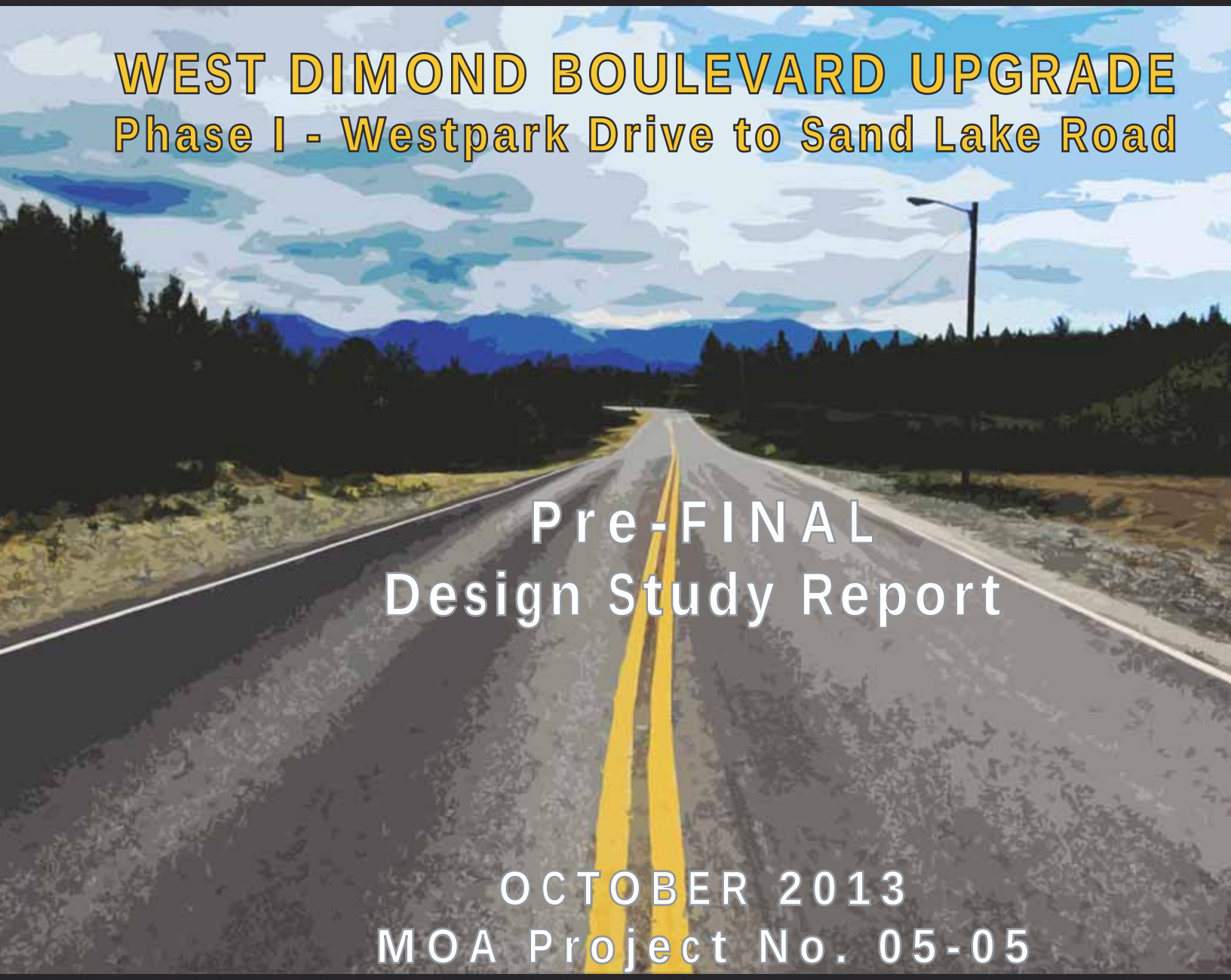
Municipality of Anchorage
Public Works Department

Project Management & Engineering Division

WEST DIMOND BOULEVARD UPGRADE
Phase I - Westpark Drive to Sand Lake Road



Pre-FINAL
Design Study Report

OCTOBER 2013
MOA Project No. 05-05

Prepared by:

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PRE-FINAL DESIGN STUDY REPORT

West Dimond Boulevard Upgrade: Phase I – Westpark Drive to Sand Lake Road

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EXECUTIVE SUMMARY

The Municipality of Anchorage (MOA) is upgrading West Dimond Boulevard from Jodhpur Street to Sand Lake Road. This report addresses Phase I (Westpark Drive to Sand Lake Road). Final design and construction of Phase II (Jodhpur Street to Westpark Drive) will not advance until full construction funding becomes available. West Dimond Boulevard within the project area is a two-lane, east-west collector without curbs or pedestrian facilities.

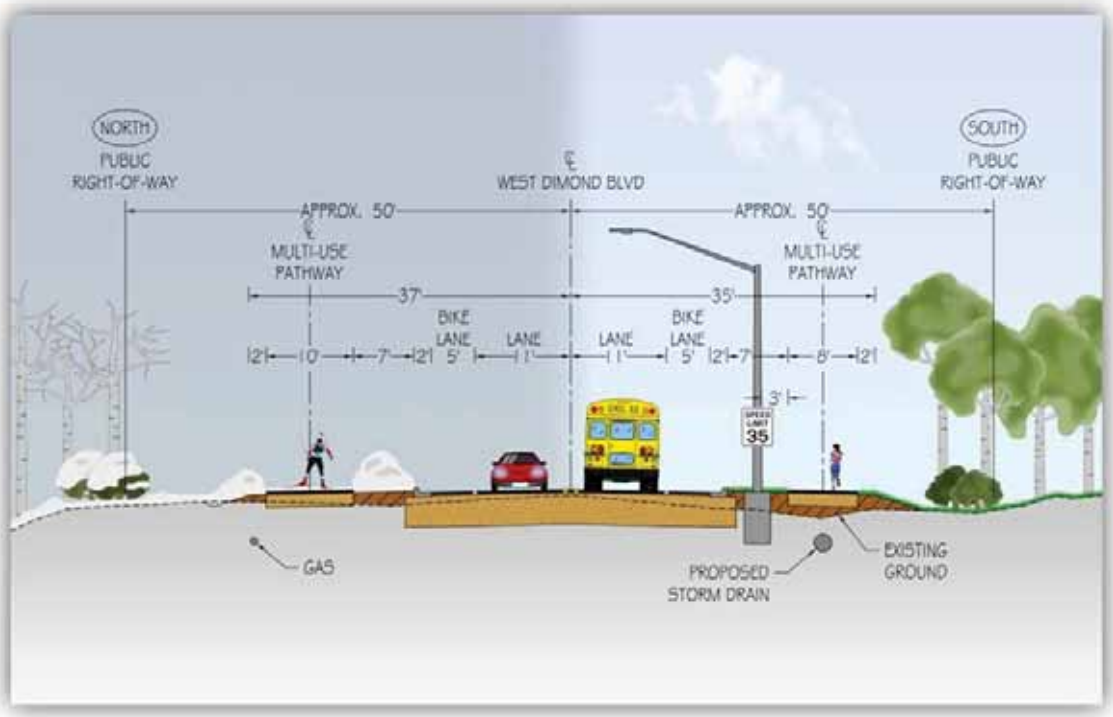
West Dimond Boulevard – Phase I Objectives are to:

- Provide pedestrian and bicycle facilities within the project corridor;
- Improve safety by:
  - Improving horizontal and vertical geometry.
  - Separating vehicles from pedestrians and bicyclists.
  - Calming traffic.
- Upgrade the roadway and intersections to current municipal road standards;
- Upgrade a public facility which has adequate capacity for the future growth and development of the area for the next 20-30 years;
- Provide major intersections that will operate at adequate service levels in the future; and
- Reduce long-term road maintenance by providing greater durability to the road surface.

The proposed improvements will be built to current municipal standards for a Class I Collector, improve intersection movements to increase traffic flow, provide traffic calming measures to control vehicle speeds, and improve pedestrian and bicycle safety.

Recommended improvements along the corridor include:

- Reconstructing the roadway surface and structural section with four-inches of asphalt pavement, adding shoulders with curb and gutter, and constructing separated pathways on each side of the roadway;
- Roadway drainage collected along the curb and gutter and conveyed through catch basins and storm drain pipes to low spots, matching the existing drainage patterns where practical and where possible, the multi-use pathway will sheet flow to a ditch or swale located outside of the shoulder and discharge into existing low spots;
- Continuous roadway lighting, using Light Emitting Diode (LED) technology;
- Landscaping that will focus on enhancing the character of the roadway; and
- Modern single-lane roundabouts at Sand Lake Road and Westpark Drive intersections with diameters between 130 feet to 140 feet.



Recommended Alternative West Dimond Blvd - Westpark Drive to Sand Lake Road, Typical Section

Recommended Alternative Single-Lane Roundabout at Westpark Drive Intersection

Recommended Alternative Single-Lane Roundabout at Sand Lake Road Intersection

The preferred alternative estimated costs are summarized as follows:

Cost Estimate

DESCRIPTION	ITEM	CALCULATION	ESTIMATED COST
Construction	A		$4,000,000
Utility Relocation	B		$300,000
Right-of-Way Acquisition	C		$300,000
Subtotal	D	A+B+C	$4,600,000
Construction Engineering	E	20% of D	$920,000
Contingency	F	30% of D	$1,380,000
Total	**G**	**D+E+F**	**$6,900,000**

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LIST OF ACRONYMS

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway & Transportation Officials
ABP	Anchorage Bike Plane
ACS	Alaska Communications System
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
AMATS	Anchorage Metropolitan Area Transportation Solutions
AMC	Anchorage Municipal Code
APDES	Alaska Pollutant Discharge Elimination System
ASD	Anchorage School District
ATP	Anchorage Trails Plan
AWWU	Anchorage Water and Wastewater Utility
BMP	Best Management Practices
BOP	Beginning of Project
CAC	Citizen's Advisory Committee
CEA	Chugach Electric Association
CL	Centerline
CMP	Corrugated Metal Pipe
CSS	Context Sensitive Solutions
D	Diameter
DCM	Design Criteria Manual
DIP	Ductile Iron Pipe
DOT&PF	Alaska Department of Transportation and Public Facilities
DSR	Design Study Report
EOP	End of Project
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
F/O	Fiber Optic
GCI	General Communication
HDPE	High-Density Polyethylene
ICD	Inscribed Circle Diameter
IES	Illuminating Engineering Society
LED	Light Emitting Diode
LID	Low Impact Development
LOS	Level of Service
mph	Miles Per Hour
MOA	Municipality of Anchorage
MTP	Metropolitan Transportation Plan
MUTCD	Manual of Uniform Traffic Control Devices
OS&HP	Official Streets and Highway Plan
PCM	Alaska DOT&PF Highway Preconstruction Manual
PM&E	Project Management & Engineering
PZC	Planning and Zoning Commission
R&M	R&M Consultants, Inc.

ROW	Right-of-Way
Sta	Station (100 ft)
SWPPP	Storm Water Pollution Prevention Plan
TRB	Transportation Research Board
UDC	Urban Design Commission
UGE	Underground Electric
USPS	United States Postal Service

WEST DIMOND BOULEVARD UPGRADE
PHASE 1: WESTPARK DRIVE TO SAND LAKE ROAD
PRE-FINAL DESIGN STUDY REPORT

1.0 INTRODUCTION

1.1 General

The MOA has contracted with R&M Consultants, Inc. (R&M) to provide planning, stakeholder involvement and engineering services associated with the upgrade of West Dimond Boulevard from Jodhpur Street to Sand Lake Road. As a result of the current funding limitations and identified need to expedite construction of proposed improvements between Sand Lake Road and Westpark Drive, the project is divided into two phases (see figure 1.2 Local Area and Vicinity Map). Phase I improvements will extend from Sand Lake intersection to approximately 850 feet west of the Westpark Drive intersection (station 77+00). Phase I pedestrian facilities will not extend west of the Westpark Drive intersection. Phase II improvements will extend from Station 77 +00 to Jodhpur Street. Final design and construction of Phase II will advance once full funding becomes available. Dividing the project into two phases allows construction of Phase I to be accelerated and commence in 2014. This section of roadway is located in southwest Anchorage and contained within the Sand Lake Community Council.

The scope of this project is to plan, design and construct upgrades to the existing facilities of West Dimond Boulevard between Westpark Drive and Sand Lake Road including. This Design Study Report (DSR) is part of the project development and approval process and documents the analyses responsible for the selection of the preferred alternatives. Studies conducted include: Geotechnical Recommendations, Illumination Recommendations, and Traffic, Safety and Alternatives Analysis.

