


Lake Mary
Juniper
Juniper
Old Juniper
Juniper Ridge
Juniper
Juniper
Juniper Springs
Juniper Springs
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Juniper Ridge
0
200
400
ft.
N


Kelly Tract
DI-0034
DI-0033
Majestic Pines
DI-0035
DI-0032
Lodestar
Meridian
DI-0024
DI-0022
CB-0026
DI-0023
Holiday Vista
Villa Vista
Villa Vista
The Crest
CB-0027
CB-0035
DI-0077
Juniper Springs
Vistas
DI-0149
Creekview
DI-0150
DI-0151
Snowcreek
Majestic Pines
Waterford
Waterford
North
Meadow
Old Mammoth
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Vistas
0
200
400
ft.
N

NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
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Storm Structure
- Manhole
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- Open Channel
- Culvert
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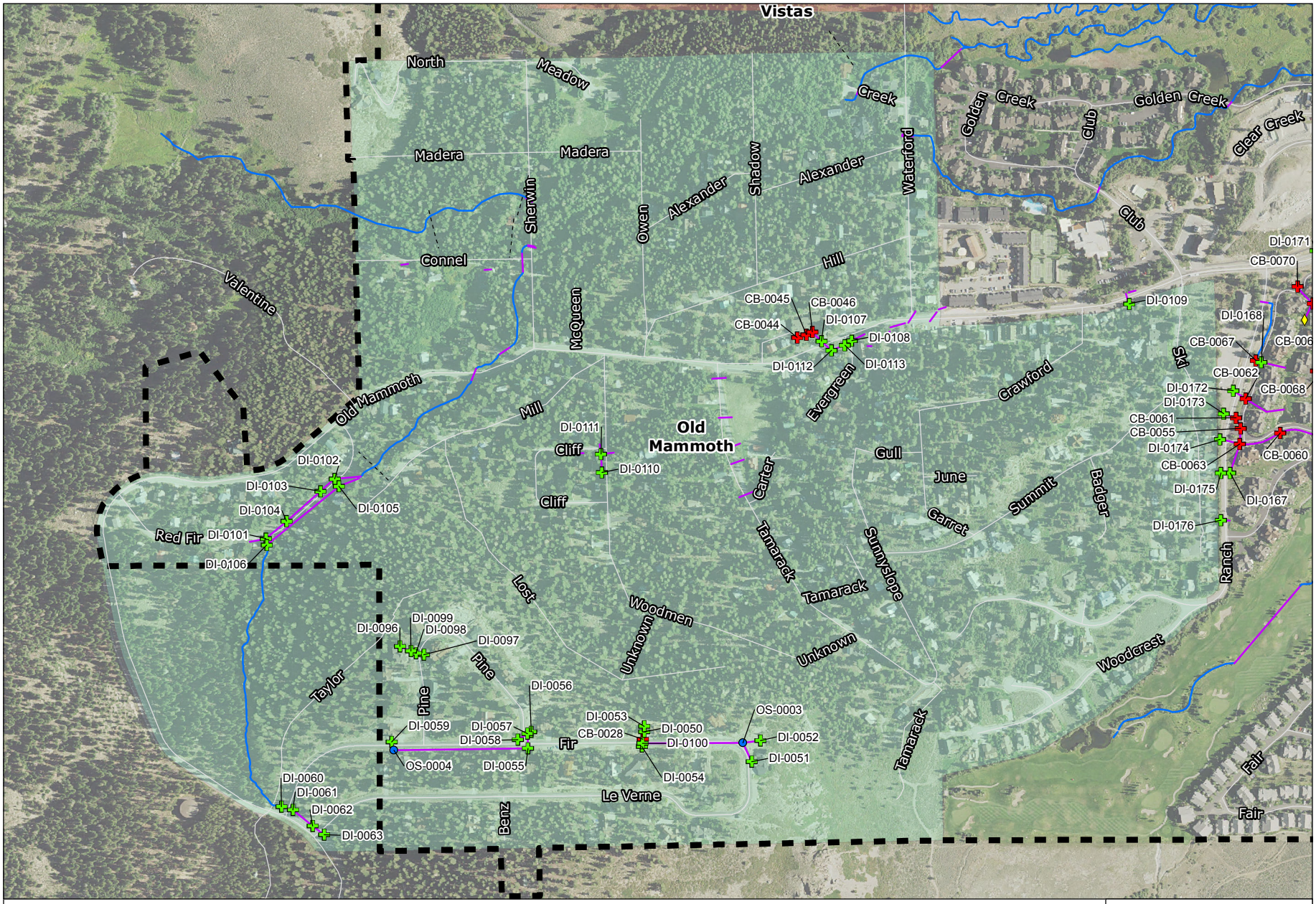
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes
Stormwater Facilities
By Service Area

The Crest

0 200 400 ft.

N


Vistas
North
Meadow
Creek
Golden
Creek
Golden Creek
Club
Clear Creek
Madera
Madera
Sherwin
Owen
Alexander
Shadow
Alexander
Waterford
Club
Connel
Hill
Valentine
McQueen
CB-0045
CB-0046
CB-0044
DI-0107
DI-0108
DI-0112
DI-0113
DI-0109
DI-0171
CB-0070
DI-0168
CB-0067
CB-006
Ski
CB-0062
DI-0172
CB-0068
DI-0173
CB-0061
CB-0055
DI-0174
CB-0060
CB-0063
DI-0175
DI-0167
DI-0176
Old Mammoth
Mill
Evergreen
Crawford
DI-0111
Cliff
DI-0110
Old Mammoth
Carter
Gull
June
Summit
Badger
Garret
DI-0102
DI-0103
DI-0104
DI-0105
Red Fir
DI-0101
DI-0106
Cliff
Tamarack
Sunnyslope
Ranch
Lost
Woodmen
Tamarack
Unknown
Unknown
Woodcrest
DI-0099
DI-0096
DI-0098
DI-0097
Pine
Taylor
Pine
DI-0056
DI-0059
DI-0057
DI-0058
OS-0004
DI-0055
DI-0053
CB-0028
Fir
DI-0050
DI-0100
OS-0003
DI-0052
DI-0051
DI-0054
Tamarack
Fair
Fair
DI-0060
DI-0061
DI-0062
DI-0063
Le Verne
Benz
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
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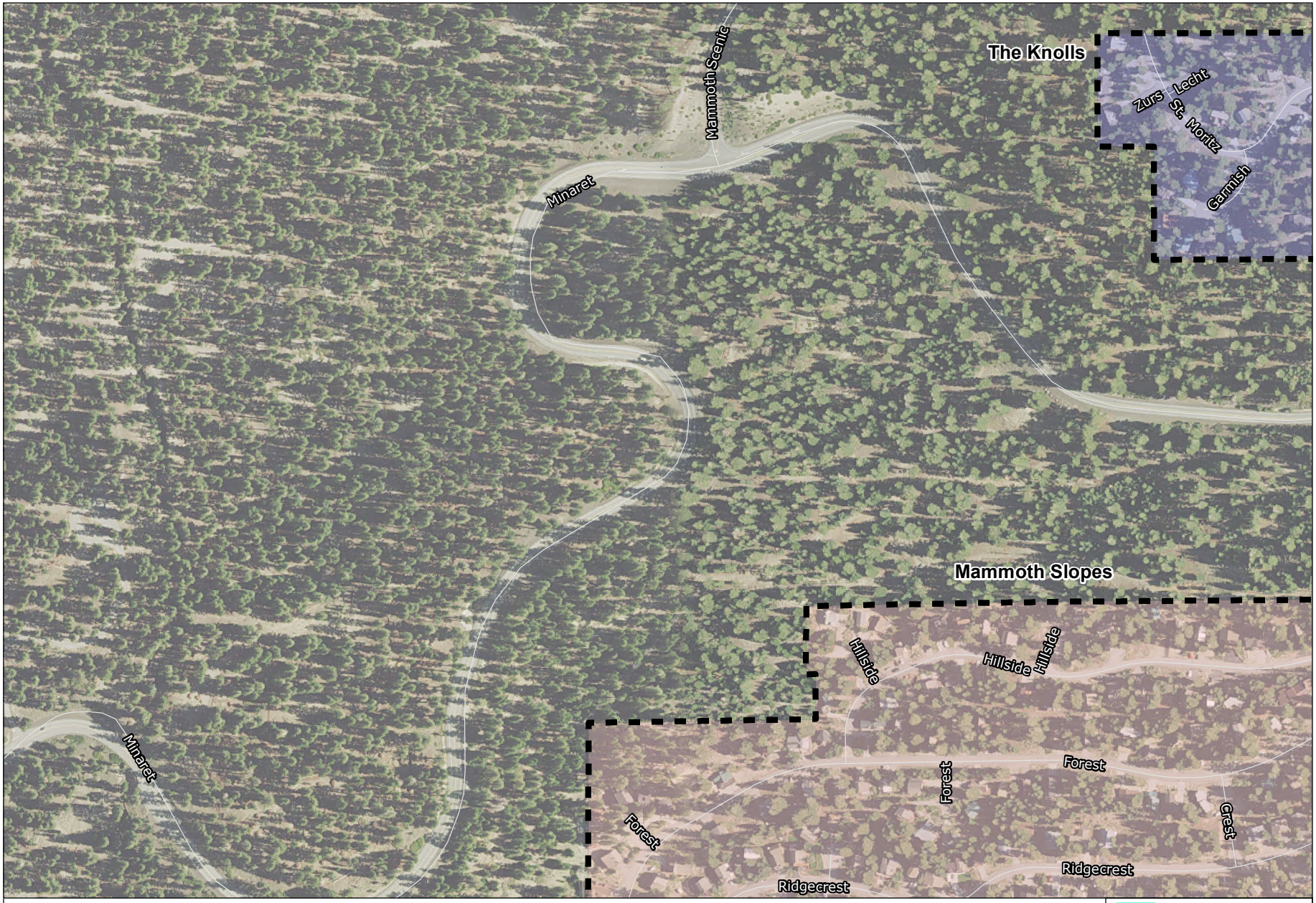
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Facilities
By Service Area
Old Mammoth
0 200 400
ft.
N

Facilities by Map Index



Collection Device
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Storm Fitting
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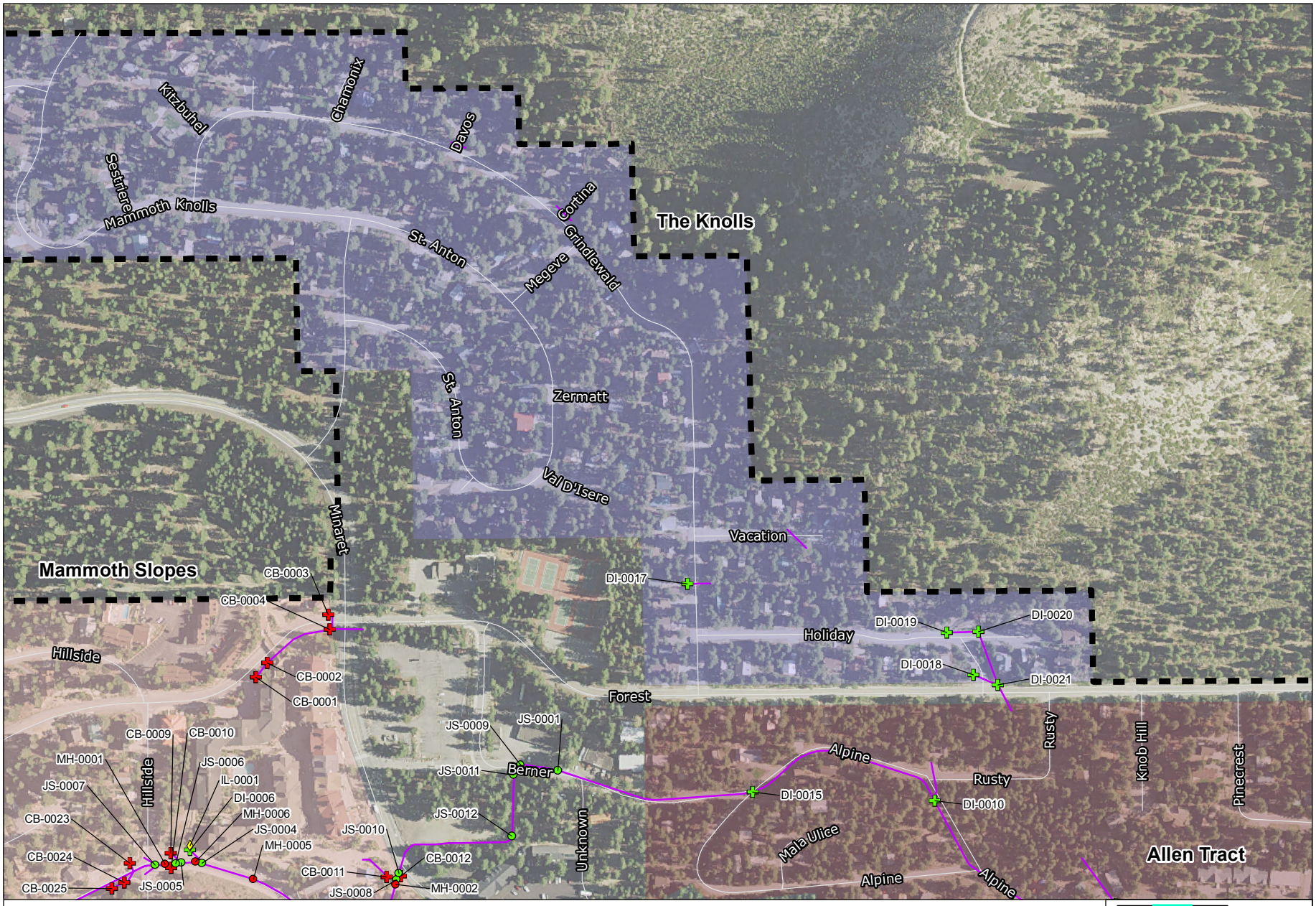
Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
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Town of Mammoth Lakes Stormwater Map Book

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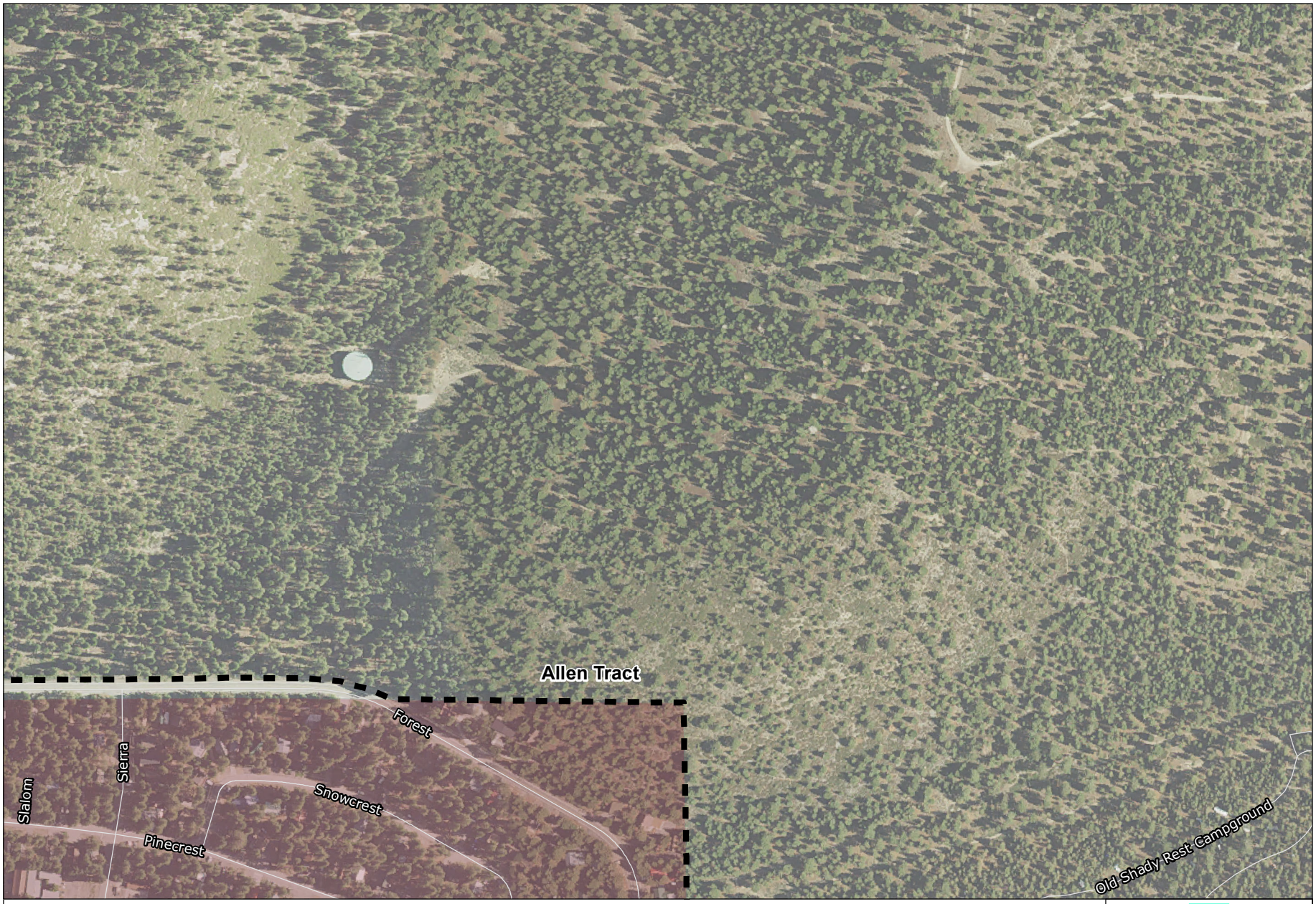
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



