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Memo

To:	Kristi Bischofberger, Municipality of Anchorage, Watershed Management Services
CC:	Bill Rice, US Fish and Wildlife Service
From:	Adinda Demske, Scott Norton, Meg O'Mullane and Ingrid Corson, HDR Alaska, Inc.
Project:	Chester Creek Watershed Subbasin Prioritization for LID Stormwater Projects
Date:	December 17th, 2012 — Job No: 180446
Re:	This memorandum presents criteria and methods for prioritizing subbasins in the Chester Creek watershed for potential low-impact development (LID) stormwater projects.

Contents

List of Figures (figures are attached to the end of this memorandum)

Introduction

The Municipality of Anchorage (MOA) and Alaska Department of Transportation and Public Facilities (ADOT) hold a MS4 Permit that allows the discharge of municipal stormwater outfalls to waters of the United States within the corporate boundary of the Municipality of Anchorage. The permit requirements include completion of at least two individual watershed plans for specific water bodies before expiration of the permit in 2015. One of the requirements for a watershed plan is to identify potential opportunities for Low Impact Development (LID) practices. In preparation for creating a watershed plan to meet their MS4 permit requirements, the MOA Watershed Management Services (WMS) requested that HDR Alaska, Inc. (HDR) evaluate the Chester Creek watershed to identify potential opportunities for LID implementation. The MOA also requested that HDR develop a methodology for prioritizing subbasins that could be applied to other watersheds.

HDR's original scope of work included the following:

- Identify recent stormwater improvement projects completed within the Chester Creek Watershed
- Create an LID Priority List of 20 subbasins in the Chester Creek watershed
- Identify LID opportunities in the 20 priority subbasins

During this project a work group consisting of representatives from HDR, WMS, and US Fish and Wildlife Service (USFWS), met periodically to review progress and redefine the direction of the work effort.

This memorandum describes the work that was undertaken to meet the project scope, and presents the results of the analysis.

Study Area

The Chester Creek watershed is approximately 11 miles long, 4 miles wide, and consists of roughly 19,470 acres. The area evaluated for this study includes 11,161 acres in the urbanized lower portion of the watershed. Figure 1 shows the general features of the lower Chester Creek watershed including wetlands, lakes, and the stormwater conveyance network. The lower Chester Creek watershed is comprised of 4 subwatersheds and 176 subbasins shown in Figure 2.

Recent LID Projects in the Watershed

LID has been implemented on a number of sites within the Chester Creek Watershed. The following list details some projects that have been completed recently or are still under construction. The list was developed through an interview with Watershed Management Services staff.

Table 1

Subwatershed	Subbasin	Name of Project	Description
Middle Fork	1253	New Providence Health Building	Detention pond for runoff. Still under construction.
	1253	Cartee Softball Fields	Porous pavement with underground detention and infiltration gallery. Accepts runoff from the parking lot. Pilot project to see how porous pavement works in Alaska conditions.
	1253 and 478	Ace Hardware	Complete underground infiltration gallery. Connected to the stormdrain.
	520	New 4-plex at 20th and Wesleyan	Development was graded so that runoff from parking lot drains to the adjacent wetland for treatment.
South Fork	169	UAA Sports Arena	When this development is completed a large area of the roof and parking lot will be directed to a constructed depression.
	175	State Crime Lab	Low impact design features were incorporated into the new development.
	175	Providence Day Care	A constructed pond receives runoff.
	Building is on 167. Pond is on 623.	UAA Health Science Building	Runoff from the roof is directed to the west to a large infiltration building. Overflow goes to constructed pond. On south of building runoff from parking goes to rock basin/ ditch/swale. The low depression area was filled with rock to provide treatment.
	527	New Providence Extended Care, under construction	Runoff from building and parking will go to a constructed pond when this development is completed.
	574	Medical Office Building - Alaska Heart Institute, and Cancer Center Building	Runoff from parking lot goes to a constructed pond. Water discharges into the adjacent wetland. There is no direct connection to the creek.
	597	Creekside Drive Development	A constructed pond collects runoff from the roofs and parking lot. The pond drains to the west, towards the creek.
	623	MHLT. Mental Health Trust Fund	A constructed detention pond accepts runoff from this currently-vacant land.
	1251	Alaska Native Tribal Health Consortium building	A constructed pond to the east of the building receives runoff from the entire parking lot and roof. The parking area on the east side of the pond also drains to the pond.