1.2 Purpose

The southwest Anchorage/Sand Lake area served by West Dimond Boulevard is experiencing changes in land use and population growth. Vacant, buildable land for residential development, future parks and schools will continue to increase demand on West Dimond which serves as the neighborhood road for adjacent properties and as the area wide corridor which connects to the larger transportation network for work, school, shopping and recreational activities. As the Westpark Subdivision continues to develop in the next 10-20 years, pedestrian and bicycle facilities will be needed to complete connections to existing pathways in the area. West Dimond Boulevard is also one of the main access roadways into Kincaid Park, a popular destination for recreational users from the entire Municipality including residents from Chugiak-Eagle River, Turnagain Arm and Girdwood. The intersection of West Dimond Boulevard and Sand Lake Road is projected to exceed capacity between 2025 and 2035 if no improvements are made.

Figure 1.1 Location Area

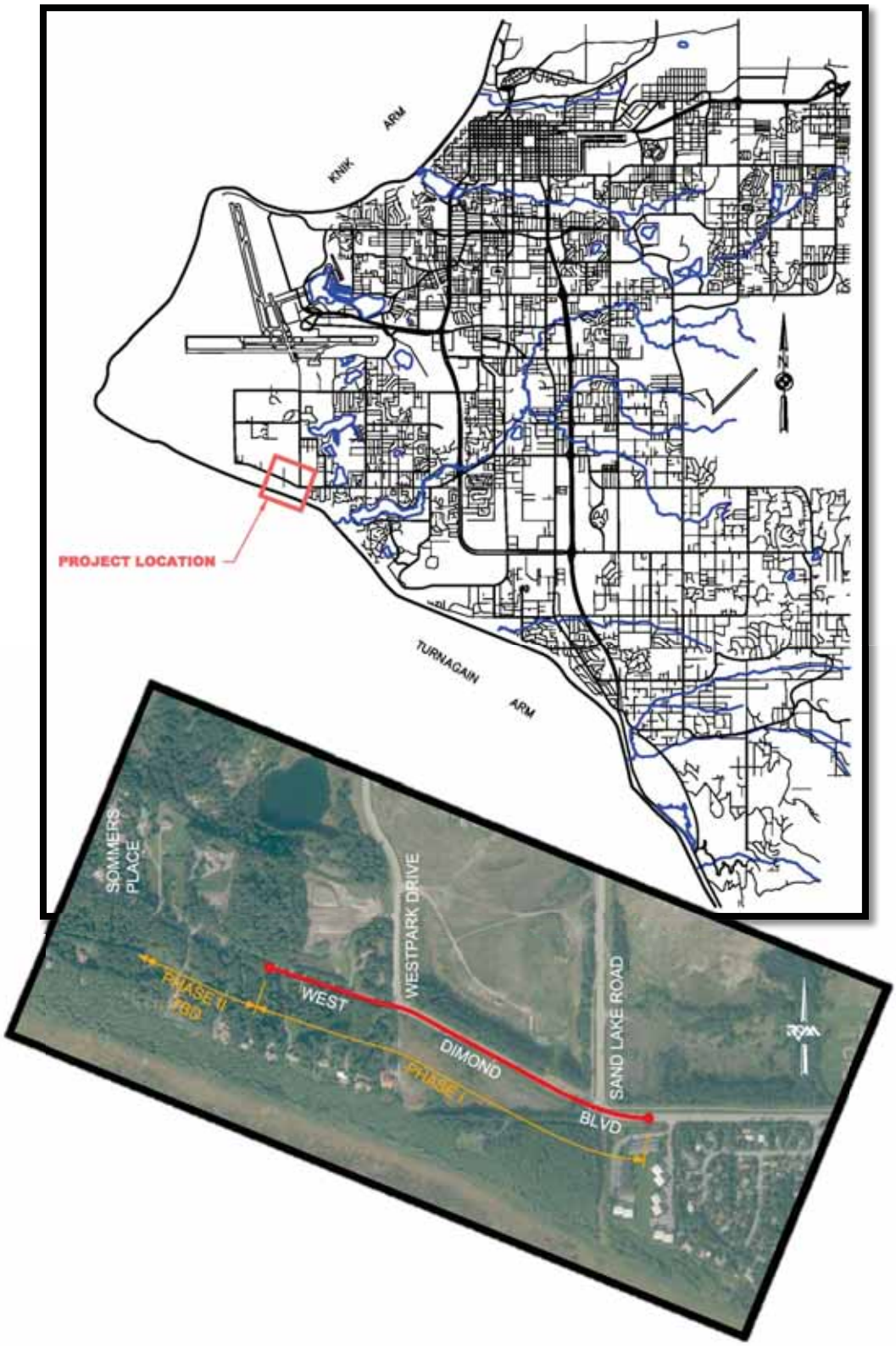

Figure 1.2 Local Area and Vicinity

The purpose of the project is to:

- Construct dedicated pathways and pedestrian facilities in the project corridor;
- Improve safety by:
  - Improving horizontal and vertical geometry;
  - Providing safe areas for pedestrians and bicycle use; and
  - Implementing traffic calming.
- Upgrade the roadway and intersections to current municipal standards;
- Construct a transportation facility which has adequate capacity for future growth and development of the area;
- Improve major intersections to operate at adequate service levels in the future; and
- Provide a lasting and maintainable road surface.

1.3 Project Needs

The scoping, concept and design study phases identified specific needs which will be addressed by this project.

Problems Identified:

- No pedestrian and bicycle facilities[1] (see Figure 1.3);
- Substandard horizontal and vertical geometry limiting intersection sight distance;
- Speeding[2]
- Sand Lake Road intersection:
  - Skewed approach affecting sight distance and gap selection;
  - Stop-sign control will not have adequate capacity in the future; and
- Pavement deterioration due to structural section fatigue (see Figure 1.4).

[1] See also Section 3.2.3 and Appendix D for detailed crash data.
[2] See Table 3.2 and Appendix D for speed studies.

Figure 1.3 Sand Lake Road Intersection Bicycle-Vehicle Conflicts
(Source: Google Street View)

Figure 1.4 West Dimond Boulevard Pavement Deterioration

1.4 Context Sensitive Solutions Summary/Project Goals

The West Dimond Boulevard Upgrade Project began in 2006 and closely followed the Context Sensitive Solutions (CSS) policy guidelines before CSS was officially adopted and implemented by MOA in 2009. CSS policy goals include involving stakeholders during the early stages of the project to help define the problems to be solved and to provide input on conceptual solutions to the problems. A concept phase summary including public involvement activities that have been completed to date are included in Appendix G and E, respectively. Goals identified from input from the public and agency stakeholders include:

- Provide pedestrian and bicycle facilities;
- Improve safety;
- Address speeding;
- Provide traffic calming;
- Improve the curvature of the road in some sections;
- Improve drainage;
- Improve pavement conditions;
- Provide shoulders;
- Improve side street intersections with West Dimond Boulevard;
- Reduce rolling hills along West Dimond Boulevard;
- Provide turning lanes at West Park Drive and Sand Lake Road intersections;
- Maintain the character of each section of roadway;
- Include street lighting only in some sections; and
- Where practical, retain vegetation buffer.

The design study phase, documented in the DSR, evaluates the improvements to the roadway, within the CSS policy framework, the Design Criteria Manual (DCM), the Official Streets and Highways Plan (OS&HP), Title 21 Land Use and Development Regulations and other adopted plans and policies to achieve these goals. The design study did not consider the No Action Alternative as viable as it would not solve or resolve the problems identified. The CSS project development process will continue through the design phase and will include opportunities for stakeholders to participate, evaluate and provide input through open houses, the project website, e-mails, phone calls, user group and community council presentations.

2.0 PROJECT HISTORY

West Dimond Boulevard is a major east-west transportation corridor in southwest Anchorage. The segment of West Dimond Boulevard from Jodhpur Street to Sand Lake Road represents the westernmost end of the alignment. According to the design documents entitled *Territory of Alaska – Alaska Highway and Public Works Department, Highway Division, Project No. 5202(1)*, the corridor was constructed in 1958 and was originally named Kincaid Road. The roadway was subsequently paved in the mid-1960s and served a former Nike military ground-to-air missile site and borough car dump which became park land in 1978. Jodhpur Street, the western terminus of the project, forms the eastern boundary of Kincaid Park. Since that time, Kincaid Park has transformed into 1,500 acres of rolling, forested hills and beautiful scenery that is now a major recreational destination for thousands of residents and visitors each year.

R&M began preliminary engineering for this project in February 2006. During 2006 and the spring of 2007, the topographic survey and geotechnical site investigations were completed, public involvement was started, and the preliminary engineering resulted in the Draft DSR May 30, 2007. The Draft DSR underwent an internal review at MOA Project Management & Engineering (PM&E) but did not move forward for public review or boards and commission approval. The project was put on hold in 2007 pending available funding to complete the design and construct the improvements.

The MOA resumed the planning efforts in 2013 when funding became available. This report advances Phase I improvement recommendations consistent with current state grant funding.

3.0 EXISTING CONDITIONS

3.1 Facility Description, Context, and Setting

While the majority of Dimond Boulevard has a more developed context, this segment of West Dimond Boulevard, from Sand Lake Road to Westpark Drive, has narrow pavement, ditches and an alignment that follows rolling terrain. MOA's *1996 OS&HP (Amended 2005)* classifies West Dimond Boulevard as a Class I Collector. This same classification was retained on the 2012 draft OS&HP. This segment of West Dimond Boulevard is also functionally classified as an Urban Collector (Minor) by the State of Alaska Department of Transportation and Public Facilities (DOT&PF).

East of Westpark Drive, West Dimond Boulevard has two 12-foot lanes, 2-foot paved shoulders, 4-foot gravel shoulders, and is located on open, level terrain.

Figure 3.1 West Dimond Boulevard between Westpark Drive and Sand Lake Road

Non-motorized (pedestrians, bicyclists, etc.) facilities currently do not exist within the project corridor. Several side streets that intersect with West Dimond Boulevard have non-motorized facilities such as sidewalks and pathways. For instance, there are separated pathways along the west side of Westpark Drive and Sand Lake Road, as well as on the north side of Dimond Boulevard east of Sand Lake Road.

3.2 Traffic Conditions

Kinney Engineering LLC (KELLC) completed a Traffic, Safety and Alternatives Analysis in February 2013. The analysis is summarized below and the full version is included in Appendix D.

3.2.1 Existing Traffic Volumes

Average Annual Daily Traffic (AADT) volumes were obtained from DOT&PF's *Central Region Annual Traffic Volume Report* (2010-2012) and updated readings taken in August 2013. These values are tabulated in Table 3.1 below. These historical traffic volumes are used for evaluation of the crash history and projection of future traffic volumes.

Table 3.1 Current AADT Traffic Volume

ROADWAY	SEGMENT	AADT	
		2012	2013
West Dimond Blvd	Westpark Dr to Sand Lake Rd	N/A	2,415
West Dimond Blvd	Edinburgh Dr to Sand Lake Rd	4,501	N/A
Sand Lake Rd	West Dimond Blvd to Kincaid Rd	2,597	N/A

The Design Year traffic volumes can be found in section 4.3 and Appendix D.

3.2.2 Speed Data

Speed studies (radar) were conducted within the Phase I project limits during February 2006 and again during August 2013. The MOA also conducted a speed study for West Dimond Boulevard in May 2006. Existing speed data from the traffic studies within each project segment are summarized below:

Table 3.2 Speed Data Summary

Year	MEAN SPEED	85^{TH} PERCENTILE SPEED	POSTED SPEED	HIGHEST SPEED RECORDED
2006	38 mph	44 mph	45 mph	53 mph
2013	41 mph	46 mph	45 mph	N/A

3.2.3 Crash Rates

Crash information was provided by the Central Region Traffic and Safety Section of DOT&PF and by the Municipality of Anchorage, Traffic Department for 2000 to 2009. There were 22 crashes during this period including 1 fatality. These were

sorted into intersections and segment locations; however, the single crash at Westpark Drive intersection is included in both analyses. Further information can be found in Appendix D.

Table 3.3 Intersection Crash Rates 2000 - 2009

INTERSECTION	FATALITY	MINOR INJURY	PROPERTY DAMAGE	TOTAL
Sand Lake Rd West Dimond Blvd	0	5	9	14
Westpark Dr West Dimond Blvd	0	0	1	1

Table 3.4 Segment Crash Rates 2000-2009

SEGMENT	FATALITY	MINOR INJURY	PROPERTY DAMAGE	TOTAL
West Dimond Blvd. Sand Lake Rd to Jodhpur St	1	2	5	7

3.2.4 Intersection Turning Movements

Turning movement data was collected in February and March of 2006 at the Sand Lake Road intersections with West Dimond Boulevard. The Westpark Drive and West Dimond Boulevard intersection turn movements were counted in January of 2013.