Collection Device
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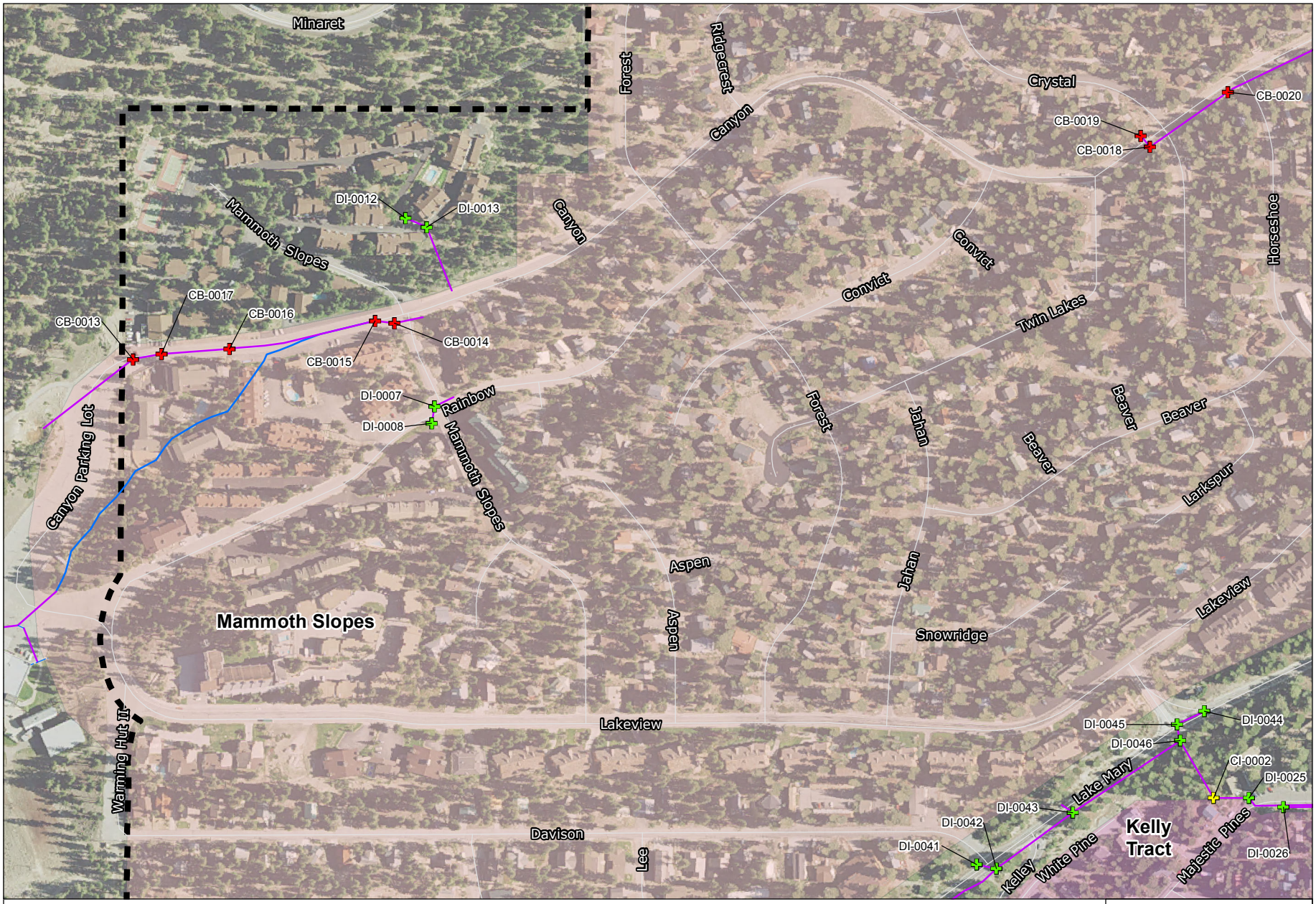
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



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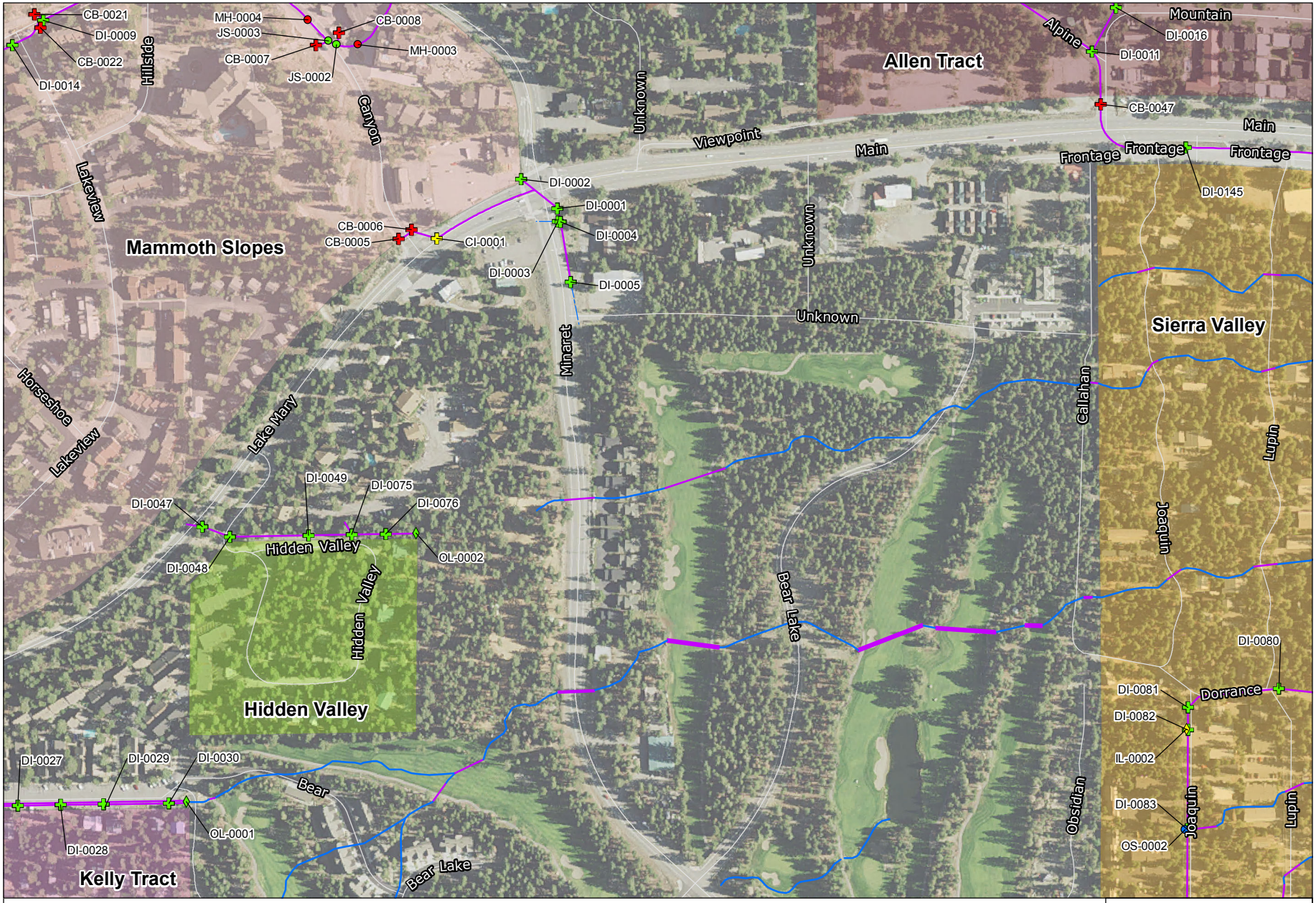
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

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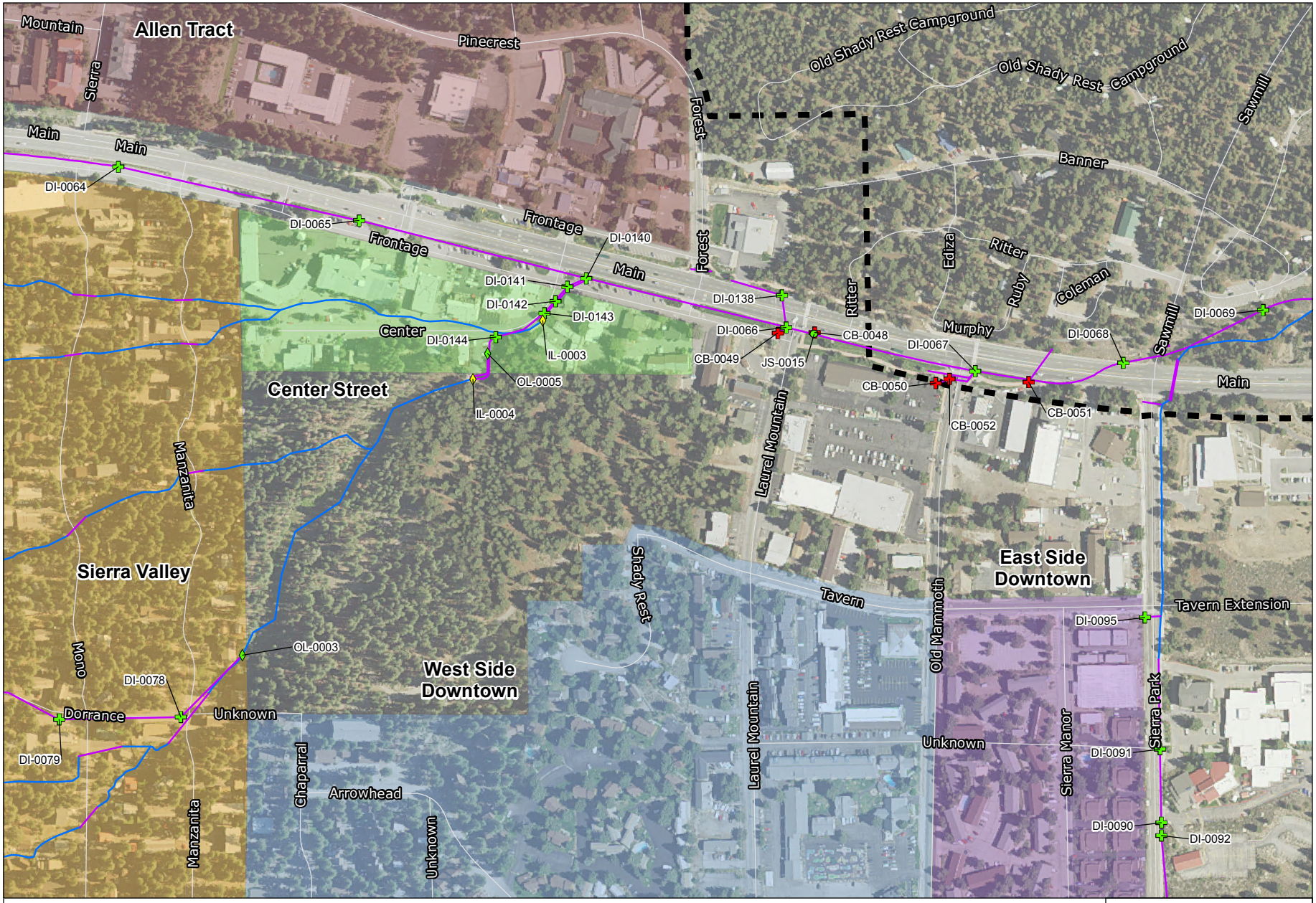
D1	D2	D3		
E1	E2	E3		

N



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A1	A2	A3		
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D1	D2	D3		
E1	E2	E3		

N

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D1	D2	D3		
E1	E2	E3		

N

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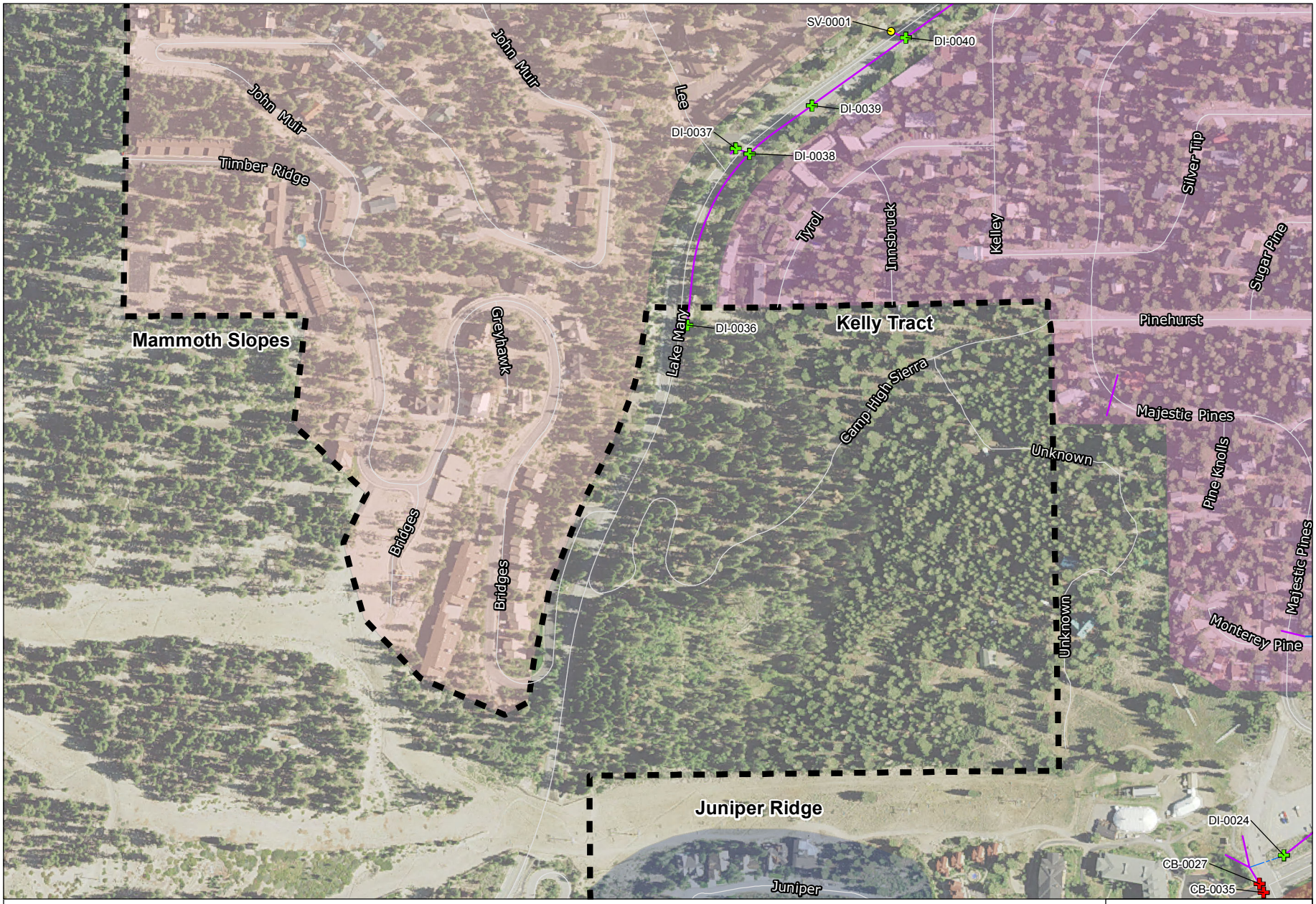
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