Development of Prioritization Criteria

HDR worked with three different criteria to prioritize subbasins before developing a prioritization methodology that was satisfactory. HDR discussed the results of each criteria with the work group as the project developed in order to determine which criterion best matched the intent of the work group to identify priority subbasins. All three criteria were based on directly connected impervious area (DCI). DCI is the area of land that is covered by an impervious surface that is connected directly to the stormwater conveyance system. DCI area in the lower Chester Creek watershed is highlighted in yellow in Figure 2. DCI is an indicator of urban development and larger DCI area in a watershed leads to increased concentration of stormwater runoff. Low impact development practices (LID) often seek to reduce total watershed DCI area, which is why the DCI-based criterion was selected as the criteria with which to prioritize subbasins for LID. The following section describes each criteria and the development of the preferred prioritization methodology.

Percentage DCI

The original scope for this project stated that subbasins would be prioritized based on the percentage of each subbasin area that is directly connected impervious (DCI%), and this is the first criterion that was used to prioritize subbasins. Figure 3 shows the 20 subbasins with the highest percentage of DCI and a list of these subbasins with their percentage DCI is shown in Table 3 of Appendix A. Note that many subbasins with the largest *total DCI area* have not been prioritized by using the DCI% criterion. Many of the smallest subbasins were preferred by this criterion.

Total DCI Area

The work group reasoned that subbasins with the largest total DCI areas would have the biggest impact on Chester Creek because those subbasins would contribute the largest volume of runoff to the creek. This is because runoff is directly proportional to rainfall on DCI areas. Therefore, the work group reasoned that subbasins with the largest areas of DCI should be prioritized for LID. The subbasins were prioritized a second time using total DCI area. Figure 4 shows the 20 subbasins with the largest total DCI area. A list of these subbasins and their corresponding total DCI area is shown in Table 4 of Appendix B.

Total DCI area that is designated commercial, industrial, institutional, or transportation land use

With total DCI in each subbasin mapped, the work group felt that the prioritization could be improved by looking at the types of land use within the DCI areas, and trying to identify the land use for properties that were large and covered in DCI, where LID retrofits could greatly diminish the volume of runoff going to the creek. Properties with large parking lots and roofs such as strip malls, schools, churches, and box stores, were frequently designated commercial, industrial, institutional, or transportation. Within this group of properties were vacant areas that could possibly be available for use treating stormwater. It was reasoned that the MOA would be able to more easily collaborate with the owners of institutional land to make LID improvements. In many cases the MOA was the owner of institutional land.

The subbasins were prioritized a third time using the criterion of 'total DCI area that is designated commercial, industrial, institutional, or transportation land use'. Figure 5 shows the top 20 subbasins. The work group decided that this criterion best matched the group's intent to identify priority subbasins. It is recommended that this criterion be used to prioritize subbasins in other watersheds that are highly urbanized.

Note that the original scope of work stated that the five most impacted subbasins within each of the four subwatersheds would be identified in the LID Priority List. However HDR found that applying the prioritization criteria to the entire watershed gave better results because it identified the most impacted subbasins that were distributed among the four subwatersheds. Choosing five subbasins in each watershed resulted in some of the most impacted subbasins being ignored, and so this method was not used.

Results: LID Priority List

Table 2 shows the LID priority list of 20 subbasins that was developed using the prioritization criterion of total DCI area that is designated commercial, industrial, institutional, or transportation land use. Figure 5 maps the subbasins in the watershed.

Table 2. Priority Subbasins for LID

Priority #	Subbasin #	DCI within Commercial, Industrial, Institutional, and Transportation Land (acres)	Percentage DCI (%)	Total DCI (acres)	Subwatershed
1	602	200	73%	204	NORTH FORK
2	475	171	48%	479	NORTH FORK
3	549	104	64%	154	LOWER
4	523	91	73%	226	LOWER
5	594	84	92%	128	LOWER
6	527	79	36%	272	SOUTH FORK
7	1253	78	31%	341	MIDDLE FORK
8	175	57	38%	110	SOUTH FORK
9	515	48	59%	116	MIDDLE FORK
10	616	40	72%	87	LOWER
11	133	39	87%	65	LOWER
12	623	36	36%	56	SOUTH FORK
13	504	35	79%	86	LOWER
14	1251	28	44%	43	SOUTH FORK
15	992	26	60%	36	SOUTH FORK
16	130	22	31%	94	SOUTH FORK
17	479	24	88%	35	NORTH FORK
18	554	17	72%	35	LOWER
19	127	17	41%	37	SOUTH FORK
20	167	15	26%	22	SOUTH FORK

LID Opportunities in Priority Subbasins

The Mapbook Series of Priority Subbasins presents the 20 priority subbasins and shows potential LID projects. The LID opportunities are listed in Appendix C.