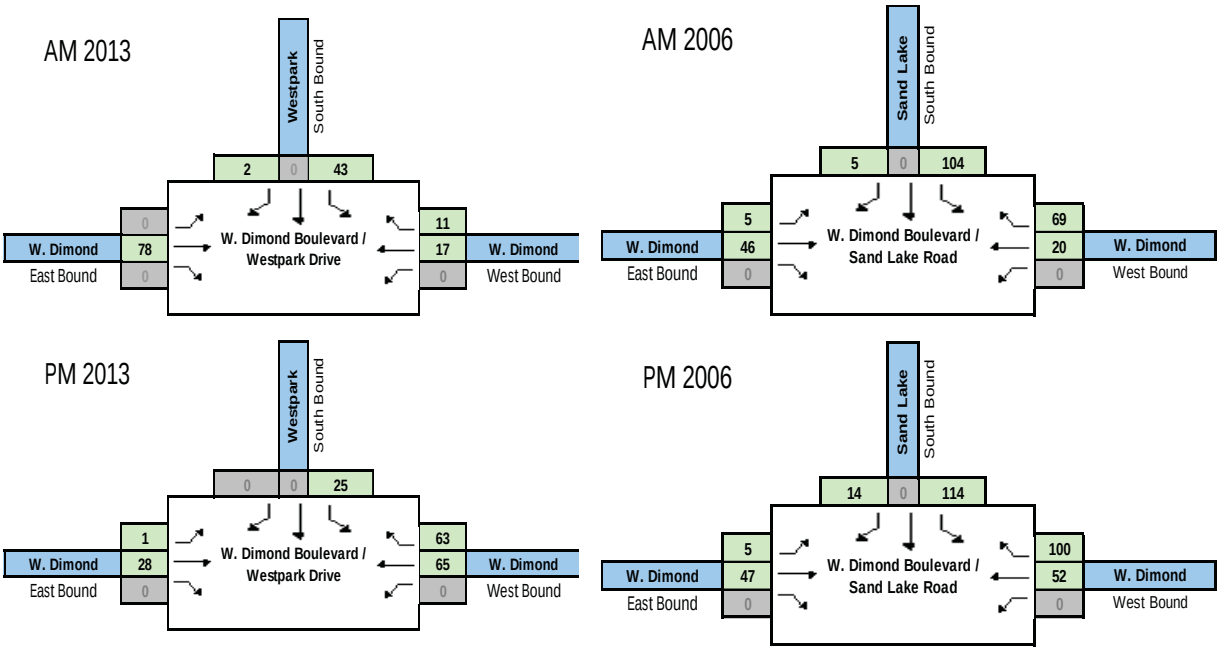

Figure 3.2 2006 and 2013 Peak Hour Turning Movement Counts

3.3 Land Use and Ownership

The land adjacent to the West Dimond Boulevard corridor is currently a mix of both large-lot residential development that sets back from the roadway, single family residential and vacant land tracts zoned for medium density residential development. The corresponding zoning districts are R-6 (Suburban Residential District), PLI-P (Public Lands Institutional), and R-1A (Single Family Residential).

Kincaid Park is a dedicated Municipal park on the western boundary of the project corridor along Jodhpur Street and is zoned PLI-P. East of Jodhpur Street and north of West Dimond Boulevard, R-1A zoning extends easterly along the entire length of the project to Sand Lake Road. R-1A zoning also exists on the south side of the corridor from Westpark Drive to Sand Lake Road. The remainder of the zoning south of Dimond Boulevard from Jodhpur Street to Westpark Drive is R-6 (see Figure 3.4 Land Use and Zoning).

The MOA and the Anchorage School District (ASD) owns two vacant tracts north of West Dimond Boulevard within the Westpark Subdivision that is a future site for both an elementary and middle school to serve the future needs of the area as it develops. Westpark Drive is a dedicated Municipal right-of-way that is a north-south collector connecting Kincaid Road to West Dimond Boulevard. West Dimond Boulevard between Jodhpur Street and Sand Lake Road is also owned by MOA.

Figure 3.3 Westpark Development

There are several large tracts of vacant, buildable land zoned for residential development (R-1A) adjacent to West Dimond Boulevard within the project corridor. One of these includes the Dimond Sands property south of West Dimond Boulevard between Westpark Drive and Sand Lake Road which show preliminary plans for attached single-family residential dwellings on 44 lots. Coordination to ensure that development plans and the West Dimond Boulevard upgrade project are ongoing and will continue during subsequent phases of the project. Another planned development within the project area is the Sonoma Glen at Westpark Planned Unit Development Phase 1 on the southern end of the Westpark Subdivision. Sonoma Glen at Westpark is approximately 39 acres and is being phased in five parts for the construction of approximately 220 dwelling units with a mix of both single family and residential duplexes north of West Dimond Boulevard between Westpark Drive and Sand Lake Road.

The DOT&PF owns several roadways and the corresponding intersection rights-of-way in the area including Jodhpur Street, Sand Lake Road, and Dimond Boulevard east of Sand Lake Road. Improvements for this project will be coordinated with DOT&PF.

ZONING AND LAND USE

- R-6 Residential Limited Intensity
- R-1, R-1A Residential Low Intensity - Detached Houses
- R-1A, R-2A, R-2A-SL, R-5 Residential Low Intensity - Attached & Detached Houses
- PLI-P Parks and Natural Resource
- R-1A Other Area that Functions as Park & Natural Resource
- R-1A, R-2A-SL Schools & Community Institutional
- PLI-P Public Utility / Facility
- Project Perimeter

Figure 3.4 Land Use and Zoning

3.4 Landscaping

The landscape inventory includes an overview of existing vegetation, fences, views and elements related to the aesthetics of the area including neighborhood character. Initial observations were performed in the fall when most of the deciduous vegetation was bare. The area is marked by large stands of native forest. Most of the forest immediately adjacent to the road includes mature alder, willow and cottonwood, all of which are indicative of disturbance, since these are the species that first colonize a disturbed site. Mature spruce forest with some birch and cottonwood trees forms the major vegetative patterns outside areas of disturbance. Large alder and willow penetrate the roadway prism, making the road feel narrow and providing a rural element.

The road has a rollercoaster alignment in terms of vertical curves. The existing road tends to follow the gentle and steep bits of terrain that characterize the area. Numerous cut and fill slopes occur on either side of the roadway, most are heavily vegetated with mature alder. Many long narrow gravel driveways provide access to adjacent residences, particularly on the south side of West Dimond Boulevard. Access driveways on the north side of West Dimond Boulevard are generally paved, providing shared access or leading to housing developments. Mailboxes cantilever over the roadway shoulder along much of the alignment. Fences, landscape trees, shrubs and lawns are atypical.

The roadway corridor is within a mix of low-density and medium-density residential neighborhoods with older homes intermixed with new subdivision developments. The neighborhood to the south includes homes located between the bluff and the road. On the north side of the road, between Sand Lake Road and Jodhpur Street, the character along the road is changing. Newer homes and entries to new subdivisions are visible. Still, there are large areas of native vegetation that line and distinguish the roadway corridor. To the north, the Westpark subdivision includes new internal subdivision streets and residential sited into land that was once a large gravel pit. Approximately three quarters of the lots are developed. To the south of the intersection a large parcel of land is currently vacant, but devoid of vegetation.

According to the Anchorage Wetlands Management Plan, there are no wetlands within or adjacent to the project corridor.

3.5 Drainage

Existing drainage within the project area consists of sheet flow from roadway pavement into ditches along the roadway which outfalls into existing low areas. These low areas collect drainage but have no further conveyance. Runoff from storm events most likely infiltrate into the surrounding grade.

Figure 3.5 Ponding During Breakup

Figure 3.6 Ponding During Summer

There are no primary watercourses (major waterways or streams) that enter, cross or exit the project area. Standing water has been observed alongside the roadway between Westpark Drive and Sand Lake Road, due to the flat grade and lack of outfall.

The existing drainage along the West Dimond Boulevard Upgrade project area is made up of three drainage basins to the north and two to the south. The basins are delineated on the drainage plans found in Appendix C and described as follows:

3.5.1 North Basins

Sta 77+00 to Westpark Drive: This basin drains from the west (Tract 3, Block 2 Seaview Heights Subdivision) and the east (Tract 1B) and collects in a low area located in Tract 2 along West Dimond Boulevard. There is an existing berm to the north of the low area. During a large storm event, this berm could cause water to flow across the roadway towards the low area to the south.

Westpark Drive to Sand Lake Road: This basin sheet drains from West Dimond Boulevard towards the north and down into the Kincaid Estates Subdivision. The east side of Westpark Drive and the west side of Sand Lake Road also drains into the subdivision.

Sand Lake Road to End of Project (EOP): This basin is bound by Sand Lake Road to the west and West Dimond Boulevard to the south and sheet drains to the north east. The low area is well to the north of the project area.

3.5.2 South Basins

Sta 77+00 to Westpark Drive: This basin sheet drains from the south towards a low area at Sta 78+00. There are two other low areas in this basin. The first is located at Sta 76+50 and drains into the low area at 78+00. The second low

area is located just east of a driveway at 79+50 and does not appear to continue flowing elsewhere.

Westpark Drive to EOP: This basin drains towards the center into several low areas with the largest being located 215 feet from centerline at Sta 97+00. The low areas eventually drain south towards the inlet. There is one CMP at Sta 92+50 which facilitates ditch flow into an existing swale and towards the low areas.

3.6 Utilities

Existing utilities within the project perimeter consist of water mains, sanitary sewer, storm sewer, natural gas, electricity, and communication. Many properties adjacent to this section of West Dimond Boulevard have private well and on-site septic systems.

The locations of the utilities were recorded during field surveys along with record drawing research. Additional surveys will be performed during the design phase. A brief description of each utility is found below.

3.6.1 Water

An Anchorage Water and Wastewater Utility (AWWU) owned 30-inch ductile iron pipe (DIP) transmission main (installed in 1999) enters the project limits from the east and runs along West Dimond Boulevard and then turns 90 degrees north at Sand Lake Road along the eastern right-of-way limit. A 12-inch DIP leg extends approximately 300 feet along West Dimond before turning north into the Westpark Subdivision.

The residential subdivision (Tract B, Dimond Sands) is in the planning stages with a proposed extension of the 12-inch main near Sand Lake Road and Westpark Drive. The only fire hydrant in the project limits is located in the northeast quadrant of the Sand Lake intersection.

3.6.2 Sanitary Sewer

A 16-inch DIP (installed in 2005) owned by AWWU runs along the south side of West Dimond Boulevard to serve the residential subdivision (Tract 1, Kincaid Estates) to the northwest. This system flows southeast from the subdivision via lift station, crosses West Dimond Boulevard, and then flows east by gravity along West Dimond Boulevard. Past the manhole located approximately 400 feet east of the intersection with Sand Lake Road, the pipe size downstream increases to 24-inch DIP. Currently, there are no other connections to this system in the project area, though the residential subdivision (Tract B, Dimond Sands) is in the planning stages with a planned sewer extension.

3.6.3 Natural Gas

ENSTAR Natural Gas company facilities in the project area consist of underground steel gas pipe distribution lines. The gas pipe is buried along the north side of the West Dimond Boulevard ROW to Sand Lake Road, where it meets a 6-inch line in the west Sand Lake Road ROW. The gas main then crosses West Dimond Boulevard to the south and bends 90 degrees to the east, running along the south ROW until exiting the project area. The distribution pipe is six-inch steel. All gas service lines located in the project area are plastic and range in size from 5/8 to 4 inches.

3.6.4 Telephone

Alaska Communications System (ACS) owns buried and aerial fiber optic (F/O) lines along the project corridor. An underground F/O cable run is located with an easement approximately 400' west of the West Dimond Boulvevard / Sand Lake Road intersection and continues to the east side of Sand Lake Road. Another underground crossing extends south across West Dimond Boulevard at this location. An aerial crossing is located west of the West Dimond Boulevard / Westpark Drive intersection.

Figure 3.7 Existing Roadway Illumination Poles

3.6.5 Electric Utilities

There is are a number of existing Chugach Electric Association (CEA) owned overhead electric utility poles along West Dimond Boulevard. Overhead electric lines parallel West Dimond Boulevard from Westpark Drive to Sand Lake Road. Overhead electrical lines also cross West Dimond Boulevard at two locations. CEA began utility undergrounding activities adjacent to the project corridor in 2013 and will continue to coordinate with the project's schedule for future work.