Collection Device
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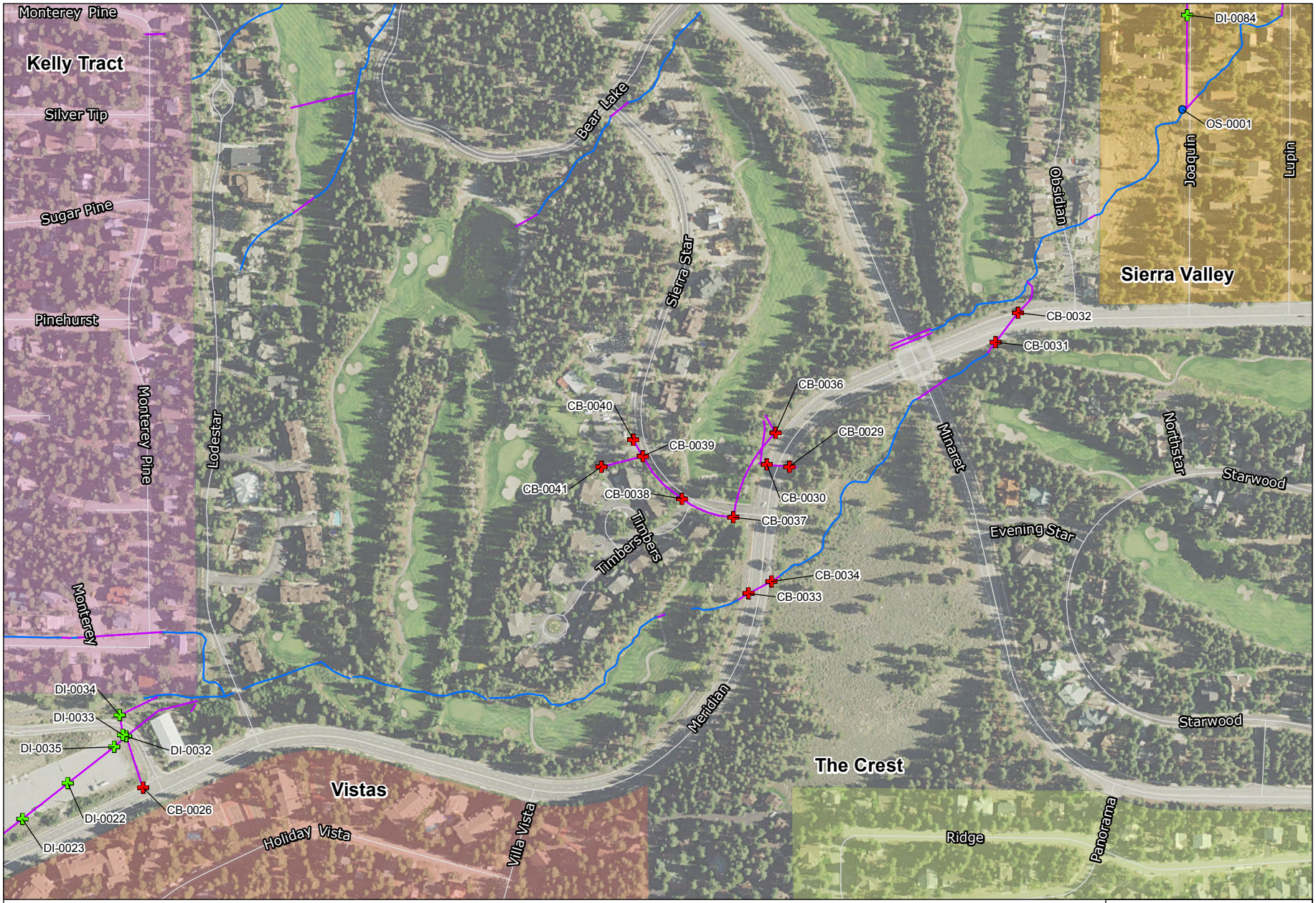
A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



Collection Device
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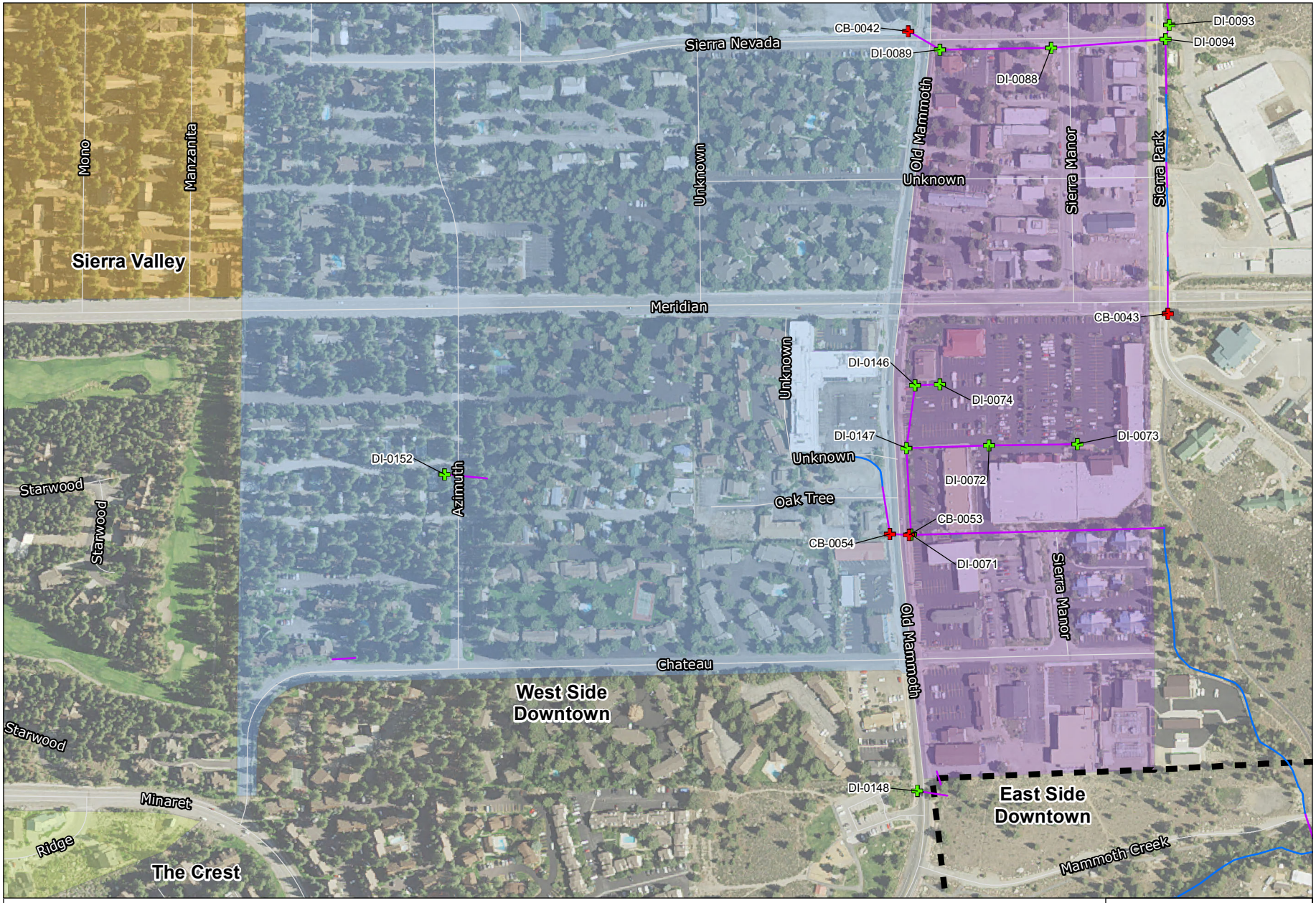
Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
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0 200 400 ft.

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B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N

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Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

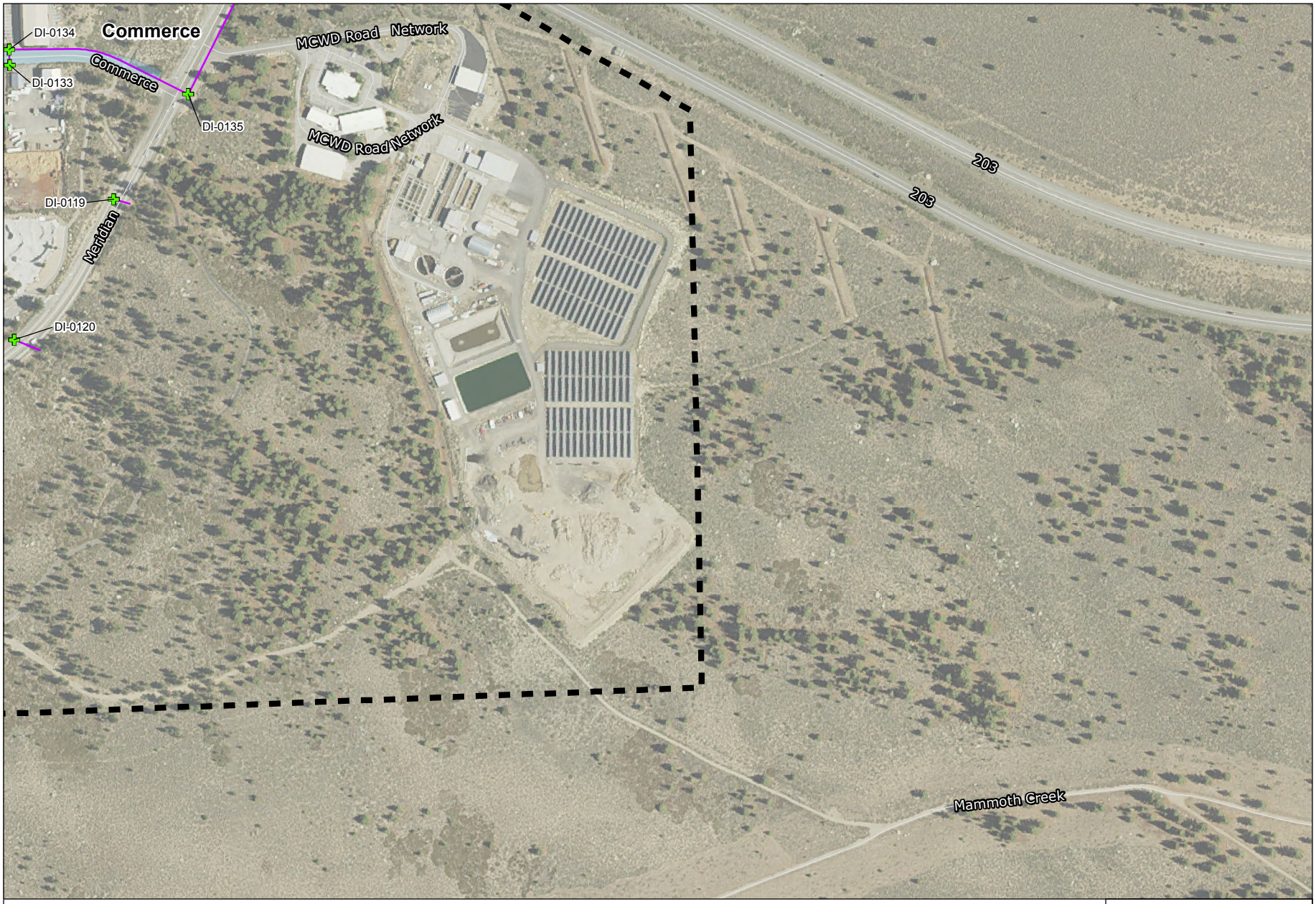
Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
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- Town Boundary

Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

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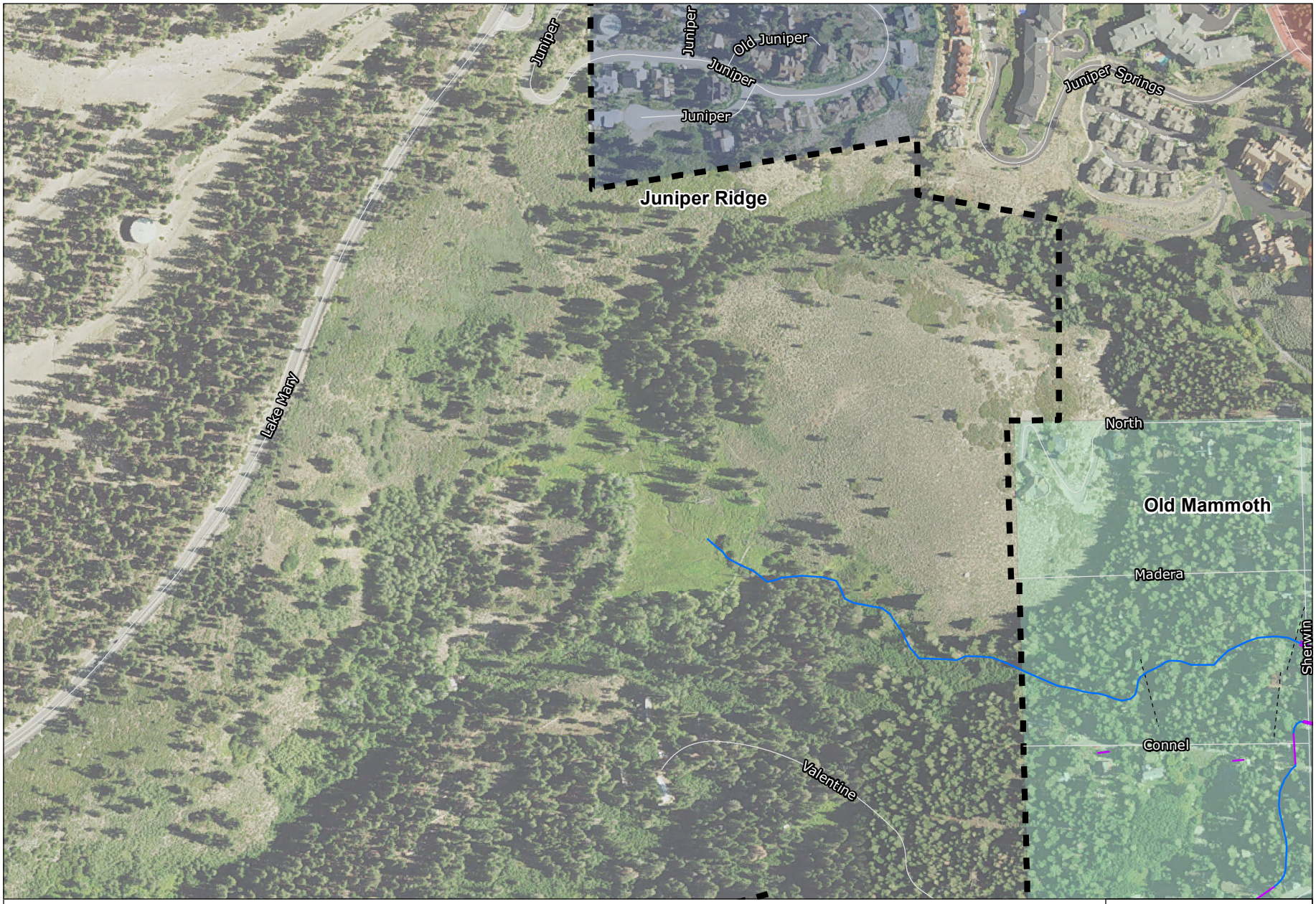
A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
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- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
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Town of Mammoth Lakes Stormwater Map Book