LID opportunities in the 20 priority subbasins were identified by examining each of the subbasins in GIS. Fieldwork was not within the scope of this project, and the feasibility of each LID opportunity was not tested. In each subbasin particular attention was given to properties that were covered in DCI, because these areas offered a good opportunity to decrease stormwater runoff by either decreasing impervious area, or disconnecting the impervious areas from the storm drain network. Attention was also paid to properties that are MOA-owned, or Anchorage School District-owned, or classified as Public/Institutional Land Use. It was reasoned that these properties might be more available to LID implementation than private properties, and these properties were usually larger so LID would have a greater beneficial impact on stormwater runoff in the watershed. The properties deemed suitable for LID were examined closely in GIS. Suggestions for LID projects on suitable properties were developed by looking at the following;

- Aerial photography was examined to determine the location of vegetated and impervious surfaces. This informed whether infiltration basins or vegetated swales might be appropriate on this site.
- The public storm drain network and catchbasins surrounding the property were examined to determine the direction of flow, and to determine if disconnection to the storm sewer network might be possible. Note that private storm sewer is not contained in the GIS database therefore private storm sewer networks were not examined.
- Contours were examined to inform which direction sheet flow would travel on site.
- Nearby wetlands were noted that could offer potential for disconnection from the piped stormwater system by diverting stormwater to the wetland.

Discussion

HDR mapped DCI in the Chester Creek Watershed in GIS using the MOA land cover raster dataset. The raster dataset was created in 2001. Areas that have been transformed into DCI since 2001, such as the development of a forested site into a new building and parking lot, are not classified as DCI in the MOA land cover raster dataset. Therefore the calculated area and percentage of DCI in subbasins is not current but reflects DCI coverage from 2001.

The prioritization methodology did not take into account locations were LID was already implemented. Some DCI areas identified with GIS might actually have been disconnected from the stormwater network. Some subbasins may be demoted to a lower priority once existing LID is assessed.

Subbasin 479 (priority 17) may deserve a lower priority because it appears to discharge to a wetland, not directly into Chester Creek. It was beyond the scope of this project to ground truth the routing of stormwater conveyance systems.

Appendix A: 20 Subbasins with the largest percentage of DCI area

Table 3 20 Subbasins with the largest percentage of DCI area

Priority	Subbasin ID	Percentage DCI	Subwatershed
1	489	72%	South Fork
2	594	69%	Lower
3	602	68%	North Fork
4	479	67%	Middle Fork
5	132	66%	Lower
6	133	66%	Lower
7	611	61%	Lower
8	564	60%	Lower
9	504	59%	Lower
10	554	59%	Lower
11	575	55%	Lower
12	495	52%	Lower
13	616	52%	Lower
14	992	51%	South Fork
15	523	49%	Lower
16	492	46%	Lower
17	549	45%	Lower
18	604	45%	Lower
19	515	42%	Middle Fork
20	136	22%	Lower

Appendix B: 20 Subbasins containing the largest areas of DCI

Table 4 20 Subbasins containing the largest areas of DCI

Priority	Subbasin ID	Total DCI (acres)	Subwatershed
1	475	479	North Fork
2	1253	341	Middle Fork
3	527	272	South Fork
4	549	254	Lower
5	523	226	Lower
6	602	204	North Fork
7	555	134	Lower
8	598	129	South Fork
9	594	128	Lower
10	515	116	Middle Fork
11	175	109	South Fork
12	492	96	Lower
13	130	94	South Fork
14	616	87	Lower
15	504	86	Lower
16	133	65	Lower
17	494	63	Middle Fork
18	478	61	South Fork
19	495	59	Lower
20	623	56	South Fork