The existing illumination system consists of luminaires mounted on steel poles at the Sand Lake and West Dimond Boulevard intersection and on wooden poles for the remainder of the project area. The power for the luminaires is supplied via aerial cable from pole to pole or from pole mounted transformers. Control is through photoelectric cells at each of the luminaires. The luminaires are non-cutoff and are 150 or 250 Watt. The majority of the existing roadway lighting is provided by CEA and is paid for at a flat rate.

3.6.6 Cable

Existing cable facilities, owned by General Communication Inc. (GCI), parallel West Dimond Boulevard east of Sand Lake Road and diverge from the roadway alignment as they continue west along the section line. These facilities consist of aerial coaxial and F/O cables mounted on treated wood poles. The poles are shared-use and owned by CEA.

3.6.7 Storm Drain

In 2006, a horizontal directional drill was employed to construct a 24 inch High-Density Polyethylene (HDPE) storm drain outfall for the Westpark Subdivision. The bore began near the existing sanitary sewer lift station and crossed West Dimond Boulevard near the intersection with Sand Lake Road. From there, the pipe continued on a southerly heading, centered within the section easement, to an outfall into Turnagain Arm.

3.7 Mailboxes

Mail delivery to the residents along West Dimond Boulevard is accomplished through single-serve mailboxes located on the south side of the roadway. Approximately 7 single-serve mailboxes are located within the project perimeter, ranging from one to four per location.

Figure 3.8 Grouped Individual Mailboxes on the Southside of West Dimond Boulevard at Westpark Drive

3.8 Geotechnical Investigations Summary

A geotechnical investigation for the West Dimond Boulevard Upgrade, Jodhpur Street to Sand Lake Road was performed in fall 2006. The investigation included 20 test borings to depths of 16.5 to 21.5 feet. Soil classification of the test borings found highly variable soil conditions along the alignment, with frost classifications ranging from S1/S2 to F4. The existing structural section ranged in thickness from less than 2 feet to about 4.5 feet thick. Fill material greater than 10 feet thick was encountered in some areas. No groundwater was observed during the investigation (see Appendix B, Geotechnical Investigation).

3.9 Environmental

According to mapping obtained from MOA's Watershed Management Service, there are no streams or wetlands within the project boundary. Erosion control measures will be limited to silt fencing, jute matting, topsoil and seeding. Jute matting is required whenever slopes are steeper than 2H:1V. To avoid a temporary degradation of water quality and to meet Alaska Pollutant Discharge Elimination System (APDES) Municipal Separate Storm Sewer (MS4) permit requirements, Best Management Practices (BMP) will be implemented. The contractor will develop a *Storm Water Pollution Prevention Plan* (SWPPP), Type 3, detailing the project-specific measures to prevent pollutant discharge and minimize erosion.

4.0 DESIGN STANDARDS AND CRITERIA

4.1 General

West Dimond Boulevard is classified as a Class I Collector by the OS&HP. The project design year is 2035, assuming a construction year of 2015.

The roadway segment between Sand Lake Road and Westpark Drive has ROW widths of 100 feet to 150 feet.

4.2 Design Standards

The design guidelines and references used for this project are:

Table 4.1 References

Author	Name	Year
AASHTO	Guide for Development of Bicycle Facilities	2012
AASHTO	A Policy on Geometric Design of Highways and Streets	2011
AASHTO	Roadside Design Guide	2011
AASHTO	Guide for the Planning, Design, and Operation of Pedestrian Facilities	2004
AMC	Title 21 Land use Planning	current
DOT&PF	Alaska Traffic Manual	2012
DOT&PF	Alaska Highway Preconstruction Manual	2005
DOT&PF	Standard Specifications for Highway Construction	2004
FHWA	Manual on Uniform Traffic Devices (MUTCD)	2009
FHWA	Roundabouts: An Informational Guide	2000
IES	Roundabout Lighting	2008
MOA	Standard Specifications (MASS)	2009
MOA	Design Criteria Manual	2007
MOA	Drainage Design Guidelines	2007
MOA	Anchorage Wetlands Management Plan	1996
MOA - AMATS	2035 Metropolitan Transportation Plan	2012
MOA - AMATS	Anchorage Bicycle Plan	2010
MOA - AMATS	Anchorage Bowl 2025 Long Range Transportation Plan with 2027 Revisions	2007
MOA - AMATS	Anchorage Pedestrian Plan	2007
MOA - AMATS	Official Streets and Highways Plan	2005
MOA - AMATS	Areawide Trails Plan (ATP)	1997
TRB	Highway Capacity Manual	2010
TRB	Practices for Resurfacing, Restoration and Rehabilitation	1987

Author	Name	Year
TRIAD ENGINEERING	Westpark Subdivision Drainage Impact Analysis	2012
US Dept. Justice	ADA Standards for Accessible Design (28 CFR Part 36)	2011

4.3 Design Criteria

All geometric features of the roadway, including horizontal and vertical geometry, typical section configuration, non-motorized amenities, etc. are controlled by the selected design criteria. The design criteria was developed based on the functional classification of the roadway, current and projected traffic characteristics (volume, speed), and public involvement input. Table 4.2 provides a listing of the critical design criteria. Complete design criteria are presented in Appendix A. Identified Design Criteria Waivers are provided in Section 20.0 – Design Variances.

Table 4.2 Abbreviated Design Criteria

CRITERIA	WESTPARK DRIVE TO SAND LAKE ROAD
Design Year AADT	5,627
Design Vehicle	WB-50 (WB-67 for Sand Lake Road intersection
Design Speed	40 mph
Posted Speed	35 mph
Lane Width	11 ft
Shoulder Width	5 ft
Multi-Use Pathway Buffer Width	7 ft
Multi-Use Pathway Width	8-10 ft
Clear Zone	14 ft

Multi-use pathways will be added to both sides of the roadway, as required by the DCM. Separated multi-use pathways will optimize safety for pedestrians and provide room for snow storage in the buffer zone between the roadway and the paved pathway.

The DCM sets the minimum standards for paved, multi-use pathways between 8 feet to 10 feet wide, as described in Section 4.2 I and Figure 1-11. Within the project corridor, a higher volume of users is anticipated on the north side of West Dimond Boulevard as it provides a natural connection to the existing pathway along the west side of Sand Lake and on the north side Dimond Boulevard. Climatic conditions such as sun exposure

and quicker snow melting also favor putting the 10 feet wide multi-use pathway on the north side of West Dimond Boulevard. A multi-use pathway on the south side of West Dimond between Westpark Drive and Sand Lake road will be 8 feet wide only.

4.4 Accessibility Guidelines

The project will be designed and constructed in accordance with the Americans with Disabilities Act Accessibility Guidelines (ADAAG), as adopted per the MOA's DCM Section 1-11. Below are the relevant and critical accessibility guidelines for the West Dimond Boulevard Upgrade Project:

- Pedestrian travel route cross slopes not to exceed 2%;
- Minimum 4 feet wide curb ramps with running slopes not to exceed 1:12 (8.33%);
- 4 feet wide landings at top of curb ramps;
- Minimum pathway width of 5 feet with minimum 3 feet wide bypasses at driveways; and
- Detectable street crossing boundaries.

5.0 TYPICAL SECTION ALTERNATIVES

5.1 General

Various design alternatives were evaluated for Phase I of the West Dimond Boulevard Upgrade project, including a no-action alternative and typical section alternatives. They are summarized in the following table and discussed in greater detail in the subsequent sections.

Table 5.1 Typical Section Alternatives

ALTERNATIVE	WESTPARK DRIVE TO SAND LAKE ROAD
No-Action	✗
Uncurbed Section	✗
Curbed Section	✓

Legend: ✗ not recommended ✓ preferred

5.2 No-Action Alternatives

The No-Action Alternative assumes acceptance of the existing conditions, without construction changes, but continued maintenance through the design year of the study period. The benefit is the near term construction cost savings. The downside is increased delays during peak hours at the Sand Lake Road and Westpark Drive intersections and not addressing the problems defined by stakeholders including the need for pedestrian and bicycle facilities, reducing opportunities for vehicles to speed, improving intersection delays and providing for future increased traffic projections from growth and development of homes and schools to serve the area.

5.3 Westpark Drive to Sand Lake Road

This segment connects the Westpark subdivision to Dimond Boulevard east of Sand Lake Road. The continued residential development of the Westpark area will increase pressure on this segment over the life of the project. Improving the corridor as a transportation facility that serves all modes and can accommodate today's travelling public and future, projected traffic.

5.3.1 Curbed Typical Section

Due to projected traffic volumes and residential development currently underway, a curbed typical section with 11-foot lanes and 5-foot shoulders is the preferred alternative for this segment of West Dimond. The use of curb eliminates the

need for sizable ditches along the outside of pathways and provides a smaller roadway footprint.

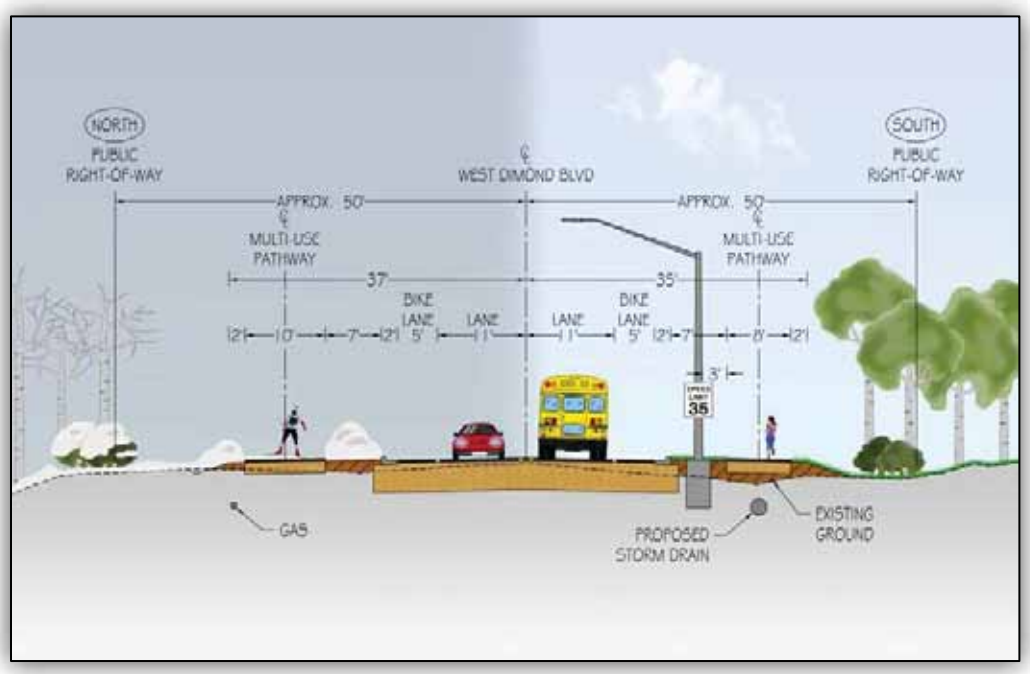

Figure 5.1 Curbed Typical Section
Westpark Drive to Sand Lake Road (preferred)

The curbed typical section would minimize disturbance to the existing vegetation. The level terrain allows the footprint to be contained within the existing ROW.

This configuration was presented to the project stakeholders through the public and agency involvement process. Positive feedback from the public, including the CAC and agency representatives, indicated the proposed typical section was acceptable. No additional alternatives were proposed for the roadway segment from Westpark Drive to Sand Lake Road.

6.0 INTERSECTION ALTERNATIVES

6.1 General

Several intersection alternatives were evaluated. The range of feasible intersection control alternatives was evaluated based on predicted traffic volumes and performance in the Traffic, Safety and Alternatives Analysis Report (Appendix D). An intersection is considered to have adequate capacity when it is functioning at Level of Service (LOS) C or better. The selected alternatives will undergo an independent peer review by a nationally recognized expert prior to final design.

The alternatives are summarized in the following table and discussed in greater detail in the subsequent sections.

Table 6.1 Intersection Alternatives

ALTERNATIVE	INTERSECTION WITH WESTPARK DRIVE	INTERSECTION WITH SAND LAKE ROAD
No-Action	✗	✗
Right Turn Lane	✗	✗
All-Way Stop Control	⊘	✗
Modern Roundabout	✓	✓
Traffic Signal	⊘	✗

Legend: ✗ not recommended ⊘ warrant not met – not analyzed ✓ preferred

6.2 Sand Lake Road

Sand Lake Road is currently stop-controlled at the intersection with West Dimond Boulevard. The horizontal curve along West Dimond Boulevard through the intersection results in a less than desirable viewing angle for vehicles stopped at the Sand Lake approach, which is very near the limit of intersection skew recommended by AASHTO. Comparison of predicted benefits for each alternative is discussed below.