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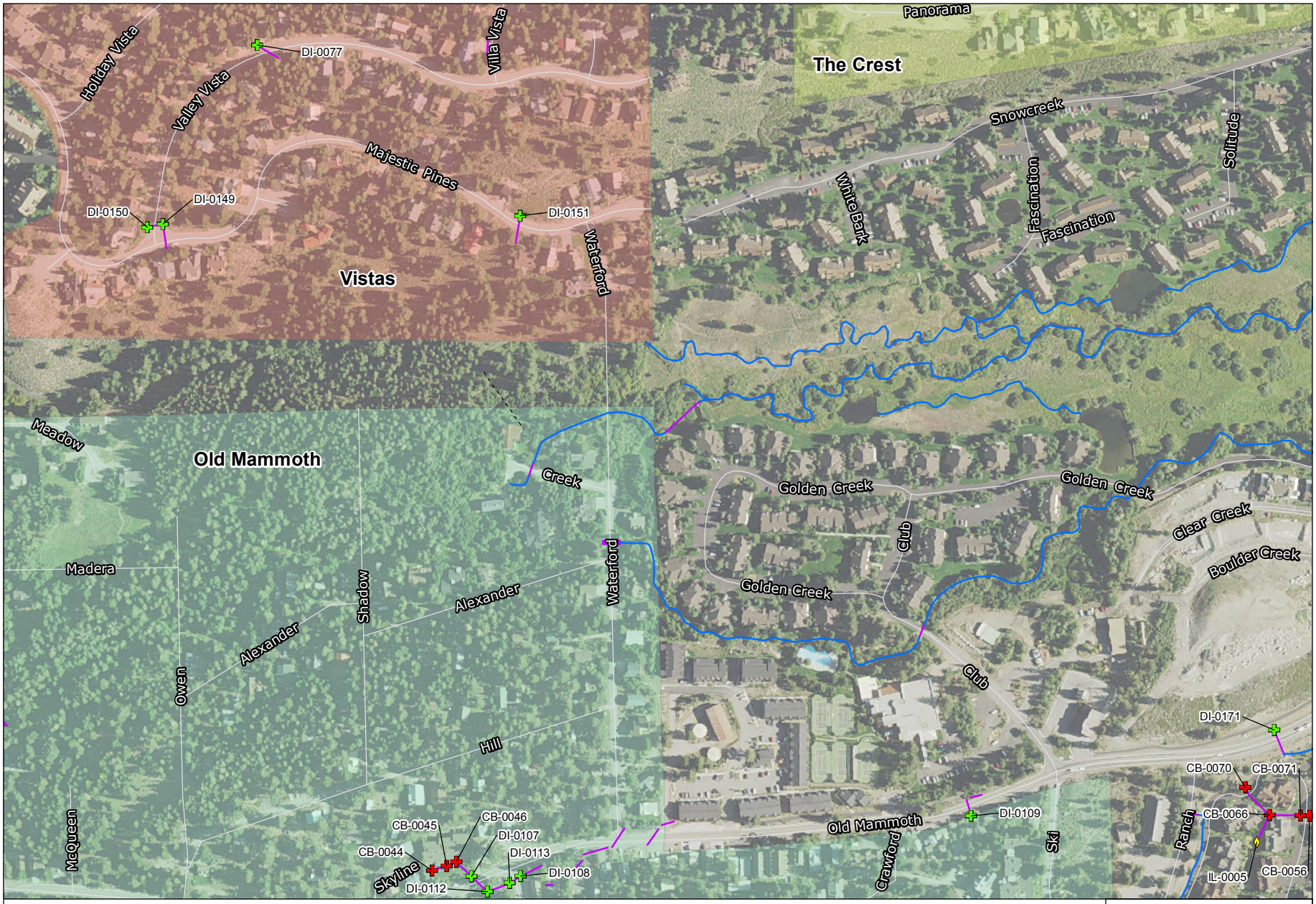
0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

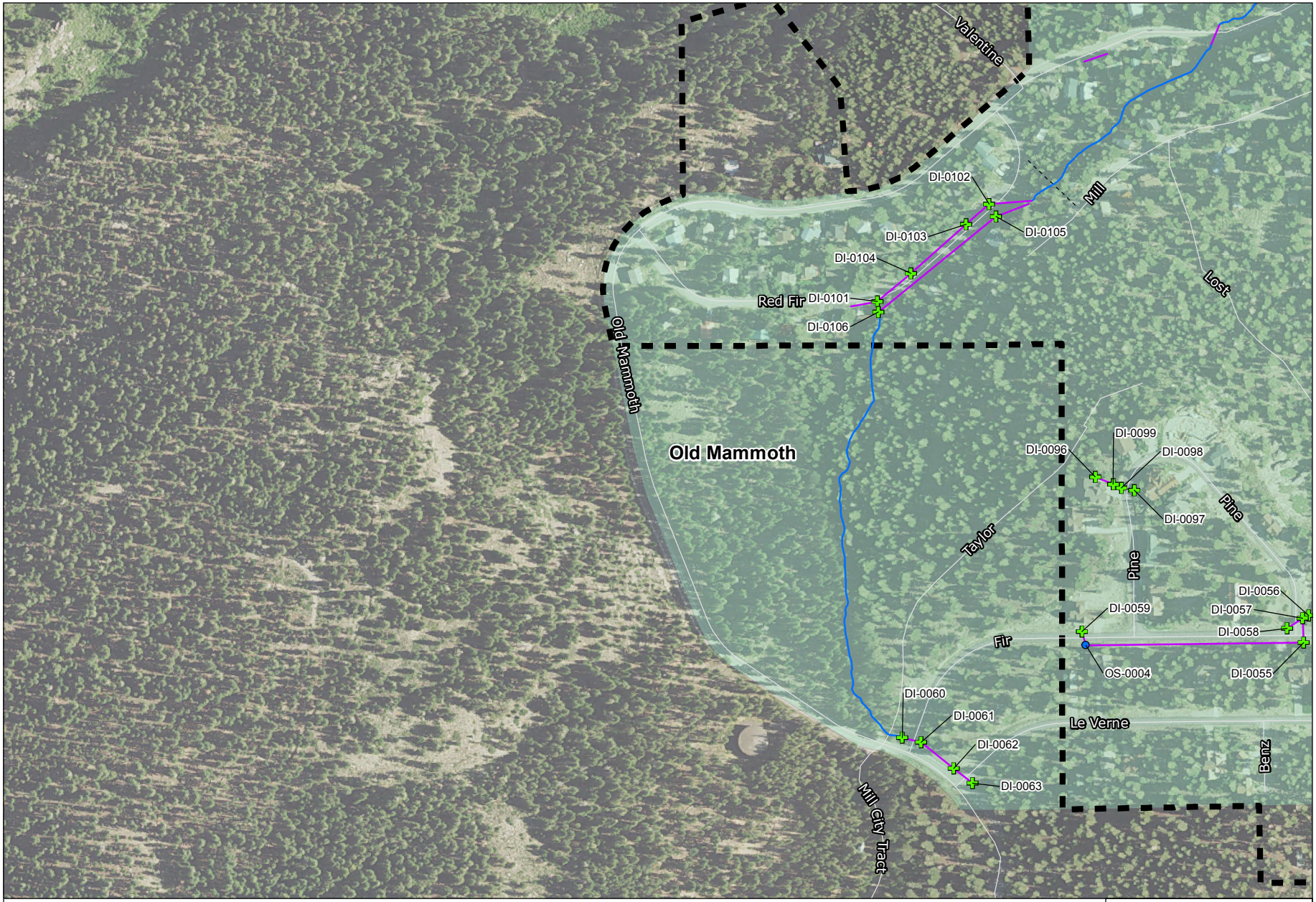
Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

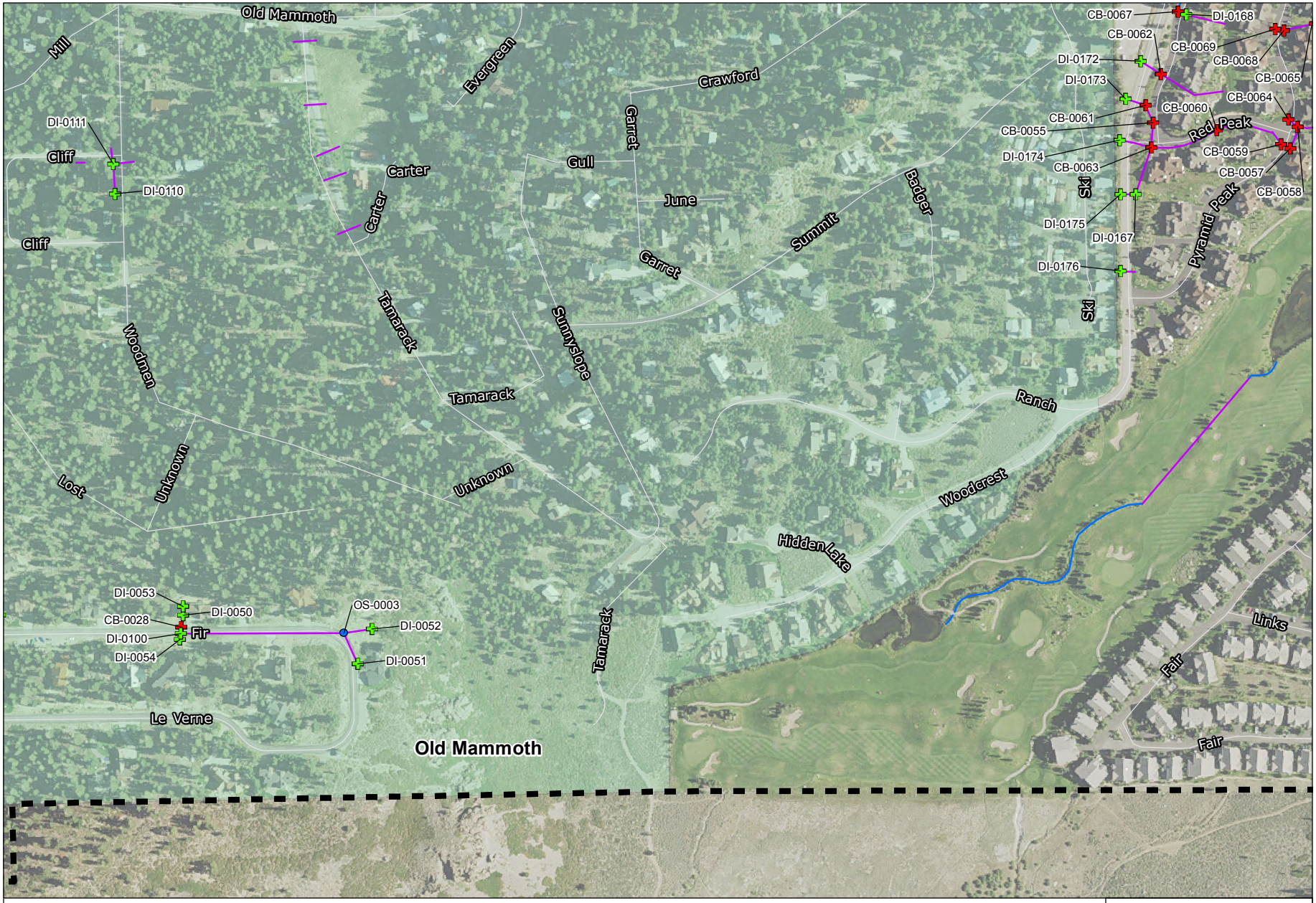
Town of Mammoth Lakes Stormwater Map Book

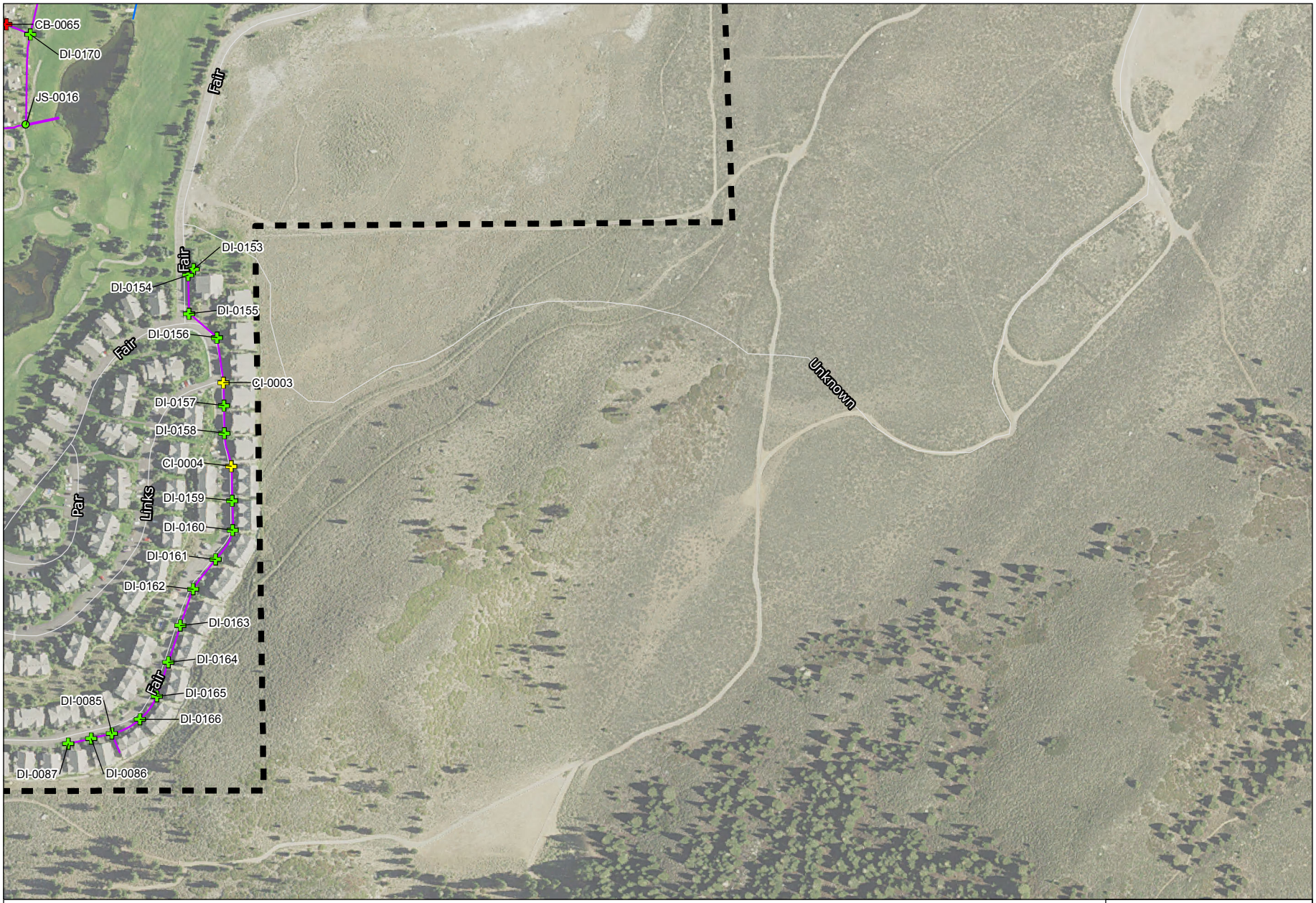
1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N


Old Mammoth
Mill
Evergreen
Crawford
Garret
Gull
June
Carter
Cliff
DI-0111
DI-0110
Tamarack
Woodmen
Sunnyslope
Summit
Badger
Ski
Red Peak
Pyramid Peak
Ranch
Woodcrest
Hidden Lake
Links
Fair
Lost
Unknown
Le Verne
CB-0067
DI-0168
CB-0062
CB-0069
CB-0068
CB-0065
DI-0172
DI-0173
CB-0064
CB-0060
CB-0061
CB-0055
CB-0059
CB-0057
CB-0058
DI-0174
CB-0063
DI-0175
DI-0167
DI-0176
DI-0053
DI-0050
CB-0028
DI-0100
DI-0054
Fir
OS-0003
DI-0052
DI-0051
Old Mammoth
Collection Device
Catch Basin
Curb Cut
Curb Inlet
Drop Inlet
Other
Storm Fitting
Outfall
Inlet
Outlet
Other
Storm Structure
Manhole
Detention Basin
Storm Vault
Junction Structure
Other
Conveyance
Open Channel
Culvert
Earthen Ditch
Curb Gutter
Storm Drain Pipe
Swale
Slotted Drain
Other
Town Boundary
Town of Mammoth Lakes
Stormwater Map Book
1 in. = 400 ft.
0
200
400
ft.
A1 A2 A3
B1 B2 B3 B4 B5
C1 C2 C3 C4 C5
D1 D2 D3
E1 E2 E3
N



NCE

Mammoth Lakes CALIFORNIA

Collection Device
- Catch Basin
- Curb Cut
- Curb Inlet
- Drop Inlet
- Other

Storm Fitting
- Outfall
- Inlet
- Outlet
- Other

Storm Structure
- Manhole
- Detention Basin
- Storm Vault
- Junction Structure
- Other

Conveyance
- Open Channel
- Culvert
- Earthen Ditch
- Curb Gutter
- Storm Drain Pipe
- Swale
- Slotted Drain
- Other
- Town Boundary

Town of Mammoth Lakes Stormwater Map Book

1 in. = 400 ft.