Appendix C List of LID Opportunities in the 20 Priority Subbasins

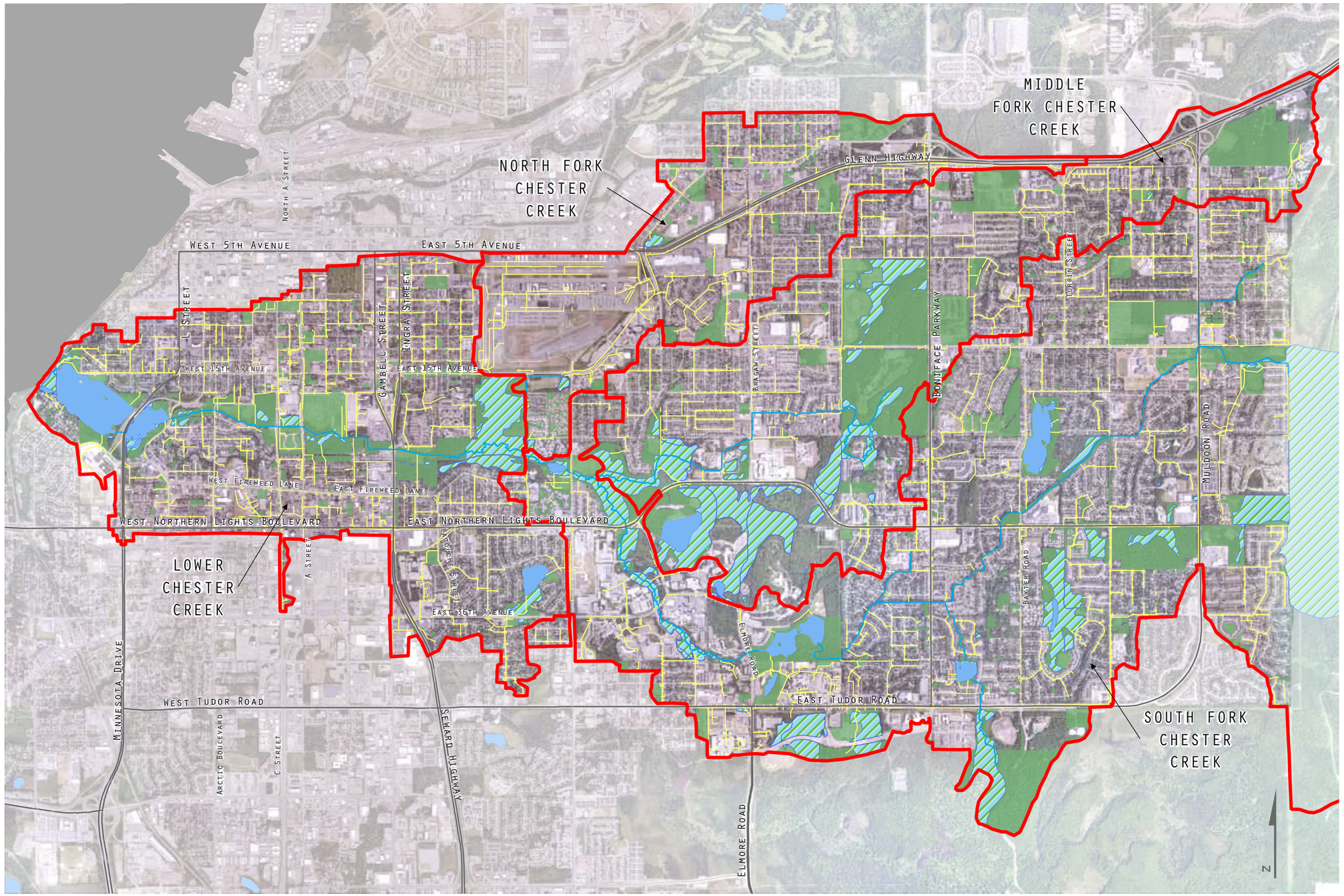
Table 5 LID Opportunities in the 20 Priority Subbasins