The horizontal skew of the Sand Lake approach could be reduced by realigning Sand Lake Road to approach more perpendicular to the intersection with West Dimond Boulevard for better vehicle visibility.

6.2.1 No Action Alternative

The street stop sign on Sand Lake Road allows for free flow of traffic on West Dimond Boulevard. The no change alternative is predicted to reach a LOS E in the design year. Pedestrians and bicyclist crossing West Dimond Boulevard at this intersection would experience a LOS F in the design year.

6.2.2 Add Westbound Right Turn Lane Alternative

Adding a right turn lane on West Dimond Boulevard would improve the design year LOS to D for the Sand Lake Road southbound movement. However, this solution would not serve pedestrians/bicyclists well because the crossing of West Dimond Boulevard east of Sand Lake Road would become longer, increasing delay.

Figure 6.1 Westbound Right Turn Lane

6.2.3 All-Way Stop-Controlled

The MUTCD summarizes all-way stop controlled warrants. Applying these criteria, the intersection would warrant all-way stop control between 2025 and 2035. Furthermore, to provide an acceptable LOS of C, a right turn auxiliary lane would need to be added. Adding the all-way stop would enhance safety for crossing pedestrian.

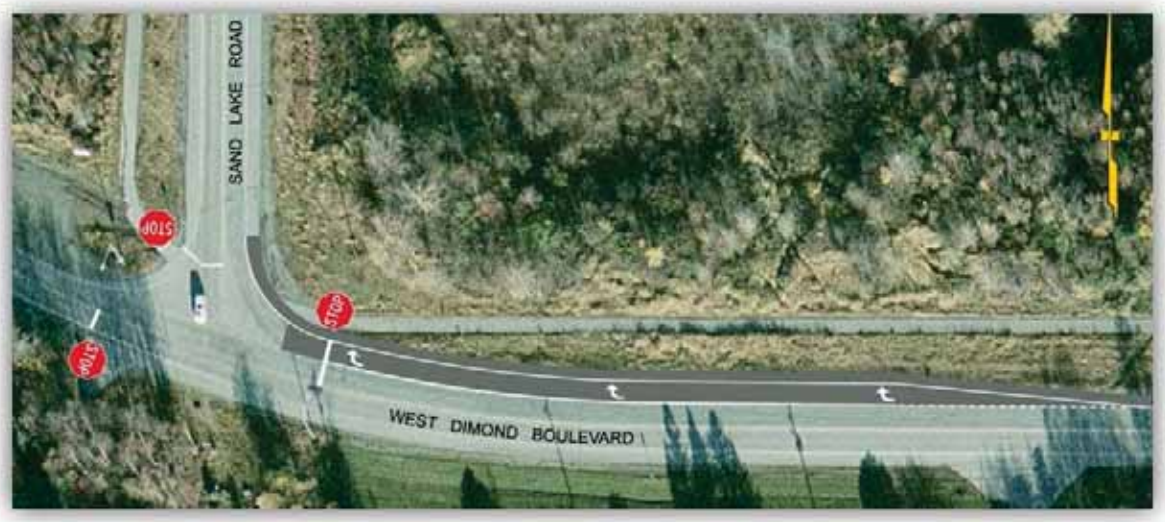

Figure 6.2 All-Way Stop Control with Westbound Right Turn Lane

6.2.4 Roundabout Alternative

A single lane, modern roundabout with an Inscribed Circle Diameter (ICD) of 140 feet is predicted to provide a LOS B or better in the design year. The Sand Lake Road approach, as well as the West Dimond Boulevard approaches, would be realigned as part of the intersection design to provide optimum approach angles to the roundabout. Pedestrian crossings are integrated into the intersection for enhanced visibility and safety by adding splitter island refuges that decrease crossing distances. The driveway south of the intersection serves a single residence and can be connected directly to the circulating lane.

Figure 6.3 Single-Lane Modern Roundabout At Sand Lake Road

The potential of a high-speed crash is significantly reduced by the roundabout configuration, improving safety over stop or signal-controlled intersections. The roundabout also provides traffic calming benefits over signalized intersections by requiring all vehicles traveling through the intersection to slow or stop.

6.2.5 Signalized Intersection

Signalization of the intersection and controlled pedestrian crossings provides a LOS B or better in the design year but requires a 350-foot long westbound right turn lane. The horizontal skew of the Sand Lake approach could be reduced as in the other stop sign controlled alternatives, but reducing the skew is less imperative for signalized intersections. This alternative has the highest construction and long-term maintenance cost compared to the other intersection alternatives.

Figure 6.4 Signalized Intersection At Sand Lake Road Alternative

6.3. Westpark Drive Intersection Alternative

Westpark Drive is currently a side street that is stop-controlled at the intersection with West Dimond Boulevard at a skew of approximately 70 degrees. The westbound approach to Westpark Drive has an existing right-turn only lane that is 180 feet long with a 20:1 entry taper. The range of feasible intersection control alternatives was explored in the Traffic, Safety and Alternatives Analysis (Appendix D). Traffic volumes and predicted intersection performance for the design year are detailed in the Traffic, Safety and Alternatives Analysis (Appendix D).

6.3.1 No Action

Predicted intersection traffic volumes for the design year do not warrant changing the intersection control from side street stop-controlled on Westpark Drive. Proposed residential development on the north side of West Dimond Boulevard will increase the peak turning traffic, but the overall increase is not significant enough to warrant consideration of full stop control for the intersection, with exception for the westbound right-turn traffic. The No Action alternative lacks a safe north-south crossing for pedestrians.

6.3.2 Right-Turn Only Lane Extension

The existing length of the right-turn only lane does is not sufficient to accommodate vehicle deceleration.

Figure 6.5 Right Turn Lane Extension At Westpark Drive

Extending the length will decrease the likelihood of rear-end collisions and will improve the southbound left-turn flows during peak periods. The additional length in the right-turn only lane will allow westbound vehicles to decelerate in the right-turn lane rather than in the through lane, as well as remove them from conflict with the southbound left-turning traffic on Westpark Drive. The predicted intersection performance will be LOS C in the design year period. This configuration will have lower construction cost than the roundabout.

6.3.3 Roundabout

A single-lane, modern roundabout with an ICD of 130 feet is predicted to provide a minimum LOS B in the design year. The Westpark Drive approach, as well as the West Dimond Boulevard approach, would be realigned as part of the intersection design to provide optimum approach angles to the roundabout. Pedestrian crossings are integrated into the intersection for enhanced visibility. A southern approach could be added to accommodate the proposed Dimond Sands residential development, including the consolidation of existing driveways. ROW acquisition will be required at lot corners in each quadrant of the intersection to allow for optimum alignment of each approach. The potential of a high-speed crash is significantly reduced by the roundabout configuration, providing improved safety over stop-controlled intersections. The roundabout also provides traffic calming benefits by requiring all vehicles traveling through the intersection to slow or stop, which is not provided by side street stop-controlled intersections.

Figure 6.6 Single-Lane Modern Roundabout At Westpark Drive

7.0 EVALUATION AND RECOMMENDATION

7.1 General

The design study phase evaluated several alternatives that reasonably represent the range of options available for a rehabilitation project. The No-Action Alternative does not meet the purpose and need for this project. The preferred alternative includes the following:

7.2 Typical Section

The curbed typical section alternative narrows the width of the improvements, reducing impacts to existing vegetation, properties outside the ROW and overall earthwork requirements for the roadway segment. The curb and gutter collects the roadway runoff and conveys it to catch basins for off-site discharge. Eliminating sheet drainage washing over the pathways will improve the experience and comfort of pathway users and decrease pathway surface maintenance costs over the service life. The pathway will be sloped away from the roadway to reduce materials such as vegetative debris from obstructing the gutter flow. A shallow ditch or swale will be constructed beyond the outside pathway shoulder to collect the runoff as well as facilitate the use of driveway culverts.

Figure 7.1 Visualization Of the Preferred Alternative (Looking East) on West Dimond Boulevard. *Inset: existing roadway.*

The curbed typical section reduces costs, ROW impacts, enhances the experience for pathway users and is the preferred typical section alternative.

West of the Westpark Drive intersection, the roadway will transition back to the existing horizontal and vertical alignment over a distance of approximately 700 feet. This is necessary to correct the vertical geometry leading into the west roundabout approach. The roadway embankment will be constructed wide enough to accommodate two separated pathways for Phase II, if that preferred alternative is carried forward.

7.3 Sand Lake Road Intersection

The roundabout intersection provides the highest level of service (LOS B) for a lower cost than a signalized intersection. The roundabout is the preferred alternative at Sand Lake Road because it provides the highest level of service and safety, and introduces a traffic-calming enhancement not provided by other alternatives.

Table 7.1 Sand Lake Road Intersection Alternatives Comparison

ALTERNATIVE	SAFETY	DESIGN YEAR LOS	PEDESTRIAN CROSSING	COST
No-Action	✗	E	✗	0
Right Turn Lane	✗	D	✗	$
All-Way Stop Control	✓	C	✓	$
Modern Roundabout	✓	B	✓	$$
Traffic Signal	✓	B	✓	$$$

Legend: ✗ no improvement ✓ improvement

7.4 Westpark Drive Intersection

The roundabout intersection provides the highest LOS (B), traffic calming and safety benefits, although it has higher construction costs and ROW impacts when compared with the other alternatives. The traffic-calming element of the roundabout will address speeding, which was specifically identified in the public involvement process as a concern. The roundabout is the preferred alternative based on safety, traffic-calming and level of service.

The configuration of the roundabout will be finalized during the design process and may need to be adjusted depending on the adjacent development of the Dimond Sand Subdivision. Shifting the roundabout as far east as possible will also avoid the steepest portion of the crest vertical curve.

Table 7.2 Westpark Drive Intersection Comparison

ALTERNATIVE	SAFETY	DESIGN YEAR LOS	PEDESTRIAN CROSSING	COST
No-Action	✗	B	✗	0
Right Turn Lane Extension	✗	A	✗	$
Modern Roundabout	✓	A	✓	$$

Legend: ✗ no improvement ✓ improvement

7.5 Cluster Mailboxes

Replacing single-serve mailboxes with cluster mailboxes benefits the United States Postal Service (USPS) by reducing delivery times, reducing maintenance for the roadway owner, and enhances security for mail recipients. However, consolidating single-serve mailboxes over a long stretch of roadway can also be inconvenient to residents.

Positive feedback has been received from the area postmaster and mail carrier regarding improvements to the mailboxes. Homeowners will be consulted and if desired cluster mailboxes and turnouts will be considered. Coordination with USPS and homeowners will continue for the final locations and configurations of mailboxes during detailed design. All mailbox replacements will adhere to crashworthy design standards.

8.0 SOILS AND PAVEMENT DESIGN

Based on the design methodology presented in the DCM, Chapter 1.10, the total required structural pavement thickness for Beginning of Project (BOP) to the Westpark Drive intersection would be 8 feet. However, previous experience and calculations using the Reduced Subgrade Strength method indicate that a 4-foot thick structural section will be adequate for the proposed roadway and pathways. The existing structural section is less than 2 feet thick in some areas, and there is no past history of significant frost heaving. Additionally, the area is generally well drained and no groundwater was observed in the test borings drilled for this project.

In the segment east of the Westpark Drive intersection, the subgrade generally has low frost susceptibility. A structural section of 2-foot thickness will achieve the desired performance.

To provide for future mill-and-overlay projects, 4 inches of asphalt will be used between Westpark Drive and Sand Lake Road, including the roundabouts.

Roadway insulation has been added to the construction cost estimate as a contingency item.

9.0 NON-MOTORIZED ACCESS

9.1 Non-Motorized Facilities

West Dimond Boulevard is well used by bicyclists, runners, walkers and roller skiers. There are no pedestrian facilities, dedicated bicycle facilities or shoulders along West Dimond Boulevard. Bicyclists have been observed to share the narrow roadway with motorized vehicles traveling at higher than posted speeds within the project corridor. The proposed typical section includes multi-use pathways on both sides of the roadway, with 7 feet of separation from the back of curb and paved shoulder bike lanes, to accommodate all users of the corridor. Crossings of West Dimond Boulevard are proposed at the Westpark Drive and Sand Lake Road intersections. Facilities on both sides of the roadway will limit the need for additional mid-block crossings. Curb ramps along the corridor would be provided at all curb intersections and will conform to current Americans with Disabilities Act (ADA) standards. MOA's People Mover does not serve areas within the project area.