0 200 400 ft.

A1	A2	A3		
B1	B2	B3	B4	B5
C1	C2	C3	C4	C5
D1	D2	D3		
E1	E2	E3		

N

Facility Unique ID by Map Index and Service Area

Type Codes

CD = Collection Device | SF = Storm Fitting | SS = Storm Structure

Unique ID	Type	Index	Service Area
CB-0001	CD	A2	Mammoth Slopes
CB-0002	CD	A2	Mammoth Slopes
CB-0003	CD	A2	Mammoth Slopes
CB-0004	CD	A2	Mammoth Slopes
CB-0005	CD	B2	Mammoth Slopes
CB-0006	CD	B2	Mammoth Slopes
CB-0007	CD	B2	Mammoth Slopes
CB-0008	CD	B2	Mammoth Slopes
CB-0009	CD	A2	Mammoth Slopes
CB-0010	CD	A2	Mammoth Slopes
CB-0011	CD	A2	Mammoth Slopes
CB-0012	CD	A2	Mammoth Slopes
CB-0013	CD	B1	Mammoth Slopes
CB-0014	CD	B1	Mammoth Slopes
CB-0015	CD	B1	Mammoth Slopes
CB-0016	CD	B1	Mammoth Slopes
CB-0017	CD	B1	Mammoth Slopes
CB-0018	CD	B1	Mammoth Slopes
CB-0019	CD	B1	Mammoth Slopes
CB-0020	CD	B1	Mammoth Slopes
CB-0021	CD	B2	Mammoth Slopes
CB-0022	CD	B2	Mammoth Slopes
CB-0023	CD	A2	Mammoth Slopes
CB-0024	CD	A2	Mammoth Slopes
CB-0025	CD	A2	Mammoth Slopes
CB-0026	CD	C2	*Unassociated*
CB-0027	CD	C1	*Unassociated*
CB-0028	CD	E2	Old Mammoth
CB-0029	CD	C2	*Unassociated*
CB-0030	CD	C2	*Unassociated*
CB-0031	CD	C2	*Unassociated*
CB-0032	CD	C2	*Unassociated*
CB-0033	CD	C2	*Unassociated*
CB-0034	CD	C2	*Unassociated*
CB-0035	CD	C1	*Unassociated*
CB-0036	CD	C2	*Unassociated*
CB-0037	CD	C2	*Unassociated*
CB-0038	CD	C2	*Unassociated*
CB-0039	CD	C2	*Unassociated*
CB-0040	CD	C2	*Unassociated*
CB-0041	CD	C2	*Unassociated*
CB-0042	CD	C3	West Side Downtown
CB-0043	CD	C3	*Unassociated*
CB-0044	CD	D2	Old Mammoth
CB-0045	CD	D2	Old Mammoth
CB-0046	CD	D2	Old Mammoth
CB-0047	CD	B2	*Unassociated*
CB-0048	CD	B3	*Unassociated*
CB-0049	CD	B3	*Unassociated*
CB-0050	CD	B3	*Unassociated*
CB-0051	CD	B3	*Unassociated*
CB-0052	CD	B3	*Unassociated*
CB-0053	CD	C3	East Side Downtown
CB-0054	CD	C3	West Side Downtown
CB-0055	CD	E2	*Unassociated*
CB-0056	CD	D2	*Unassociated*
CB-0057	CD	E2	*Unassociated*
CB-0058	CD	E2	*Unassociated*
CB-0059	CD	E2	*Unassociated*
CB-0060	CD	E2	*Unassociated*
CB-0061	CD	E2	*Unassociated*
CB-0062	CD	E2	*Unassociated*
CB-0063	CD	E2	*Unassociated*
CB-0064	CD	E2	*Unassociated*
CB-0065	CD	E3	*Unassociated*
CB-0066	CD	D2	*Unassociated*
CB-0067	CD	E2	*Unassociated*
CB-0068	CD	E2	*Unassociated*
CB-0069	CD	E2	*Unassociated*
CB-0070	CD	D2	*Unassociated*
CB-0071	CD	D2	*Unassociated*
CI-0001	CD	B2	*Unassociated*
CI-0002	CD	B1	*Unassociated*
CI-0003	CD	E3	*Unassociated*
CI-0004	CD	E3	*Unassociated*
DB-0001	SS	C4	*Unassociated*
DI-0001	CD	B2	*Unassociated*
DI-0002	CD	B2	*Unassociated*
DI-0003	CD	B2	*Unassociated*
DI-0004	CD	B2	*Unassociated*
DI-0005	CD	B2	*Unassociated*
DI-0006	CD	A2	Mammoth Slopes
DI-0007	CD	B1	Mammoth Slopes
DI-0008	CD	B1	Mammoth Slopes
DI-0009	CD	B2	Mammoth Slopes
DI-0010	CD	A2	Allen Tract
DI-0011	CD	B2	Allen Tract
DI-0012	CD	B1	*Unassociated*
DI-0013	CD	B1	*Unassociated*
DI-0014	CD	B2	Mammoth Slopes
DI-0015	CD	A2	Allen Tract
DI-0016	CD	B2	Allen Tract
DI-0017	CD	A2	The Knolls
DI-0018	CD	A2	The Knolls
DI-0019	CD	A2	The Knolls
DI-0020	CD	A2	The Knolls
DI-0021	CD	A2	*Unassociated*
DI-0022	CD	C2	*Unassociated*
DI-0023	CD	C2	*Unassociated*
DI-0024	CD	C1	*Unassociated*
DI-0025	CD	B1	*Unassociated*
DI-0026	CD	B1	*Unassociated*
DI-0027	CD	B2	*Unassociated*
DI-0028	CD	B2	*Unassociated*
DI-0029	CD	B2	*Unassociated*
DI-0030	CD	B2	*Unassociated*
DI-0031	CD	D3	*Unassociated*
DI-0032	CD	C2	*Unassociated*
DI-0033	CD	C2	*Unassociated*
DI-0034	CD	C2	*Unassociated*
DI-0035	CD	C2	*Unassociated*
DI-0036	CD	C1	*Unassociated*
DI-0037	CD	C1	*Unassociated*
DI-0038	CD	C1	*Unassociated*
DI-0039	CD	C1	*Unassociated*
DI-0040	CD	C1	*Unassociated*
DI-0041	CD	B1	*Unassociated*
DI-0042	CD	B1	*Unassociated*
DI-0043	CD	B1	*Unassociated*
DI-0044	CD	B1	*Unassociated*
DI-0045	CD	B1	*Unassociated*
DI-0046	CD	B1	*Unassociated*
DI-0047	CD	B2	*Unassociated*
DI-0048	CD	B2	*Unassociated*
DI-0049	CD	B2	*Unassociated*
DI-0050	CD	E2	Old Mammoth
DI-0051	CD	E2	Old Mammoth
DI-0052	CD	E2	Old Mammoth
DI-0053	CD	E2	Old Mammoth
DI-0054	CD	E2	Old Mammoth
DI-0055	CD	E1	Old Mammoth
DI-0056	CD	E1	Old Mammoth
DI-0057	CD	E1	Old Mammoth
DI-0058	CD	E1	Old Mammoth
DI-0059	CD	E1	Old Mammoth

Facility Unique ID by Map Index and Service Area

Type Codes

CD = Collection Device | SF = Storm Fitting | SS = Storm Structure

Unique ID	Type	Index	Service Area
DI-0060	CD	E1	Old Mammoth
DI-0061	CD	E1	Old Mammoth
DI-0062	CD	E1	Old Mammoth
DI-0063	CD	E1	Old Mammoth
DI-0064	CD	B3	*Unassociated*
DI-0065	CD	B3	*Unassociated*
DI-0066	CD	B3	*Unassociated*
DI-0067	CD	B3	*Unassociated*
DI-0068	CD	B3	*Unassociated*
DI-0069	CD	B3	*Unassociated*
DI-0070	CD	B4	*Unassociated*
DI-0071	CD	C3	East Side Downtown
DI-0072	CD	C3	East Side Downtown
DI-0073	CD	C3	East Side Downtown
DI-0074	CD	C3	East Side Downtown
DI-0075	CD	B2	*Unassociated*
DI-0076	CD	B2	*Unassociated*
DI-0077	CD	D2	Vistas
DI-0078	CD	B3	Sierra Valley
DI-0079	CD	B3	Sierra Valley
DI-0080	CD	B2	Sierra Valley
DI-0081	CD	B2	Sierra Valley
DI-0082	CD	B2	Sierra Valley
DI-0083	CD	B2	Sierra Valley
DI-0084	CD	C2	Sierra Valley
DI-0085	CD	E3	*Unassociated*
DI-0086	CD	E3	*Unassociated*
DI-0087	CD	E3	*Unassociated*
DI-0088	CD	C3	East Side Downtown
DI-0089	CD	C3	East Side Downtown
DI-0090	CD	B3	*Unassociated*
DI-0091	CD	B3	*Unassociated*
DI-0092	CD	B3	*Unassociated*
DI-0093	CD	C3	*Unassociated*
DI-0094	CD	C3	*Unassociated*
DI-0095	CD	B3	*Unassociated*
DI-0096	CD	E1	Old Mammoth
DI-0097	CD	E1	Old Mammoth
DI-0098	CD	E1	Old Mammoth
DI-0099	CD	E1	Old Mammoth
DI-0100	CD	E2	Old Mammoth
DI-0101	CD	E1	Old Mammoth
DI-0102	CD	E1	Old Mammoth
DI-0103	CD	E1	Old Mammoth
DI-0104	CD	E1	Old Mammoth
DI-0105	CD	E1	Old Mammoth
DI-0106	CD	E1	Old Mammoth
DI-0107	CD	D2	Old Mammoth
DI-0108	CD	D2	Old Mammoth
DI-0109	CD	D2	Old Mammoth
DI-0110	CD	E2	Old Mammoth
DI-0111	CD	E2	Old Mammoth
DI-0112	CD	D2	Old Mammoth
DI-0113	CD	D2	Old Mammoth
DI-0114	CD	C4	*Unassociated*
DI-0115	CD	B4	The Trails
DI-0116	CD	C4	The Trails
DI-0117	CD	C4	*Unassociated*
DI-0118	CD	C4	*Unassociated*
DI-0119	CD	C5	*Unassociated*
DI-0120	CD	C5	*Unassociated*
DI-0121	CD	C4	*Unassociated*
DI-0122	CD	C4	*Unassociated*
DI-0123	CD	C4	*Unassociated*
DI-0124	CD	C4	*Unassociated*
DI-0125	CD	C4	*Unassociated*
DI-0126	CD	C4	*Unassociated*
DI-0127	CD	C4	The Trails
DI-0128	CD	C4	The Trails
DI-0129	CD	B4	Commerce
DI-0130	CD	B4	Commerce
DI-0131	CD	B4	*Unassociated*
DI-0132	CD	B4	Commerce
DI-0133	CD	C5	*Unassociated*
DI-0134	CD	C5	*Unassociated*
DI-0135	CD	C5	*Unassociated*
DI-0136	CD	B5	*Unassociated*
DI-0137	CD	B5	*Unassociated*
DI-0138	CD	B3	*Unassociated*
DI-0139	CD	B4	*Unassociated*
DI-0140	CD	B3	*Unassociated*
DI-0141	CD	B3	*Unassociated*
DI-0142	CD	B3	Center Street
DI-0143	CD	B3	Center Street
DI-0144	CD	B3	Center Street
DI-0145	CD	B2	*Unassociated*
DI-0146	CD	C3	East Side Downtown
DI-0147	CD	C3	East Side Downtown
DI-0148	CD	C3	*Unassociated*
DI-0149	CD	D2	Vistas
DI-0150	CD	D2	Vistas
DI-0151	CD	D2	Vistas
DI-0152	CD	C3	West Side Downtown
DI-0153	CD	E3	*Unassociated*
DI-0154	CD	E3	*Unassociated*
DI-0155	CD	E3	*Unassociated*
DI-0156	CD	E3	*Unassociated*
DI-0157	CD	E3	*Unassociated*
DI-0158	CD	E3	*Unassociated*
DI-0159	CD	E3	*Unassociated*
DI-0160	CD	E3	*Unassociated*
DI-0161	CD	E3	*Unassociated*
DI-0162	CD	E3	*Unassociated*
DI-0163	CD	E3	*Unassociated*
DI-0164	CD	E3	*Unassociated*
DI-0165	CD	E3	*Unassociated*
DI-0166	CD	E3	*Unassociated*
DI-0167	CD	E2	*Unassociated*
DI-0168	CD	E2	*Unassociated*
DI-0169	CD	D3	*Unassociated*
DI-0170	CD	E3	*Unassociated*
DI-0171	CD	D2	*Unassociated*
DI-0172	CD	E2	*Unassociated*
DI-0173	CD	E2	*Unassociated*
DI-0174	CD	E2	*Unassociated*
DI-0175	CD	E2	*Unassociated*
DI-0176	CD	E2	*Unassociated*
IL-0001	SF	A2	Mammoth Slopes
IL-0002	SF	B2	Sierra Valley
IL-0003	SF	B3	Center Street
IL-0004	SF	B3	*Unassociated*
IL-0005	SF	D2	*Unassociated*
JS-0001	SS	A2	*Unassociated*
JS-0002	SS	B2	Mammoth Slopes
JS-0003	SS	B2	Mammoth Slopes
JS-0004	SS	A2	Mammoth Slopes
JS-0005	SS	A2	Mammoth Slopes
JS-0006	SS	A2	Mammoth Slopes
JS-0007	SS	A2	Mammoth Slopes
JS-0008	SS	A2	Mammoth Slopes
JS-0009	SS	A2	*Unassociated*
JS-0010	SS	A2	Mammoth Slopes

Facility Unique ID by Map Index and Service Area

Type Codes

CD = Collection Device | SF = Storm Fitting | SS = Storm Structure

Unique ID	Type	Index	Service Area
JS-0011	SS	A2	*Unassociated*
JS-0012	SS	A2	*Unassociated*
JS-0013	SS	C4	The Trails
JS-0014	SS	B5	*Unassociated*
JS-0015	SS	B3	*Unassociated*
JS-0016	SS	E3	*Unassociated*
MH-0001	SS	A2	Mammoth Slopes
MH-0002	SS	A2	Mammoth Slopes
MH-0003	SS	B2	Mammoth Slopes
MH-0004	SS	B2	Mammoth Slopes
MH-0005	SS	A2	Mammoth Slopes
MH-0006	SS	A2	Mammoth Slopes
OL-0001	SF	B2	*Unassociated*
OL-0002	SF	B2	*Unassociated*
OL-0003	SF	B3	Sierra Valley
OL-0004	SF	C4	The Trails
OL-0005	SF	B3	Center Street
OS-0001	SS	C2	Sierra Valley
OS-0002	SS	B2	Sierra Valley
OS-0003	SS	E2	Old Mammoth
OS-0004	SS	E1	Old Mammoth
SV-0001	SS	C1	*Unassociated*

Attachment 4 – Inspection Form

Town of Mammoth Lakes **Stormwater Facilities Inspection Form**

Date:_____ Initials:_____

Unique ID	Feature Type	Priority Feature	Maint. Req.	Service Area	Photo email to GIS person w/ID# in subject line	Inspection Notes
(CB-0001)	See list[1]	Y/N	Code[2]	Abbreviation[3]	Y/N	Description of maintenance activity, photo details, or anything else of interest

[1]Feature Types: Catch Basin, Culvert, Curb Cut, Curb Gutter, Curb Inlet, Detention Basin, Drop Inlet, Earthen Ditch, Inlet, Junction Structure, Manhole, Open Channel, Outfall, Slotted Drain, Storm Drain Pipe (Pipe), Storm Vault, Swale, Other (describe in notes)

[2]Maintenance Codes:

0 – No Maintenance Required
1 – Accumulated Sediment
2 – Accumulated Trash
3 – Accumulated Debris
4 – Vegetation Concerns
5 – Water Quality Concerns
6 – Impeded Water Flow
7 – Erosion Concerns
8 – Structural Repairs Needed
9 – Cover/Frame/Grate Issues
10 – Damaged Pipes
11 – Mosquito Breeding
12 – Could Not Locate
13 – Access Issue (e.g., locked)
14 –
15 –
16 –
17 –
18 –
19 –
20 –
21 –
22 –
23 –
24 –
25 –
26 –
OTR – Other (describe in notes)

[3]Service Area Abbreviations: The Knolls (KNOL), Mammoth Slopes (MASL), Allen Tract (ALTR), Juniper Ridge (JURI), Kelly Tract (KETR), Hidden Valley (HIVA), Sierra Valley (SIVA), Center Street (CEST), Vistas (VIST), Old Mammoth (OLMA), The Crest (CRES), West Side Downton (WSDO), East Side Downton (ESDO), The Trails (TRAI), and Commerce (COMM).

NCE

Mammoth Lakes CALIFORNIA

Attachment 5 – Example Work Order Form

Town of Mammoth Lakes

Stormwater Facilities Work Order Form

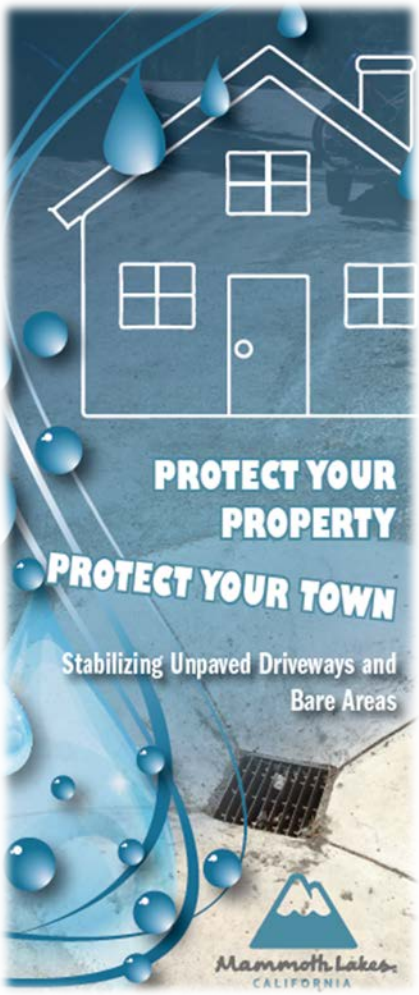
Date _____ Initials _____

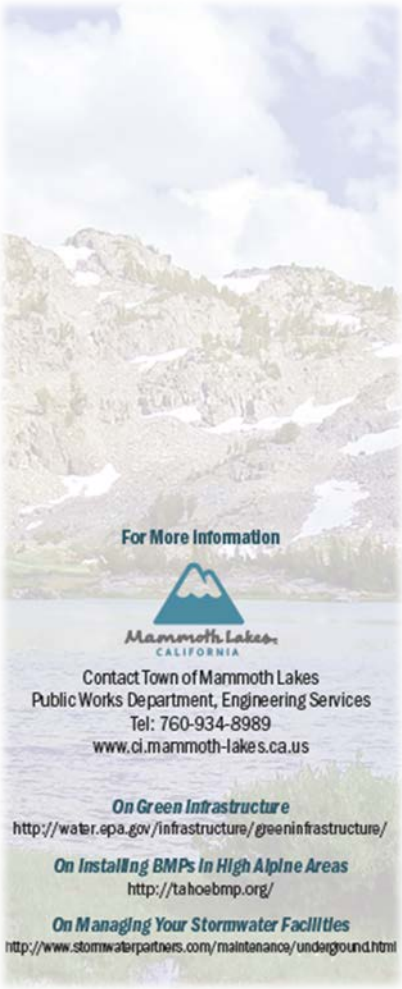
Unique ID	Feature Type	Priority Feat.	Service Area	Inspect Date	Maint. Required	Maint. Performed	Photo	Maintenance Notes
e.g., CB-0001	e.g., Catch Basin	Y/N	e.g., Mammoth Slopes	from inspection form	from inspection form	Cleaned, Repaired, Replaced, Other (describe in notes)	Y/N (email to GIS person with ID# in subject line)	Notes about action performed, photo details, etc.
CB-0001	Catch Basin	Yes	Mammoth Slopes	4/15/2015	Accumulated Sediment			
DI-0010	Drop Inlet	Yes	Allen Tract	4/20/2015	Other			
DI-0014	Drop Inlet	Yes	Mammoth Slopes	4/15/2015	Impeded Water Flow			
DI-0016	Drop Inlet	Yes	Allen Tract	4/20/2015	Vegetation Concerns			
MH-0001	Manhole	Yes	Mammoth Slopes	4/15/2015	Structural Repairs Needed			
PI-0017	Storm Drain Pipe	No	Mammoth Slopes	4/15/2015	Structural Repairs Needed			
PI-0033	Storm Drain Pipe	No	Mammoth Slopes	4/15/2015	Structural Repairs Needed			
PI-0085	Storm Drain Pipe	No	Mammoth Slopes	4/15/2015	Structural Repairs Needed			
PI-0087	Storm Drain Pipe	No	Allen Tract	4/20/2015	Impeded Water Flow			

RETROFIT PROGRAM OUTREACH

APPENDIX

Retrofit Program Outreach Material
Town of Mammoth Lakes





Prepared for
Town of Mammoth Lakes
P.O. Box 1609
Mammoth Lakes, CA 93546

NCE Project No.: 220.11.14

RETROFIT PROGRAM OUTREACH

Attachment 1 – Presentation for Public

Protect Your Property
Protect Your Town

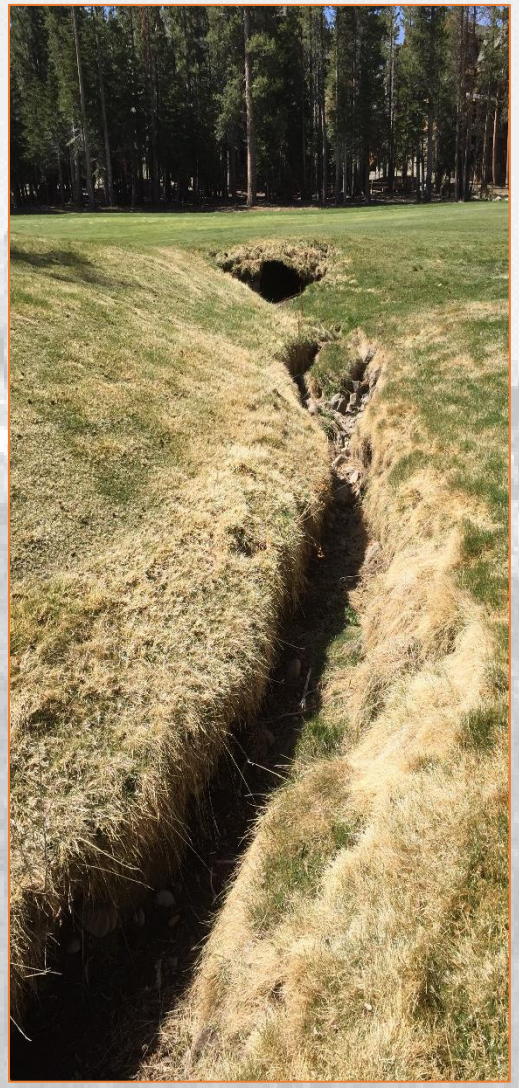
Presented by Public Works Department

Engineering Services

Does this look familiar?

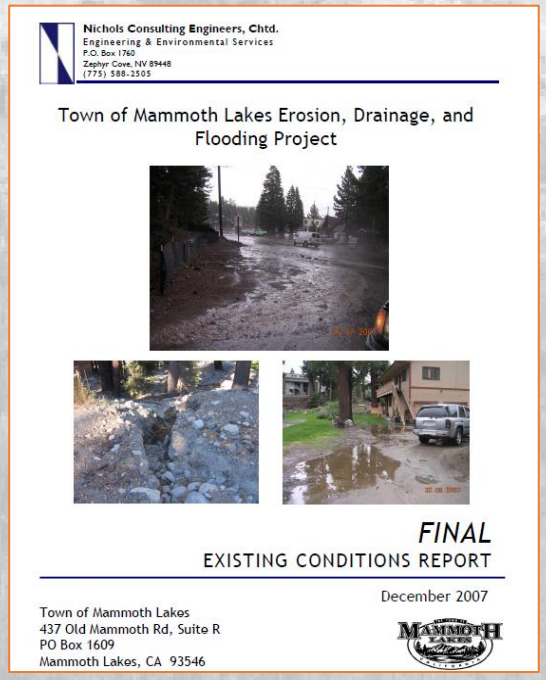
Has this ever happened to you?

Have you seen this in Town?



Houston…we have a problem!

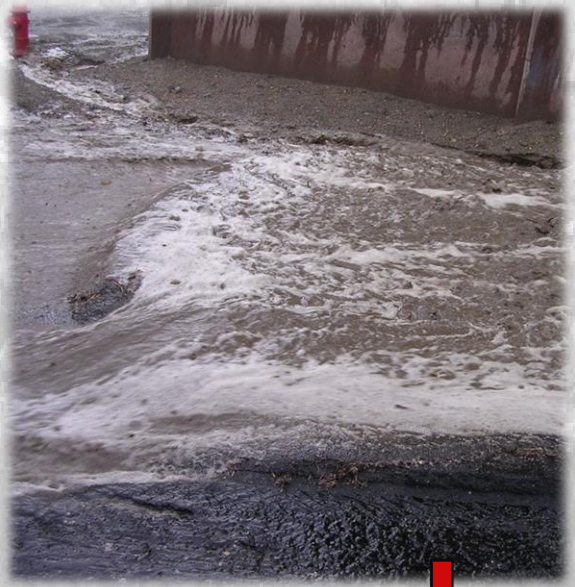
- Erosion, drainage and flooding have been and continue to be an issue for the Town
- Two big issues on private property
  - Erosion and the sediment it produces
  - Runoff overwhelming the storm drain system, causing flooding



Mammoth Lakes
CALIFORNIA

Erosion and sediment

Runoff over bare and unprotected areas = Erosion

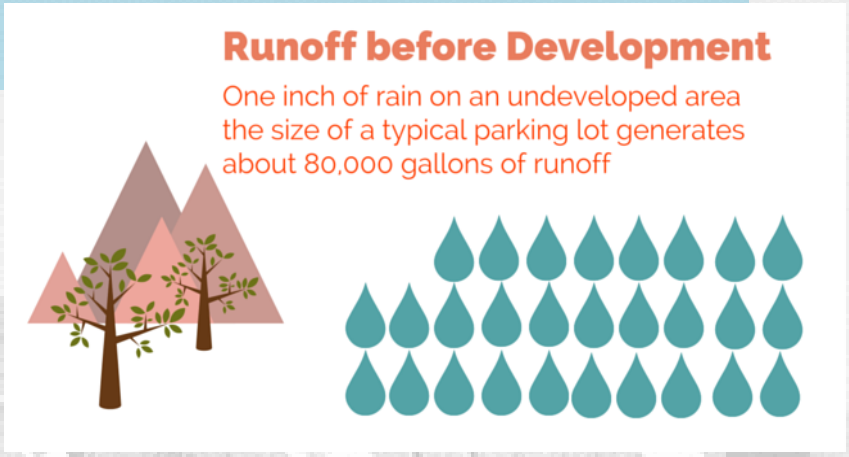


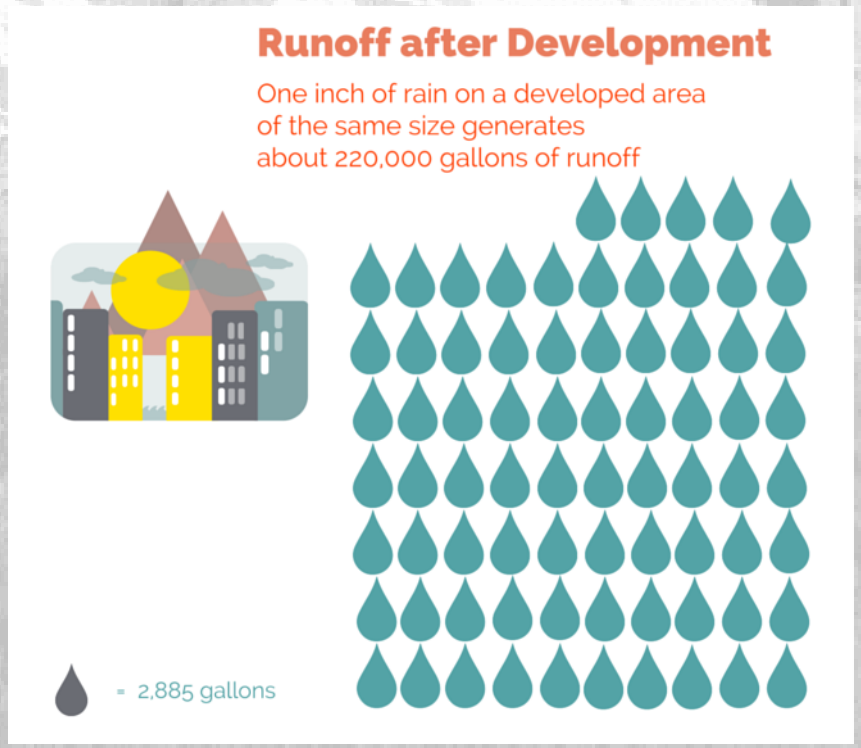
Erosion = Sediment Mobilization

Sediment = Drainage Issues

Runoff & flooding

- Developed areas create 3X more runoff than undeveloped areas
- Parking lots and driveways are big contributors



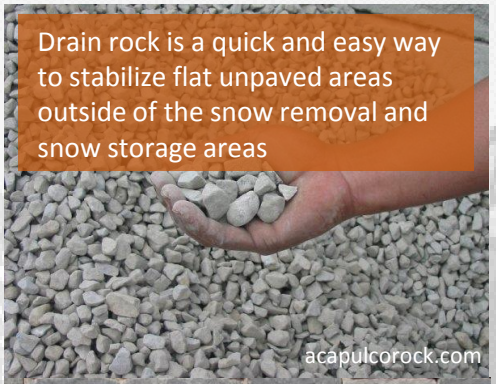


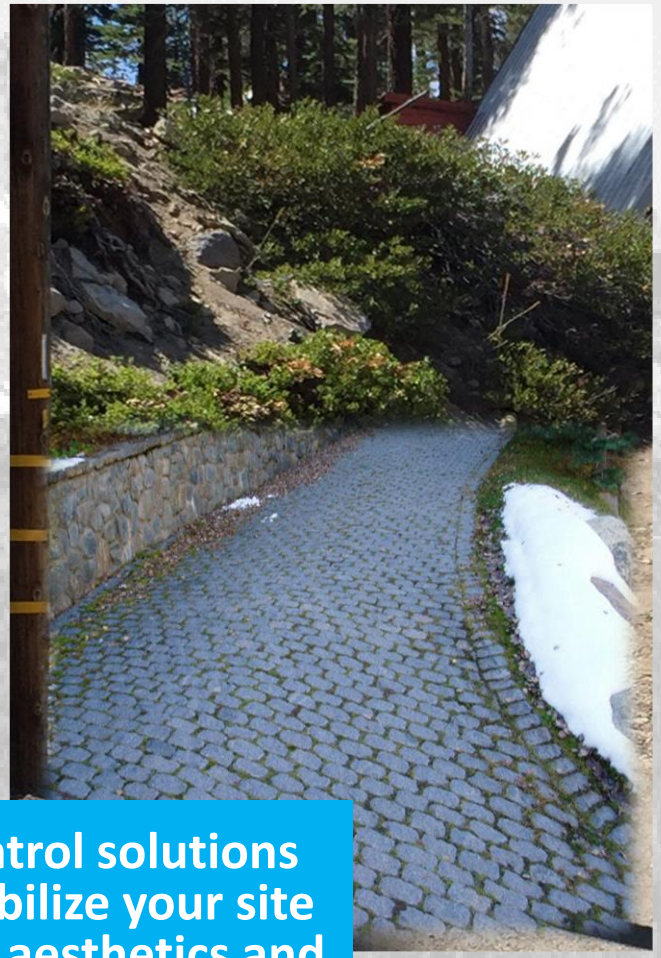
What does this mean for you?