The MOA's adopted 1997 Areawide Trails Plan (ATP) and the 2010 Anchorage Bicycle Plan (ABP) identify a separated multi-use pathway or trail along West Dimond Boulevard to accommodate a variety of non-motorized users including in-line skaters, bicyclists, joggers and pedestrians. The adopted 2012 Metropolitan Transportation Plan (MTP), the 2007 Pedestrian Plan and the 2012 West Anchorage District Plan support completing and connecting non-motorized facilities such as trails and pathways. The Draft update of the ATP (2006-2007) lists this as a priority project. Standards for multi-use paved trails recommend an 8 to 10-foot wide trail with a 7-foot setback from the back of curb. According to the ATP, a multi-use paved trail will follow West Dimond Boulevard.

The ABP identifies the need for both on-street shared use and off-street multi-purpose facilities along the project corridor. A Shared Roadway is also identified in the ABP for West Dimond Boulevard and Jodhpur Street. Shared Roadway designations include signage for routes that provide continuity to other bicycle infrastructure such as bike lanes or bike shoulders and separated pathways or the route extends along local streets and collectors that lead to an internal neighborhood destination such as a park, school or commercial district. The proposed typical sections are consistent with the recommendations of the ABP by providing paved shoulder bike lanes and multi-use pathways on both sides of the roadway. The roundabouts will be equipped with ramps to accommodate bicyclists who prefer to be off-street.

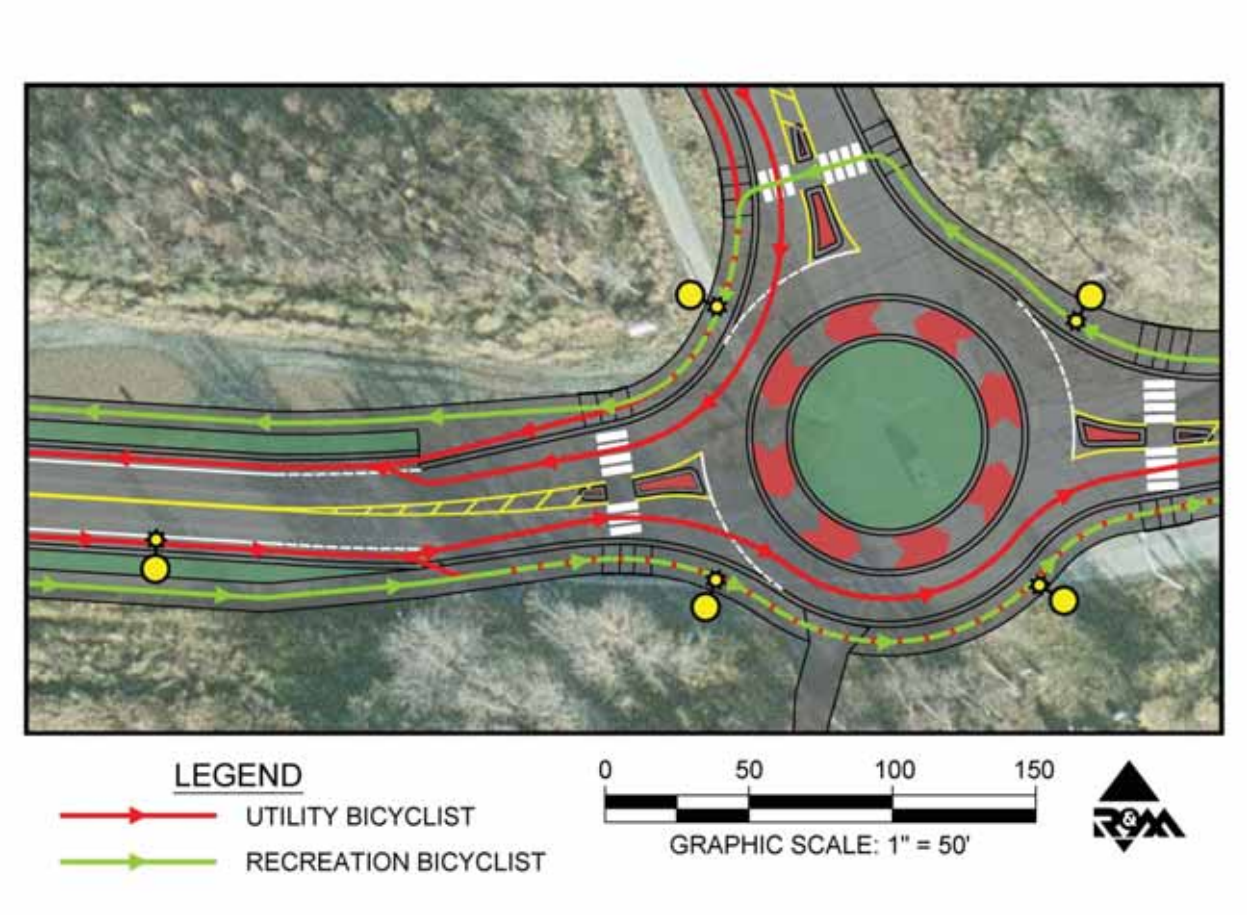

Figure 9- 1 On-Street and Off-Street Bicyclists' Accommodations at Roundabouts

10.0 DRAINAGE

10.1 Evaluations and Recommendations

According to the DCM, Table 2-1, the project can be classified as a minor drainageway due to its contributing area of less than 40 acres. Therefore, the storm drain must accommodate the 24 hour, 10-year design storm. Drainage guidelines set forth in the DCM mandate that at least one lane in each direction is kept free of water and that no curb overtopping occurs. All proposed recommendations are to maintain existing patterns on or around the project area. Mitigation for the additional discharge will be developed with the affected property owners.

The preferred alternative states that all roadway will have curb and gutter with all low points (and intermediate points if necessary) having curb inlets which then collect and transport storm water through a network of buried pipes and ditches into existing drainage low areas. All existing driveway and approach culverts within the proposed road improvement area will need to be replaced as shown on the attached plans. Drainage easements will be secured to provide on-property access for maintenance if necessary. Specific recommendations per each basin are as follows:

10.1.1 North Basins

BOP to Westpark Drive: The proposed ditches or swales along the north of the pathway, will maintain the existing drainage pattern. Storm drain piping (centered on Sta 79+90) will move flow from the north ditch plus any roadway drainage and discharges to the south low area near Sta 78+25. The driveway at Sta 82+25 will need a new culvert crossing at the proposed ditch line.

Westpark Drive to Sand Lake Road: The proposed vertical road alignment will slightly alter the existing drainage pattern by channeling the flow towards the low spot at Sta 93+75. The storm water will then cross West Dimond Boulevard via pipe, combine with the south catch basin and then outlet to the south. A ditch will be constructed on the north side directing water to the sag vertical curve low spot at Sta 93+75. At this point, the water will be routed to the south side.

Sand Lake Road to EOP: No changes to the existing drainage pattern are expected.

10.1.2 South Basins

BOP to Westpark Drive: Matching existing conditions, the drainage between BOP and the Westpark Drive intersection will be directed into this basin at Sta 78+50, along with the existing drainage west of BOP. This system will transfer overflow from the ditch north of West Dimond Boulevard, as well as drainage from both gutters along the roadway, to the low area to the south.

Westpark Drive to Sand Lake Road: Two catch basins will be installed in the south curb at the sag vertical curve low spot near Sta 93+75. A ditch will be constructed on the south side directing water to the sag vertical curve low spot at Sta 93+75.

Previous plans called for an outfall towards the north into the Westpark Subdivision. However, changes to the DCM have effectively shown the storm drain infrastructure within the Westpark Subdivision is undersized (*Westpark Subdivision Drainage Impact Analysis, page 1*). Therefore, it is considered unfeasible to use any portion of that storm drain system for the purposes of draining the West Dimond Boulevard ROW.

In accordance with the MOA's MS4 permit, "runoff reduction techniques" (i.e. Low Impact Development) must be evaluated and incorporated if feasible (*US EPA, Authorization to Discharge under the National Pollutant Discharge Elimination System, Permit No. AKS-052558, Section II.B.2.c.v., effective February 1, 2010*).

In light of this, the following alternatives were evaluated:

- Piped storm drain system outfalling into Turnagain Arm south of Sand Lake Road;
- Piped storm drain system outfalling into Turnagain Arm south of Westpark Drive;
- Low Impact Development (LID).

The feasibility of LID will be evaluated during the design process and will depend on the available methods, soil characteristics, ROW requirements, and maintenance considerations. For the purposes of this report, the piped outfall solutions were estimated to be the most conservative.

The two outfall options are illustrated in the figures below.

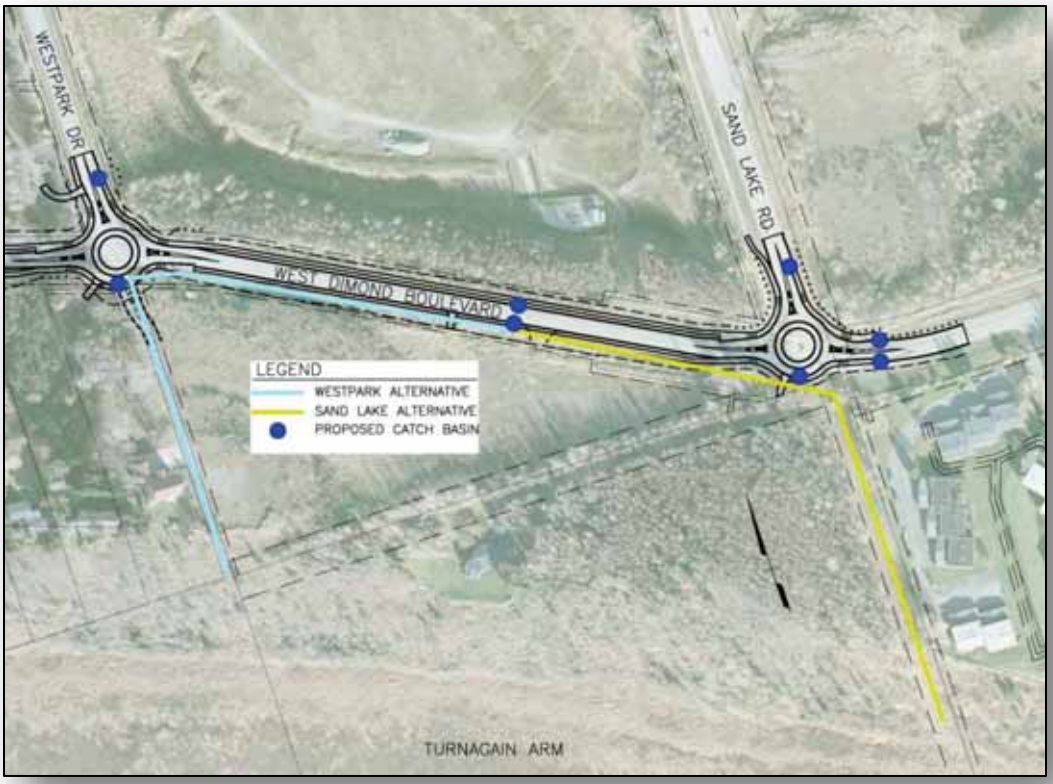

Figure 10.1 Storm Drain Alternatives – plan view

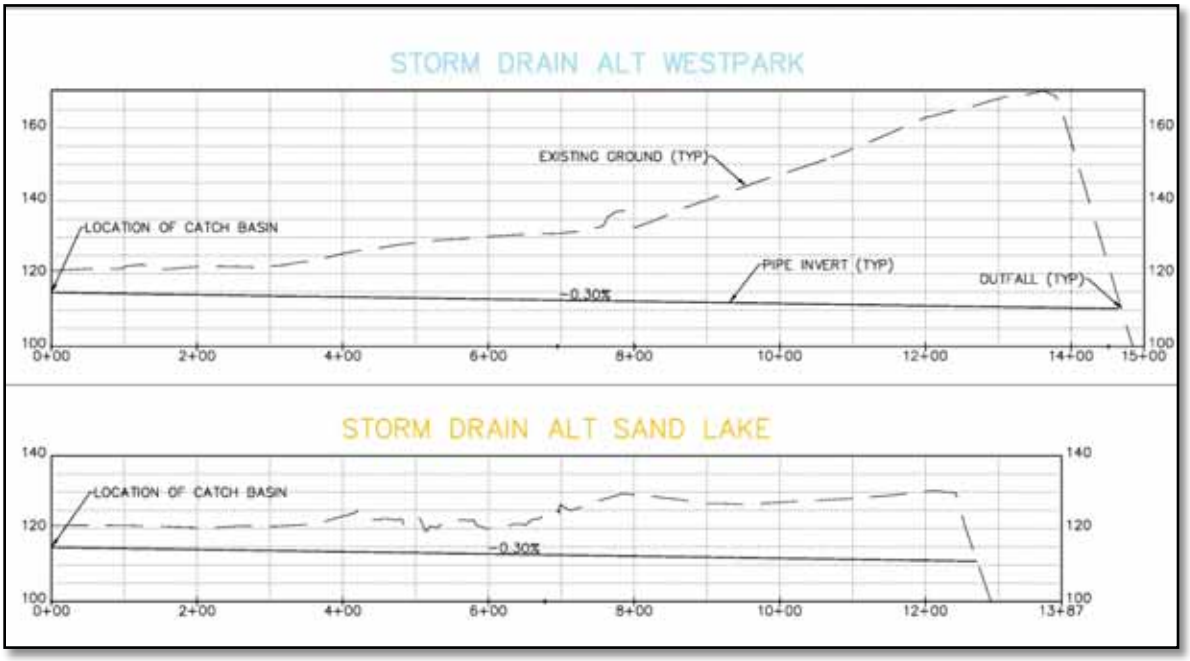

Figure 10.2 Storm Drain Alternatives – profile view

Table 10.1 Storm Drain Alternative

ITEM	OUTFALL ALTERNATIVE	
	WESTPARK DRIVE	SAND LAKE ROAD
Open trench	750 ft	1,000 ft
Trenchless	750 ft	300 ft
Minimum pipe cover	4 ft	4 ft
Maximum pipe cover	60 ft	20 ft
Construction cost estimate	$1,000,000	$750,000

The Sand Lake Road alternative is recommended due to its lower cost. The system will be centered within the existing, 50- foot wide section line easement. To reduce erosion, the bluff between the outfall and the marsh below will be lined with riprap. An oil and grit separator will be installed downstream of the last inlet and will be accessible for maintenance.

11.0 UTILITY IMPACTS

11.1 General

Utility companies with facilities located within the proposed West Dimond Boulevard Upgrade project area have been contacted to coordinate utility conflicts and identify any facility relocations that may be necessary. Presented below are summary descriptions of the utility companies contacted, and issues related to the proposed project.

A more detailed analysis of the need for relocations or extension will be made during the design process. The locations of utilities within the project corridor were recorded during field surveys and record drawing research. Additional surveys will be performed during the design process to supplement current information as necessary.

Plan views showing existing utility locations are shown in Appendix C, Plan Sheets.

11.2 Water and Sanitary Sewer

Coordination with AWWU regarding the 12-inch DIP water main at the Sand Lake and West Dimond Boulevard intersection will need to be resolved as well as any future extensions to serve the Dimond Sands Subdivision. Approximately two sanitary sewer manholes will be impacted during this project. These impacts range from adjusting manhole rings to replacing cone sections. Further coordination will be required during the design process to identify the best solution for adjusting these manholes. The conflicts are shown on the summary tables below.

Table 11.1 Water Conflicts

LOCATION	DESCRIPTION
Westpark Drive	Water line runs parallel to Westpark Drive and terminates within proposed roundabout. Planned water line crossing for Dimond Sands. Consider installing preemptively.
Sta. 95+00	Planned water line crossing for Dimond Sands. Consider installing preemptively.
Sta. 99+20 LT	Water line valve box located in proposed roundabout area.
Sta. 100+25 LT	Water line valve box located north of proposed roundabout area.
Sta. 100+75 LT	Fire hydrant and valve box located within work zone

Table 11.2 Sanitary Sewer Conflicts

LOCATION	DESCRIPTION
96+15	Sewer line crosses roadway.
96+25 RT	Sewer manhole located within work area.
96+25	Planned sewer connection for Dimond Sands. Consider installing preemptively.
96+25 to 103+50 RT	Sewer line runs parallel along West Dimond Boulevard
99+65 RT	Sewer manhole located within work area.

11.3 Natural Gas

There are approximately six separate ENSTAR service crossings of West Dimond Boulevard and two valves that may need relocation or protection in the vicinity of the Sand Lake intersection. Some of the gas mains and services will require relocation due to excavation limits and depth of fill. Currently, ENSTAR currently does not have planned upgrades within the project limits.

The summary table of gas conflicts is below:

Table 11.3 ENSTAR Gas Conflicts

LOCATION	DESCRIPTION
77+15	Gas line crosses road to service lots to south.
79+00	Gas line crosses road to service lots to south.
82+50	Gas line crosses road to service lots to south.
83+75Lt	Service line perpendicular to road.
84+90LT	Service line perpendicular to road.
85+00	Gas line crosses road to service lots to south.
85+40	Gas line crosses road to service lots to south.
95+00LT	Service line perpendicular to road.
99+35LT	Gas valve located in proposed roundabout area.
99+45	Gas line crosses West Dimond Boulevard as well as running north along Sand Lake Road.
99+60RT	Gas valve located in proposed roundabout area.
99+60 to 102+50RT	Gas line runs parallel to West Dimond Boulevard.

11.4 Telephone

ACS owns and operates underground crossings beneath the north and east approach legs of the proposed Sand Lake Road roundabout. These crossings, and associated above-ground facilities, may require relocation or protection based on the final roundabout siting. Immediately west of the Westpark Drive intersection, a shared ACS/CEA aerial crossing will be undergrounded in conjunction with this project.

The summary table of telephone conflicts is below:

Table 11.4 Telephone/Fiber Optic Conflicts

LOCATION	DESCRIPTION
82+55	Shared aerial crossing (ACS/CEA) will be undergrounded.
98+90 to 100+65 LT	Underground F/O telephone line crosses proposed Sand Lake roundabout
100+65	Underground F/O telephone line crosses West Dimond Boulevard

11.5 Electric Utility Conflicts

It is anticipated that 7 existing illumination-only poles will need to be removed in lieu of the proposed continuous lighting system. 11 poles with service conductors will also need to be replaced. One existing overhead crossing does not meet the minimum vertical clearances (20.5' per PCM Table 1130-1) and needs to be raised or relocated. Underground electric (UGE) distribution lines may require relocations due to changes in depth of bury and the location of pad mounted electrical cabinets. Relocation work will be coordinated with lighting improvements included in project construction work. The existing aerial crossing west of the Westpark Drive intersection will be undergrounded in conjunction with the project. The summary table of electrical conflicts is below:

Table 11.5 Electric Conflicts

LOCATION	DESCRIPTION
79+05 RT	Illumination pole and guy wire within proposed pathway buffer.
82+50 RT	Power pole and guy wire located in cut area.
82+60	Overhead electric wire crossing. Vertical clearance = 32.6'
85+60 LT	Illumination pole in roundabout area.
85+75 RT	Illumination pole in roundabout area.
88+90 RT	Illumination pole in work area.
92+00 RT	Illumination pole in work area.
95+00 RT	Illumination pole in work area.
95+60 LT	J-Boxes for underground electric line.
95+60 to 100+50 LT	UG electrical line parallels roadway on left near work area.
98+00RT	Illumination Pole near work area.
99+20 LT	Illumination pole in roundabout area.
99+20 to 100+60RT	UG electric line runs parallel to W. Dimond Blvd.
100+60 LT	Power pole located near work area.
100+80	Overhead electric wire crossing. Vertical clearance = 19.0'

11.6 Cable

The existing shared cable facility near the proposed Sand Lake roundabout is anticipated to be outside the project work area.

11.7 Storm Drain

The Westpark subdivision storm drain main is approximately 75-feet below existing ground depth at the crossing location and is not considered to be in conflict.

11.8 Relocation Costs

Planning level cost estimates for the utility conflict mitigations are shown in the following table:

Table 11.6 Estimated Utility Relocation Costs

UTILITY	ESTIMATED COST
AWWU Water	included in construction cost estimate
AWWU Sanitary Sewer	included in construction cost estimate
ENSTAR	$ 150,000
ACS	$ 50,000
CEA	$ 100,000
GCI	$ 0
Utilities Total:	**$ 300,000**

12.0 ACCESS AND RIGHT-OF-WAY CONSIDERATIONS

12.1 Access Control

The intersections of Westpark Drive and Sand Lake Road feature yield control of all entering traffic (roundabout). All other cross-streets and driveways are stop controlled. In many cases along the roadway, residential driveways access West Dimond Boulevard directly, especially along the south side. The preferred alternative does not propose changes to the existing access control.

12.2 Right-of-Way

The proposed improvements extend beyond the existing ROW and will require slope, public use, and/or drainage easements in the affected areas. The roundabouts at Westpark Drive and Sand Lake Road will also require additional ROW. Temporary construction permits and temporary construction easements will be required to complete tie-ins on private property and provide access for the contractor. The horizontal and vertical geometry, along with the fill and cut slopes, have been optimized to minimize ROW impacts. Required acquisitions are illustrated on the Plan sheets in Appendix C.

Both proposed roundabout locations currently feature direct driveway access. At Westpark Drive, three lots share the western driveway and a single lot utilizes the Snead Street ROW for access. Pending negotiations with the affected property owners, a fourth approach to the roundabout will be constructed to consolidate and channelize the driveway access. A turnaround area is required for services such as solid waste, mail, and snow plowing. Several options are being considered for the Sand Lake roundabout driveway access, which serves one residence and access to the storm drain facilities. The preferred alternative will take into account maintenance, delivery and pick-up services, driver confusion, resident convenience, and deterrence.

There are other driveways that need to be realigned due to the proposed improvements. The preliminary driveway improvements have been identified on the Plan sheets in Appendix C. Table 12.1 identifies and describes all permanent easements that are required for the proposed improvements.

Table 12.1 Easements and Right-of-Way Requirements

Parcel No.	LEGAL DESCRIPTION	EASEMENT		
		SLOPE (SF)	PUBLIC USE (SF)	DRAINAGE (SF)
128a	Seaview Heights, Blk 1 Tr 6	3,624		
128b	Seaview Heights, Blk 1 Tr 6			1,099
129a	Seaview Heights, Blk 1 Tr 5	3,622		
129b	Seaview Heights, Blk 1 Tr 5			1,327
130	Seaview Heights, Blk 1 Tr 4	1,703		
131	Seaview Heights, Blk 1 Tr 3	1,639		
132	Seaview Heights, Blk 1 Tr 2	1,780		
133a	Seaview Heights, Blk 1 Tr 1a	6,194		
133b	Seaview Heights, Blk 1 Tr 1a		2,724	
135a	Dimond Sands, Tr B	4,281		
135b	Dimond Sands, Tr B		5,289	
135c	Dimond Sands, Tr B	3,981		
161a	Sonoma Glen At Westpark Ph 1 Tr 1c		2,077	
161b	Sonoma Glen At Westpark Ph 1 Tr 1c	10,594		
161c	Sonoma Glen At Westpark Ph 1 Tr 1c		158	
167a	Seaview Heights, Blk 2 Lt 1b	7,770		
167b	Seaview Heights, Blk 2 Lt 1b		364	
Total		**45,187**	**10,612**	**2,426**

12.3 Parking

No dedicated or on-street parking facilities are proposed within the project perimeter.

13.0 MAINTENANCE CONSIDERATIONS

The MOA owns and maintains West Dimond Boulevard within the project limits, with the exception of the Sand Lake Road intersection, which is owned by DOT&PF. Maintenance agreements between the MOA and DOT&PF will be required to spell out the various responsibilities. The per lane mile maintenance costs are not expected to be any different than other collector roadways.

Storm Drain manholes will be spaced no more than 300 feet and located outside of the traveled way for ease of access and reduced failure. A minimum of 18-inch pipe will be used for the storm drain system and driveway culverts. The need for thaw pipe will be analyzed during detailed design.

14.0 STREET ILLUMINATION

14.1 Street Lighting

The existing illumination system does not meet the current standards within the DCM for a continuous lighting system. The existing road is classified as a collector and has medium pedestrian conflict. Requirements for continuous lighting systems using the luminance criteria are laid out in Table 5.2 of the DCM and below:

Table 14.1 Lighting Requirements

CLASSIFICATION	PEDESTRIAN CONFLICT	AVE LUMINANCE	UNIFORMITY (AVE/MIN)	UNIFORMITY (MAX/MIN)	VEILING LUMINANCE
Collector	Medium	0.6 cd/m²	3.5	6.0	0.4

Additionally, the proposed separated pedestrian pathways are required by Section 5.4C to be illuminated in conformance with Table 5.4 of the DCM:

Table 14.2 Pathway Illumination

PEDESTRIAN CONFLICT	LAND USE	AVE ILLUMINANCE (HORIZONTAL)	VERTICAL ILLUMINANCE	UNIFORMITY (AVE/MIN)
Low	Low Density Residential	0.3 fc	0.08 fc	6.0

Existing luminaires are recommended to be demolished and a new continuous illumination system be installed per Tables 14-1 and 14-2. Due to utility conflicts and lack of right-of-way, poles will be placed inside the pathway buffer on the south side of the roadway. Breakaway bases will be specified per DCM Section 5.7.