- The <u>stormwater-related issues cause:</u>
  - Damaged property
  - High repair costs
  - Degraded lakes and creeks

What can you do?

Stabilize unpaved driveways, parking stalls and bare hillslopes

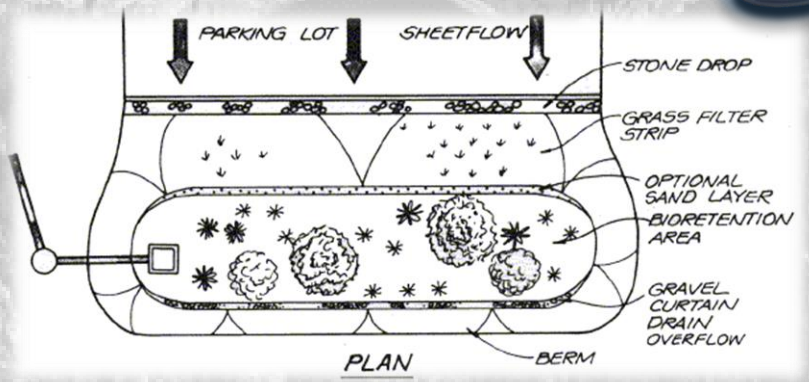




Erosion control solutions not only stabilize your site but improve aesthetics and increase property value

What can you do?

Use BMPs to capture runoff from large paved areas and parking lots



Rain gardens not only capture runoff, but improve aesthetics and increase property value

Get engaged, stay connected

- Contact Town Staff
- Sign-up for “Notify Me” Alerts on the Town Website

Public Works Department, Engineering Services

(760) 934-8989

www.ci.**mammoth-lakes**.ca.us

Protect Your Property
Protect Your Town

Attachment 2 – Talking Point Content

Talking Point Content for Media Platforms

Platform: Town E-News

Target Audience:	Residents
Distribution:	E-News emailed to subscribers of the Notify Me, Town E-News list
	E-News link posted on Town's Facebook Page
E-news Tag line:	Keep Mammoth Creek Clean

Stormwater runoff can mobilize pollutants such as sediment, oil, grease, and heavy metals into our creeks. These pollutants accumulate on impervious surfaces like paved driveways and parking areas which are transported directly to our creeks through the storm drain system when it rains. With your help, we can significantly reduce the pollution levels to protect our local creeks. Take these five simple actions to prevent stormwater from polluting our creeks:

- Sweep paved areas with a broom instead of washing it with a hose.
- Clean litter and debris out of grates to prevent flooding and keep trash out of the waterways.
- Don't dump any chemicals, oil/grease, paint, or other waste down the drain. You can drop it off at the transfer station at Mammoth Disposal located at 59 Commerce Drive. Call for more details at (760) 934-2201.
- Vegetate or mulch bare areas to soak up runoff and keep sediment from washing away.

For more information on stormwater management and what you can do to help, contact the Public Works Department, Engineering Services at (760) 934-8989, or visit our website at http://www.ci.mammoth-lakes.ca.us/.

Platform: Town E-News

Target Audience: Residential property owners

Distribution: E-News emailed to subscribers of the Notify Me, Town E-News list.
E-News link posted on Town's Facebook Page.

Tag line: Protect your Property. Protect your Town.

Unpaved driveways easily erode when it rains or when snow is removed. Erosion moves sediment and debris onto roads and into the Town's stormwater infrastructure which causes clogging. Protect your property and protect your Town by paving your driveway. If you plan to pave your driveway, obtain a driveway modification permit from the Public Works Department to ensure your retrofit will not make your home prone to erosion or flooding. Call Public Works at (760) 934-8989. (Municipal Code 15.04.100).

For more information on stormwater management and what you can do to help, contact the Public Works Department at (760) 934-8989, or visit our website at http://www.ci.mammoth-lakes.ca.us/.

Platform: Town E-News

Target Audience: Residential property owners

Distribution: E-News emailed to subscribers of the Notify Me, Town E-News list.
E-News link posted on Town's Facebook Page.

Tag line: Protect your Property. Protect your Town.

Bare areas can cause erosion on your property and allow sediment to move onto roads and into the Town's storm drain system which causes clogging. Protect your property and protect your Town by vegetating and stabilizing bare areas on your property. For flatter areas, vegetation and mulch will help protect the bare area from eroding. If your unvegetated area is sloped, check out the Town's brochure, "Protect your Property Protect your Town" for more information. For all sites, vegetation that occurs naturally in the Mammoth area will need less water and fertilizer. The easiest and cheapest mulch consists of pine needles but wood chips and other material can also be used.

For more information on stormwater management and what you can do to help, contact the Public Works Department at (760) 934-8989, or visit our website at http://www.ci.mammoth-lakes.ca.us/.

Platform: Town E-News

Target Audience: Commercial property owners and HOA managers

Distribution: E-News emailed to subscribers of the Notify Me, Town E-News list.
E-News link posted on Town's Facebook Page.

Tag line: Protect your Property. Protect your Town

Large parking areas and driveways generate significant amounts of runoff during storms which cause erosion and increase the potential for flooding. Protect your property and protect your Town by infiltrating or temporarily storing runoff on your property. This will prevent erosion, reduce the potential for flooding, and minimize costly repairs. Check any existing facilities monthly or check before a storm. Conduct or schedule maintenance if the facility is full of sediment or debris, or if the facility drains too slowly.

For more information on stormwater management and what you can do to help, contact the Public Works Department at (760) 934-8989, or visit our website at http://www.ci.mammoth-lakes.ca.us/.

Platform: Public Service Announcements

Target Audience:	Residents
Distribution:	Emailed to subscribers of the Notify Me, Public Service Announcements List.
Tag Line:	The Town of Mammoth Lakes is taking on stormwater

Opportunity to Comment on the Town's Stormwater Master Plan
The Town of Mammoth Lakes is taking on stormwater in a proactive way. Over the years, the Town has witnessed significant erosion, drainage and flooding problems related to stormwater. The Town addressed these issues as they came up and when resources were available. Now, made possible by a grant from the Inyo Mono Integrated Region Water Management Program (IRWMP), the Town is developing a Stormwater Master Plan to take on stormwater management and uniquely address stormwater priorities. Since the Town is not regulated under a Federal or State permit, the Town can develop a Stormwater Master Plan that reflects local priorities and not just permit requirements. The Town's priorities in managing stormwater are to: reduce impacts from erosion and drainage problems, protect creeks and streams from stormwater pollution, effectively manage and operate the Town's stormwater infrastructure, and engage the public to become part of the solution. The Stormwater Master Plan is focused on these priorities. This plan is available for the public to review and comment July 31 to August 14, 2015. You can download the document and the comment template at: http://www.ci.mammoth-lakes.ca.us/. Please review and submit your written comments by August 14, 2015 to Jamie Robertson at jrobertson@townofmammothlakes.ca.gov or by mail at:

Jamie Robertson
Town of Mammoth Lakes
PO Box 1609, Mammoth Lakes, CA 93546

Comments received by the Town on or before August 14th will be considered during the preparation of the final draft.

Platform: Public Service Announcements

Target Audience:	Residents
Distribution:	Emailed to subscribers of the Notify Me, Public Service Announcements List.
Tag Line:	The Town of Mammoth Lakes is taking on stormwater

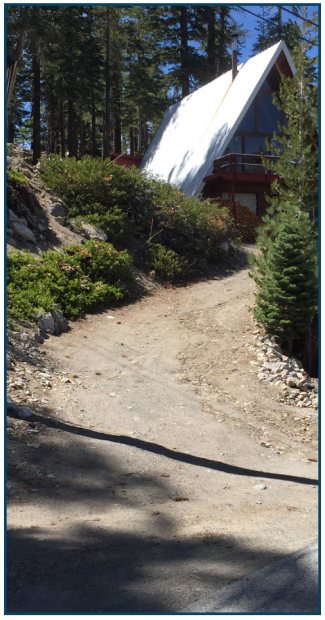
Announcing the Town of Mammoth Lakes Stormwater Master Plan
The Town of Mammoth Lakes is taking on stormwater in a proactive way. Over the years, the Town has witnessed significant erosion, drainage and flooding problems related to stormwater. The Town mitigated stormwater damage as events occurred and when resources were available. Now, made possible by a grant from the Inyo Mono Integrated Region Water Management Program (IRWMP), the Town developed a Stormwater Master Plan to take on stormwater management and uniquely address stormwater priorities. Since the Town is not regulated under a Federal or State permit, the Town developed a Stormwater Master Plan to reflect local priorities and not just permit requirements. The Town's priorities in managing stormwater are to: reduce impacts from erosion and drainage problems, protect creeks and streams from stormwater pollution, effectively manage and operate the Town's stormwater infrastructure, and engage the public to become part of the solution. The Stormwater Master Plan is focused on these priorities. The plan was developed in collaboration with Town residents as well as local, state, and federal stakeholders. The Stormwater Master Plan is focused on addressing the most pressing priorities related to stormwater. This plan is available for download and review at http://www.ci.mammoth-lakes.ca.us/. Contact Jamie Robertson at jrobertson@townofmammothlakes.ca.gov with any questions.

Attachment 3 – Unpaved Areas Brochure

You Can Prevent Erosion and Flooding

You can take action today to prevent erosion and flooding caused by unpaved driveways or bare areas. Stabilize areas where you drive or park and revegetate bare areas and slopes.

If you are paving your driveway, consider pavement alternatives that capture and treat rainfall on-site. Obtain the required driveway modification permit from the Town to ensure the driveway design will protect your property and prevent erosion and drainage problems around you.



For More information

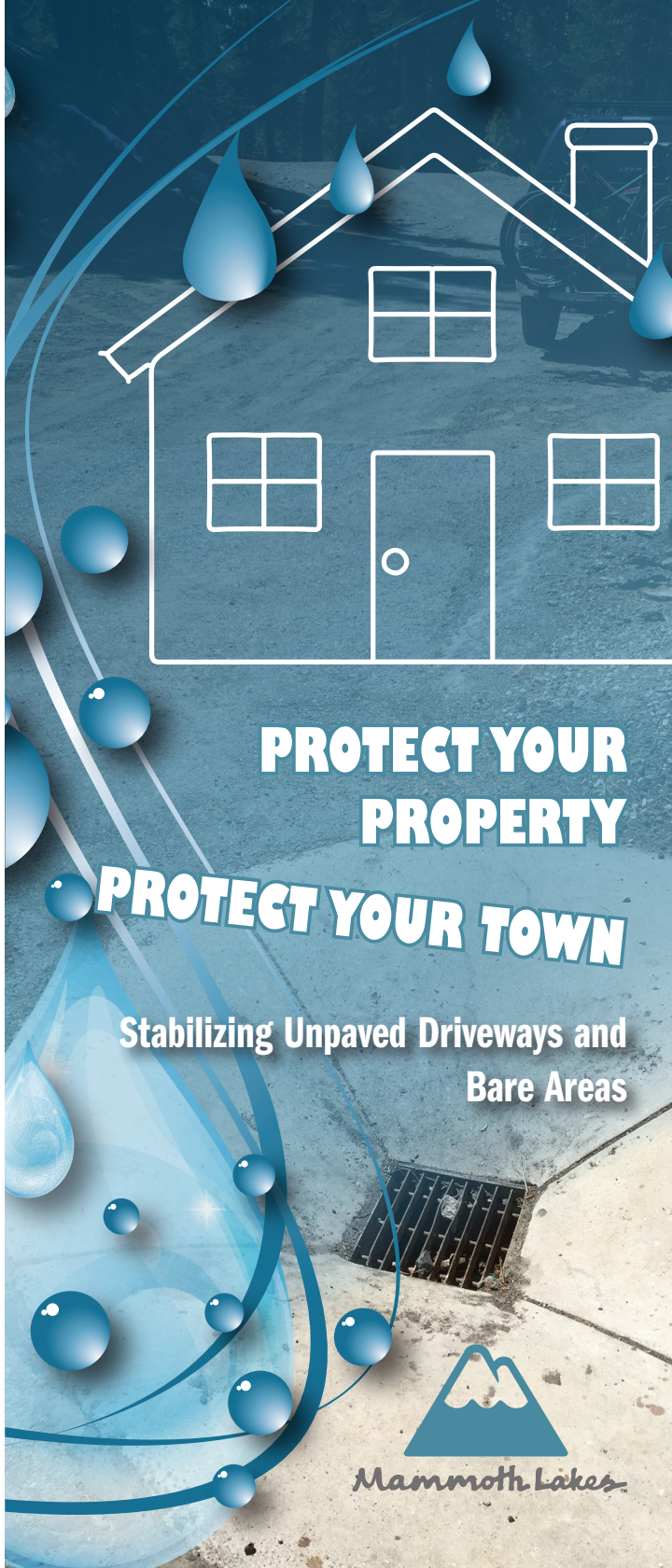
Mammoth Lakes
CALIFORNIA

For typical seed mixes used for erosion control
Contact Town of Mammoth Lakes
Public Works Department, Engineering Services
Tel: 760-934-8989
www.ci.mammoth-lakes.ca.us

On Driveway Modification Permits
Contact Town of Mammoth Lakes
Public Works Department, Engineering Services
760-934-8989

On Native Plants in the Mammoth Lakes Area
www.calflora.org

On Installing BMPs in Alpine Areas
http://tahoebmp.org/



PROTECT YOUR PROPERTY

PROTECT YOUR TOWN

Stabilizing Unpaved Driveways and Bare Areas

Mammoth Lakes

Bare Areas Erode Your Land and Contribute to Flooding

Bare compacted areas like driveways, parking stalls, and storage areas are prone to erosion and produce large amounts of sediment that contribute to clogging of the storm drain system. This degrades your land, creates maintenance problems, increases the potential for flooding, and leads to costly repairs for you, your neighbors, and the Town.

Stabilize your Driveway

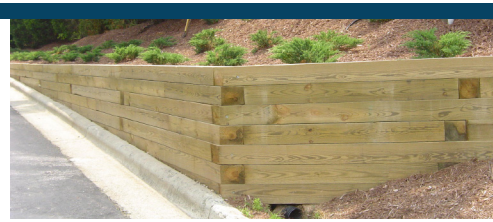
Photos: acapulcorock.com

Stabilize your dirt driveway with one of many pavement alternatives. Traditional pavements like asphalt and concrete stabilize your driveway but increase runoff from your property and the potential for flooding. Other options to stabilize your driveway include:

- Install drain rock on flatter slopes outside of Town right of way and snow removal areas.
- Install paver stones to stabilize driveways and create beautiful hardscapes.

Stabilize Your Slope

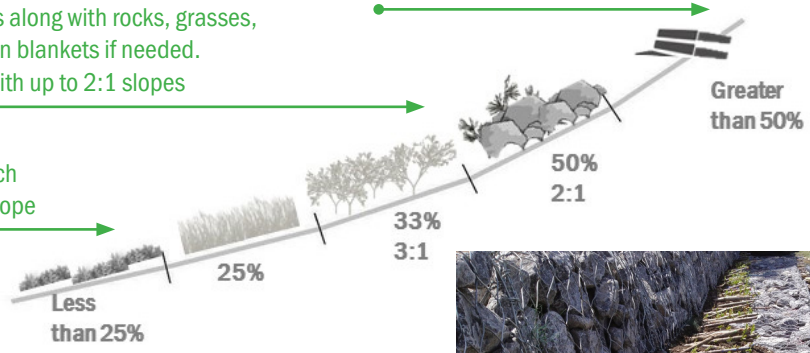
If you are stabilizing bare areas on your property, the solution depends on the slope.