Section 5.4D in the DCM, requires the use of white lighting for new construction. Current practice is to use LED luminaries on Municipal roads to meet this requirement.

Figure 14.1 Proposed Illumination Poles

The table below summarizes the continuous lighting system:

Table 14.3 LED Lighting System

SPECIFICATION	ROADWAY
Nominal wattage	271W (120 LEDs)
Mounting Height	35 ft
Approximate Spacing	195 ft
Total Poles*	17
Color	White
Estimated life	11 years**
Estimate construction cost	$250,000

*Includes 4 poles at each of the two proposed roundabouts.
**BetaLED suggests a 22 year life based on L_{70} (70% of initial lumen output), however this is a calculated value. Testing labs have not actually tested these luminaires to failure. This calculation also does not appear to take into account driver failure, so the designer recommends assuming a shorter life until more data is available.

14.2 Intersection Lighting

Two roundabouts are currently proposed, one at Sand Lake Road and one at Westpark Drive. Illumination at these roundabouts will use a single pole at each quadrant. Poles will be placed in accordance with IES DG-19-08 Roundabout Lighting and Section 5.4 H of the DCM.

Sand Lake is currently a DOT&PF maintained intersection. However, pending the execution of a maintenance agreement, MOA will assume the lighting maintenance of the intersection and specify LED luminaires.

14.3 Transition Lighting

West of the Westpark roundabout, the 700-foot roadway transition will be illuminated in accordance with the MOA's continuous lighting standard as outlined in Section 14.1. This will alert drivers to the oncoming change in vehicle speed and channelization presented by the roundabout. Also, conflicts with non-motorized users transitioning from the pathways to the roadway west of the Westpark roundabout necessitate adequate lighting.

14.4 Load Centers

It is anticipated that one load center will be required near Westpark Drive. The load center will be a Type 1A pedestal-mount, 100A, 480/240V.

15.0 LANDSCAPING

15.1 Viewshed

Views from the road driving eastward can be spectacular and include the Chugach Mountains framed by natural vegetation. Views to the road from adjacent properties vary. Many houses are set back from the road and separated by native forest, so the road is minimally visible, if at all. Several homes overlook the road; these tend to be along the north side of West Dimond Boulevard.

15.2 Climatic Zone

The climatic zone of the roadway corridor is generally Zone 3, as determined by the United States Department of Agriculture Plant Hardiness Classification System. Temperature maps for Anchorage show the project area to include some of Anchorage's warmer pockets. At the coldest extreme, Zone 3 temperature ranges are from -30 degrees to -40 degrees Fahrenheit, with a typical growing season from mid-May to the end of September (120 to 140 days). Climates within the corridor are likely influenced by proximity to the bluff.

15.3 Landscaping Recommendations

The Street and Highway Landscape Plan creates the basis for the landscape design for the roadways in this project. In terms of design, the plan provides broad guidelines that include:

- Develop a sense of visual cohesiveness along the road;
- Reduce visual clutter to improve safety;
- Maintain property values for owners adjacent to the road; and
- Enhance scenic and recreation opportunities.

The DCM also provides guidance on landscaping and focuses more on proper placement and planting techniques for trees and shrubs for their health and future maintenance.

The proposed roundabout at Westpark Drive intersection provides an opportunity for a gateway into the neighborhood and can set the tone for the drive further west. Connecting the natural vegetation in the area to the roundabout will be explored as an option during future design phases. Roadway visibility through the roundabouts and maintenance ease and costs will also help inform the type of gateway feature within the roundabouts. Keeping long-term maintenance concerns in mind, concepts such as the use of continuous planting beds, permanent edging and adequate depth of topsoil will be utilized where possible. Minimizing moose browsing of planted vegetation will also be a consideration to the extent possible. Between the edge of road and pathway the landscape treatment will include a low maintenance grass mix, placed in the form of

seed that will allow snow storage with the least amount of damage. All disturbed areas will be seeded. Initial seeding may include flower seed as a temporary amenity.

16.0 WORK ZONE TRAFFIC CONTROL

Construction should be phased to minimize impacts to local traffic and transient or cut through traffic discouraged with proper signage. It is anticipated that construction will take place under traffic conditions whenever possible. In addition, access to all residences will be maintained during construction to reduce impacts to the extent practicable. Fortunately, several detour opportunities exist that could be used during construction for potential full width roadway closures. The key to a successful construction phase is early coordination with stakeholders. Refinement of the traffic control plan will continue through final design.

17.0 PERMITTING AND APPROVALS

17.1 Planning and Zoning Commission

Planning and Zoning Commission (PZC) review and approval of the recommended alternative is required at the Design Study (35% design) phase. Concurrent technical review from MOA Departments and state agencies is also required at the 35% design study phase. The Planning and Zoning Commission review is centered on the project's conformance to adopted plans and policies, mitigation of impacts to adjacent properties, provisions to improve the corridor for pedestrians and other non-motorized users and compatibility with adjacent and area land uses.

17.2 Urban Design Commission

Public roadway project plans, including 65% complete landscaping plans, are also reviewed by the Urban Design Commission (UDC). Preliminary 65% design plans also undergo a technical review by municipal departments and state agencies such as the Alaska Department of Transportation and Public Facilities. The UDC may make design recommendations to improve the landscape elements of the project, as well as the function of the project including overall design including roadway width, pedestrian facilities, drainage and run-off and other design elements. Lighting and transit, if relevant, are also included in project reviews.

18.0 STAKEHOLDER/PUBLIC INVOLVEMENT

18.1 General

This section describes the public involvement initiated at the start of the project in 2006 and the activities that will continue throughout the project phases.

18.2 Public Involvement Completed

The public involvement and public discussion about the improvements to West Dimond Boulevard began early in the project. It started with an agency scoping meeting, where MOA Department staff were asked to provide feedback about the project to the design team. An initial public scoping meeting was held to solicit input from the community for improving the roadway corridor. In addition, a CAC was formed to assist the project team in developing the design criteria for the project.

A public involvement plan was developed and the completed items are shown in the following table. Italics are used to indicate items that will be ongoing throughout the project.

Table 18.1 Public Involvement Activity Summary

DATE	PUBLIC INVOLVEMENT TOOL (GROUP/ACTIVITY)	PROJECT PHASE/PURPOSE	TIME & LOCATION
Start of project through end of project	Establish and update project mail list	Project Mailings	N/A
Web Site	Develop and update project web site	*Ongoing.*	N/A
May 8, 2006	Post Card Mailing	Announce project and upcoming public meeting.	N/A
May 8, 2006	Sand Lake Community Council	Announce project; invite community to public meeting.	2nd Monday, 7 pm Calvary Church, Spuhler Hall W 80th/Jewel Lake Rd.
May 10, 2006	Workshop	Introduce project, seek technical input from department staff.	2:30 pm MOA Development Services Department Training Room

DATE	PUBLIC INVOLVEMENT TOOL (GROUP/ACTIVITY)	PROJECT PHASE/PURPOSE	TIME & LOCATION
May 13, 2006	Newsletter #1	Announce project and upcoming public meeting.	Door hanger along project corridor; distributed to Community Council
May 15, 2006 May 21, 2006	*Anchorage Daily News* display advertising	To advertise the public meeting on May 22, 2006.	N/A
May 22, 2006	Public Meeting #1	Introduce the project, seek public input on project scope and alternative evaluation criteria.	7-9 pm Dimond H.S. Library
July 12, 2006	Citizens' Advisory Committee Meeting #1	Meet the project team; sign Charter; define steps to be taken to recommend a solution for project..	5:30-7:30 pm Jewel Lake Plaza Multipurpose Room 8300 Jewel Lake Road
August 21, 2006	Citizens' Advisory Committee Meeting #2	Who are we designing the road for? Discussion of Pedestrian Facility Requirements; Planning and Zoning and Urban Design Commission; Street & Pedestrian Facility Maintenance.	5:30-7:30 pm Jewel Lake Plaza Multipurpose Room 8300 Jewel Lake Road
January 4, 2007	Citizens' Advisory Committee Meeting #3	Summary of CAC input; discuss typical sections; roadway impacts/design challenges; intersection alternatives.	5:30-7:30 pm Jewel Lake Plaza Multipurpose Room 8300 Jewel Lake Road

Public input, in the form of telephone call records, comment sheets from the public meetings and other written correspondence to the project team are presented in Appendix F, Public Involvement.

18.3 Citizen's Advisory Committee

A CAC consisting of seven members was formed to focus on identifying the key issues and problems to be solved early in the project. Three meetings were held from 2006 to 2007 to discuss the project in more depth and to gain feedback and suggestions from committee members. Some of the topics discussed included:

- Context Sensitive Solutions (CSS) Design Process;
- Context of West Dimond Boulevard;
- Identifying the "interdisciplinary" team;
- Identification of project stakeholders;
- Identifying existing street characteristics (classification, right-of-way width, landscaping, etc.);
- Defining the problems to be solved with this project;
- Develop criteria for evaluating West Dimond Boulevard alternatives;
- Stakeholders the road will be designed for;
- Pedestrian Facility Requirements and Opportunities;
- Planning and Zoning requirements;
- Street and Pedestrian Facility Maintenance;
- Design Alternatives – typical sections; roadway impacts/design challenges; intersection alternatives.

The CAC's work was completed during this planning and concept phase. Meeting agendas, presentation materials, handouts and meeting notes for the CAC are included in Appendix E, Public Involvement.

18.4 Public Agency Coordination

The project team met with staff from various MOA departments, ASD, DOT&PF, AWWU and private utility companies to:

- Introduce the project;
- Discuss MOA and DOT&PF goals for the project;
- Understand what each department would like to see included in this project;
- Determine what changes the public can effect and yet meet department standards or guidelines.

Another goal of this meeting was to make contact with staff and encourage project coordination internally with other ongoing municipal, state or utility projects in the area which may impact the West Dimond Boulevard project.

For a complete list of invitees and meeting notes, please refer to Appendix G, Public Involvement.

18.5 Design Study Phase Public Involvement 2013

Public Involvement continued in 2013 with an updated project website: www.westdimondblvd.com that allowed interested stakeholders to review documents, sign up for e-newsletter updates and submit comments directly through the website.

A postcard invite to a public open house held on August 28, 2013 was mailed to over 1100 resident and property owners. The open house was held at Dimond High School to review the Draft Design Study Report (DSR) and the preferred alternative released for public and agency review on July 31, 2013.

Residents, property owners, agencies, Kincaid Park user groups, recreational users and bike commuters and elected officials were also notified with an e-newsletter update of the DSR posting on the website and of the open house on August 28, 2013.

Members of the project team attended the Sand Lake Community Council on September 9, 2013 to provide an overview of the project and to answer questions about the Draft Design Study Report.

A summary of the open house, open house materials and Community Council meeting are available in Appendix G Public Involvement Activities.

An agency meeting was also held on September 23, 2013 to review and address agency comments on the proposed improvements for Phase 1 – Westpark Drive to Sand Lake Road. Agencies included ADOT&PF, Municipal departments/sections including Traffic, PM&E, Non-Motorized Transportation, Parks and Recreation; and utility providers such as ENSTAR Gas Company and Chugach Electric. A summary of agency comments and responses are available in Appendix G.

18.6 Future Public Involvement

Additional public involvement is planned for the preliminary design phase (65%), final design phase and pre-construction. An updated public involvement plan which provides in detail the methods and timeline for engaging the community and agencies as the project moves forward can be found in Appendix F.

19.0 COST ESTIMATE

The estimated costs for the preferred alternative are summarized as follows:

Table 19.1 Cost Estimate

DESCRIPTION	ITEM	CALCULATION	ESTIMATED COST
Construction	A		$4,000,000
Utility Relocation	B		$300,000
Right-of-Way Acquisition	C		$300,000
Subtotal	D	A+B+C	$4,600,000
Construction Engineering	E	20% of D	$920,000
Contingency	F	30% of D	$1,380,000
Total	**G**	**D+E+F**	**$6,900,000**

20.0 DESIGN VARIANCES

The table below summarizes the proposed design variances that will be sought based on the recommended alternatives for the West Dimond Boulevard upgrade:

Table 20.1 Design Variances

ITEM	REFERENCED STANDARD	CRITERIA	REQUESTED VARIANCE	REASON
Pavement Section	DCM 1.10 D	Limited frost penetration method	Reduced subgrade strength method	Adequate for proposed roadway
Design Speed	DCM Table 1.4	45 mph	40 mph	Terrain and sight distance limitations