Install structures, like retaining walls and vegetation on slopes of 2:1 or greater. Vegetation, like willow bundles or pole plantings, must be secured .

Establish native plants along with rocks, grasses, and mulch. Use erosion blankets if needed. Applicable for areas with up to 2:1 slopes

Place rocks, grasses, and mulch in areas with less than a 3:1 slope



Establishing vegetation requires a few tricks:

- Plants that naturally occur in the Town of Mammoth Lakes need less water and fertilizer.
- The easiest and cheapest mulch is pine needles, but wood chips and other materials work too.
- The Town of Mammoth Lakes recommends a seed mix for erosion control on disturbed sites: Hard Fescue Grass, Crested Wheat Grass, Pubescent Wheat Grass, Lupine, and Sagebrush. Contact the Town of Mammoth Lakes for seed mix recommendations.
- Prevent mulch from blowing around and clogging storm drains by pressing it into the soil by hand or securing mulch with straw netting.
- After a heavy rain, check your newly stabilized area and make any needed repair.

Willow pole plantings in rock retaining wall

Adapted for Town of Mammoth Lakes from "Stabilize Steep Slopes with Plants and Erosion Control Structures" by University of Nevada Cooperative Extension

Photo: NCE, Colorado State Cooperative Extension, APO Management, Eric Perry

Attachment 4 – Impervious Areas Brochure

What is Green Infrastructure (GI)?

Property owners around the country are using Green Infrastructure (GI) to prevent erosion, reduce stormwater, and protect their property. Green infrastructure is a set of Best Management Practices (BMPs) that address stormwater by mimicking nature's processes in how rainfall is captured and transported. Green infrastructure works by slowing and reducing stormwater runoff from large impervious areas by capturing runoff and dispersing or storing it in vegetated and/or non-erodible areas (as seen below).

Photo: Phillywater.org

Photo: Phillywater.org

You can implement GI today to prevent property damage by directing flow to pervious, non-erodible areas like rain gardens, infiltration trenches, and rock-lined swales. This prevents erosion and reduces the volume of runoff from impervious surfaces. Your actions protect your property from erosion, drainage problems and costly repairs.

For More information

Mammoth Lakes
CALIFORNIA

Contact Town of Mammoth Lakes
Public Works Department, Engineering Services
Tel: 760-934-8989
www.ci.mammoth-lakes.ca.us

On Green Infrastructure
http://water.epa.gov/infrastructure/greeninfrastructure/

On Installing BMPs in High Alpine Areas
http://tahoebmp.org/

On Managing Your Stormwater Facilities
http://www.stormwaterpartners.com/maintenance/underground.html

Mammoth Lakes
CALIFORNIA

It's raining
It's pouring
Where IS all that water going?

Controlling Runoff from Impervious Areas

What Is Stormwater Runoff?

Stormwater runoff occurs when rain falls and collects over impervious areas (such as pavements–roads, sidewalks, driveways and parking lots) or saturated surfaces. This can impact your property, creeks, lakes, and infrastructure throughout Town. Unless stormwater runoff is captured and slowed down, it can cause erosion and increase the potential for flooding.

Why Is Runoff from Impervious Areas a Problem?

Parking lots and large impervious areas generate stormwater runoff—and fast , because none of the rainfall is absorbed into the ground or taken up by vegetation.

Runoff Before Development

One inch of rain on an undeveloped area the size of a typical parking lot generates about 80,000 gallons of runoff.

Runoff After Development

One inch of rain on a developed area of the same size generates about 220,000 gallons of runoff.

Runoff has the power to cause erosion and move sediment into the Town's stormwater infrastructure. Sediment clogs and then runoff overflows the storm drain system causing erosion and increasing the potential for flooding on your property and in Town.

= 2,885 gallons

What Can I Do To Protect My Property?

You can do your part to protect your property and the property around you by slowing the flow and reducing the runoff from paved areas on your lot:

Photo: NCE

Check the stormwater facilities on your property. Maintenance is needed if your facilities have sediment build up, trash, pondwater, or signs of physical damage. Clean out any channels, drywells, and drainage inlets with a rake, vactor truck or another method if needed.

Photo: mountiancastles.org

During renovations, reduce the amount of paved areas on your property where you don't need them.

Slow the flow with Green Infrastructure (GI) practices like capturing flows on-site in rain gardens. Directing flow to parking lot planters, medians, and other vegetated areas.

Disconnect downspouts so they drain to rock-lined swales or ditches instead of driveways and parking lots.

Attachment 5 – Letter to Property Owners

Town of Mammoth Lakes
P.O. Box 1609, Mammoth Lakes, CA, 93546
(760) 934-8989
www.townofmammothlakes.ca.gov

Dear Property Owner,

You may have noticed the Town of Mammoth Lakes can experience significant drainage and flooding issues during wet weather. When it rains, the storm drain system collects the runoff along with sediment from unpaved driveways and bare areas. The sediment clogs storm drains and increases the potential for flooding. This requires the Town to dedicate significant financial resources to maintain the storm drains and clean-up after floods. These funds could otherwise be used for community improvements including parks, trails, road upgrades, and more. You can take action to protect your property and protect your Town from issues related to stormwater.

You can help prevent erosion and minimize runoff from your property by using measures called Best Management Practices (BMPs). BMPs are proven measures that slow runoff, capture sediment, and minimize erosion and drainage issues. Examples of BMPs you can use to protect your property and to protect your Town include:

Paving dirt driveways: Unpaved driveways easily erode during rainfall events or snow removal. Erosion moves sediment and debris onto roads and into the Town's storm drain system which causes clogging. If you are paving your driveway, obtain a driveway modification permit from the Public Works Department. Call Public Works at 760-934-8989. (Municipal Code 15.04.100)

Vegetating and mulching bare soils: Vegetation and mulch will help protect the soil from erosion. Vegetation occurring naturally in the Mammoth area (native plants) will need less water and fertilizer. The easiest and cheapest mulch consists of pine needles but wood chips and other material may be used. When slopes are steeper than 50%, the area is more likely to erode, and stabilization will require structures like rip-rap or terraces in combination with vegetation and mulch.

Infiltrate water from large impervious driveways and parking areas: The stormwater flowing off large parking and driveway areas and into the Town's storm drain system contributes to flooding and erosion problems. Pave your driveway and parking areas to convey water to areas on your property where it can infiltrate without causing erosion. Other ways to convey the water across your driveway and into an infiltration system include swales or slotted channel drains.

Thank you for doing your part to protect your property and protect your Town. For more information contact the Public Works Engineering Services Department at 760-934-8989.

Sincerely,

Jamie Robertson
Assistant Engineer

CONSTRUCTION SITE PROGRAM

APPENDIX

Attachment 1 – Ordinance and Grading Permit Review

MEMORANDUM

Date:	May 27, 2015
To:	Town of Mammoth Lakes (TOML)
From:	Kelley Kelso, NCE
Subject:	Component 6: Ordinance and Grading Permit Review

NCE reviewed the TOML Grading Permit Application; Town Ordinance 12.08 Land Clearing, Earthwork, and Drainage Features; and Town Ordinance 15.08 Construction Site Regulations to ensure the intent of the MOU with Lahontan is met and provides adequate authority to the Town to effectively control erosion, sediment, and drainage issues at construction sites. The following draft language recommendations are offered:

TOML Grading Permit Application

The following recommendations, if implemented, will provide the Town with more authority to control erosion, sediment, and drainage issues at construction sites.

- Waste Discharge Reports are required by the MOU with Lahontan for new development involving six or more dwelling units or for commercial developments that involve soil disturbance on ¼ acre or more. A description of the Waste Discharge Report should be included in the grading permit application. The Waste Discharge Reports consist of:
    - Description of interim erosion control measures
    - Detail of the short-term and long-term erosion and drainage control measures
    - Schedule for implementation of erosion and drainage control measures
    - Details of erosion control measures shown on engineering drawings. Include design calculations for erosion control facilities.
- Add language to the Permit Application that states that the Town has the right to enter a project area to inspect BMPs at any time.
- Pg. 2 #3.) Add the following language: Calculations of soil disturbance volume (cubic yards)_____ and area (square feet)_____. Include calculations.
- Pg. 3 Under submittal item for SWPPP, the SWMP should be defined with specific requirements. One option would be to replace the SWMP with the Waste Discharge Report (see first bullet above). This will considerably reduce confusion by applicants and the need for duplicate reports.

- Pg. 5B #6, Add "SHOW locations of all temporary and permanent BMPs and detail about how they will be installed."
- Pg. 6C, Add "Show existing underground/overhead utilities."
- Pg. 7F, Replace second sentence of #4 with, "Show locations of all stockpiles and staging areas."
- Pg. 8G #4, Add statement that perennial grasses or other ground cover shall be native or adapted plants.
- Pg. 8G #6, Add statement that vegetation should be native or adapted and include specific success criteria. Success criteria are critical to ensuring long term stability of disturbed sites.
- Pg. 8G #9, Change sentence to read, "In the Spring, during snow melt runoff conditions and prior to predicted storm events, the Permittee shall inspect all erosion and sediment control devices on a weekly basis or more often as needed and repair any damage or revise BMPs."
- Pg. 8G, Add "Project operation shall be limited to the permitted address only. No other property shall be affected or utilized unless separate grading permit is obtained for said location."
- Pg. 9, Add #7 to check list, "SWPPP or Stormwater Management Plan."

Ordinance 12.08 Land Clearing, Earthwork, and Drainage Features

NCE recommends the Director issue a bulletin to clarify Section 12.08.078D3 of the Ordinance. Currently, a development with 4,000 sq. ft. of impervious area must install a drywell. The bulletin should clarify the term drywell includes any infiltration system that is sized to infiltrate the 20 year one hour storm. If an amendment to the Code is possible, the 4,000 sq. ft. threshold should be reduced to 1,500 sq. ft.

Section 12.08.060A: Allows most small residential development to be exempt from the grading permit. NCE recommends lowering the threshold for the exemption from grading 50% of the lot or 5,000 sq. ft. to 25% of the lot or 2,500 sq. ft. The Town currently exempts projects under 50 cubic yards of cut or fill. NCE recommends lowering this quantity. For example, in Lake Tahoe only projects moving under seven cubic yards of dirt are exempt from obtaining a grading permit.

Section 12.08.090: NCE recommends adding language to clarify the differences between temporary erosion control and permanent erosion control. NCE recommends adding a clear definition explaining what constitutes permanent stabilization including revegetation success criteria.

Section 12.08.09B7: NCE recommends including specific vegetative success criteria to ensure the area is permanently stabilized.

Ordinance 15.08 – Construction Site Regulations

NCE recommends adding a reference to Ordinance 12.08 for specific regulations regarding erosion and sediment control measures required for implementation at construction sites.

Lake Tahoe, NV
PO Box 1760
Zephyr Cove, NV 89448
(775) 588-2505

Attachment 2 – Construction Site Brochure

Good Housekeeping

- All chemicals and hazardous materials are stored in watertight containers with secondary containment.
- Prevent rinse water and materials from being disposed into the storm drain system.
- Portable toilets are contained to prevent discharges of waste.
- Equipment is in place to cover waste disposal containers at the end of business day and during rain events.
- Appropriate spill response personnel are assigned and trained. Equipment and materials for cleanup of spills must be available onsite.
- Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil.
- Vehicle fueling and equipment maintenance are only performed within designated and appropriately marked BMP areas.

Inspection Protocol

Inspect BMPs prior to snowmelt and precipitation events. Repair any deficiencies in BMPs.

Record Keeping

Maintain records of any grading permits and all inspections on the site.

Post-Construction BMPs/Final Stabilization

Photo: http://www.cityoftemecula.org

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate stormwater runoff and pollutants from the site after construction is completed. In addition to water quality benefits, post-construction stormwater BMPs can also be an attractive landscape design feature.

For More information

Mammoth Lakes
CALIFORNIA

Contact Town of Mammoth Lakes
Public Works Department, Engineering Services
Tel: 760-934-8989
www.ci.mammoth-lakes.ca.us

California Stormwater Quality Association
Stormwater Best Management Practice Handbook: New Development and Redevelopment
Available on-line
http://www.casqa.org

Stormwater discharge from construction sites are regulated by the State Water Board through a Memorandum of Understanding with the Town of Mammoth Lakes. The Town requires a grading permit for all grading projects.

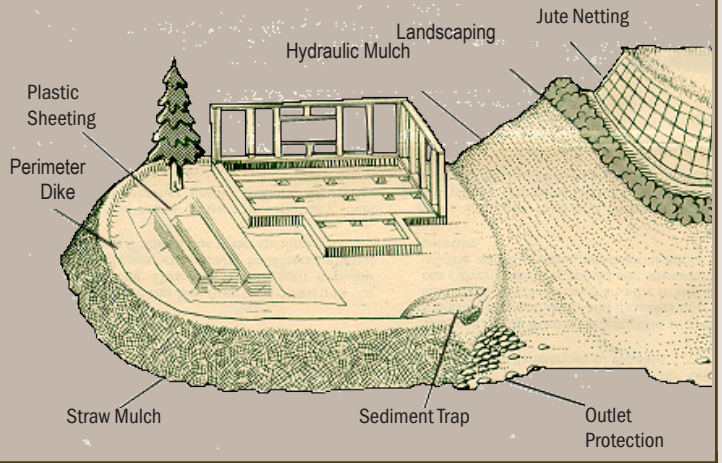
Construction Site

Best Management Practices To Prevent Stormwater Pollution

Mammoth Lakes
CALIFORNIA

To prevent discharge of pollutants from construction sites into local streams, best management practices are needed.

Construction activities have the potential to impact water quality both temporarily and in the long term. Grading disturbs soils and increases the potential for sediment discharge. Post construction impacts include reduced infiltration and higher runoff from the site.



General Site Assessment and Evaluation

- **Schedule** – Sequence construction activities to minimize exposure of soil during periods of rain, snow, and wind.
- **Limit vegetation disturbance** - Preserve existing vegetation and limit vegetation disturbance. Existing vegetation controls erosion more efficiently than areas seeded post disturbance.

BMPs

Erosion Control


Photo: NCE

ECB

Blankets or matting typically made of natural or synthetic materials and applied to surface of disturbed area. Minimizes erosion by holding soil in place and protects soil surface from wind and rain until vegetation is established.

Best Management Practices

Erosion Control


Photo: NCE

Mulch

Typically organic material (pine needles) applied to surface of disturbed area. Minimizes the potential for erosion and protects soil from wind and rain.


Photo: NCE

Stockpile Management

Stockpiles should be actively managed. BMP measures include perimeter controls (fiber roll) and appropriate surface protection (plastic covering).

Sediment Control


Photo: NCE

Fiber Rolls

A biodegradable material bound into a tight cylindrical roll wrapped in netting. They intercept runoff and reduce flow velocity for sedimentation to occur. Must be installed along contour.


Photo: NCE

Silt Fence

A woven geotextile that is trenched into the ground and detains water allowing coarse sediment to drop out. Must be installed along contour. Good for perimeter control.


Photo: http://tnepsc.org/

Inlet Protection

Can be fiber rolls, gravel bags placed around inlet, filter fabric, or drain inserts attached to a grate. Temporarily ponds runoff before it enters the storm drain allowing sediments to settle out.


Photo: http://tnepsc.org/

Sediment Basins

A temporary basin designed to capture sediment by detaining construction site runoff.


Photo: NCE

Stabilized Construction Entrance

Placed at all entrances/exits to project site. Generally constructed of angular stones placed above filter fabric or a rumble board. Reduces tracking from a construction site.


Photo: http://auto.howstuffworks.com/

Street Sweeping

Should be implemented regularly (daily on some sites) on all paved surfaces to remove sediment and debris. Prevents sediment from entering storm drain system or surface waters.


Photo: http://www.schuylerswcd.com/

Check Dams

Small barrier of rock, gravel bags, or other material placed across a drainage to reduce the flow velocity of the water for sedimentation to occur.