Priority	Subbasin	Potential LID Projects
1	602	It is unlikely that the FAA would alow any diversion of stormwater into swales because of the risk of creating open water and bird habitat. Investigate infiltration options that can be achieved without any risk of open water
		Consider diverting runoff to the wetlands south of East 15th Avenue similar to the adjacent subbasin to the west, Subbasin #575.
		There is a bentonite wall along the southern perimeter of Merrill Field that does not allow the flow of groundwater from the site.
		This southeast quarter of Merrill Field is actually gravel and should allow infiltration. The raster imagery that designated this area as 'DCI' probably couldn't detect that this was permeable gravel rather than impermeable paved surface.
		The Merrill Field Master Plan Update is in draft form and currently does not include any LID improvements. Investigate LID that might be acceptable to the FAA and will not encourage open water or bird habitat, and consider incorporating LID in the Master Plan.
2	475	MOA is doing a drainage plan for Penland Park; investigate to identify LID opportunity. Strormdrain drains to the west and might be disconnected by using the existing swale running on the east side of Airport Heights Drive.
		Drainage from the Fire Department site could be retained on site through regrading because much of this land is undeveloped but appears to be used for disaster preparation.
		Retrofit Northway Mall/Home Depot Parking area, re-grade parking to direct water to infiltration/evaporation ponds. Instead of continuous raised curb stops with raised vegetated beds, use lowered vegetated ditches and broken tire stops to allow sheet flow to run into the ditches. Don't have the ditch in the paved driveway of the parking lot that is directed towards drains.
		Roof drainage at medical park might be diverted if a swale were constructed to the northwest of the site.
		Drainage from Medical Park parking at the southwest of the site could be diverted to the surrounding vegetated strips.
		Investigate ways to infiltrate stormwater that frequently floods in this area.
		This southeast section of Merrill Field is actually gravel and should allow infiltration. The raster imagery that designated this area as 'DCI' probably couldn't detect that this was permeable gravel rather than impermeable paved surface.
		Re-grade parking to direct water to infiltration/evaporation ponds at Sam's Club and at Pacific Northern Academy.
		Consider retaining roof drainage on-site at the Anchorage Daily News building. Could disconnect by constructing infiltration ponds in landscaping on west side of site. Construct swale to the east side of the property to detain sheet flow from the parking lot.
		Some runoff from these institutional properties might be retained in the down-grade vegetated strip along Debarr Road to the southwest.
3	549	36th Avenue area has $10 million budget for improvements. LID stormwater concepts could be integrated in improvement designs.
		Consider regrading church property to retain surface drainage onsite.
		This will be part of the Highway to Highway project and LID/Storm Drain Improvements could be included in that project.
		Explore retention of stormwater on Rodgers Park Elementary School site, if not already retained.
		Drainage from BP site may be retained in vegetated buffers through regrading.

Priority	Subbasin	Potential LID Projects
		Regrading University Center parking to vegetated swales would retain drainage onsite.
		Consider parking lot size requirements and utilization in Fred Meyer parking lot and determine if part of the paving could be removed and used for storm water infiltration.
		It would be challenging to disconnect this highly urbanized area unless each property retained runoff in their small and discrete, vegetated areas.
4	523	This could be part of the Highway to Highway project and LID/Storm Drain Improvements could be included in that project.
		Consider using the Merrill Field runway "clear zone" at east of 6th Avenue/Glenn Highway curve for infiltration.
		Consider Chugach Optional/Central Middle School property for potential to disconnect roof and parking sheet flow from storm drain.
		Consider LID options for Denali School, if not already implemented.
		Consider landscaping the Earl & Muriel King Park to detain onsite stormwater and divert stormwater from the catchbasin to the north back to the park.
		Consider using the wetland tract to receive sheet flow from surrounding urban sites to the north.
5	594	Divert flow from the storm drain at C Street and 22nd Avenue to the wetlands 2-3 blocks to the east.
		The large parking lot between C Street and A Street contains a storm drain in the middle. Consider to capturing sheet flow before it reaches this drain.
		Consider parking lot size requirements and utilization along C Street and determine if part of the paving could be removed and used for storm water infiltration.
		Consider retaining stormwater using LID landscaping techniques at Steller Alternative School site. There are 9 catchbasins on the site collecting stormwater from the field, parking area and roof.
6	527	Capture sheet flow before it reaches storm drains at the west side of the Fred Meyer parking lot. Incorporate LID concepts in the development of the three parcels to the north and west of this lot that are currently owned by Wal Mart. Consider redesigning/rebuilding parts of the existing Fred Meyer parking lot.
		Investigate the potential of using the 'stormwater easement' between Elmendorf Drive and Kepner Drive for stormwater infiltration.
		Consider the drainage in Anchorage School District Education Center parking lot and roof. Raised curb stops with vegetation in this lot could be redesigned to capture sheetflow and infiltrate runoff.
		Retain runoff from Creekside Elementary School onsite.
		Retain runoff from Nunaka Elementary School onsite.
		This subbasin contains many single home residential lots. This subbasin may be a good candidate for public education to divert roof drainage away from the streets.
		Consider disconnecting church site by regrading of parking area and detaining runoff in vegetated swales.
		Detain sheet flow from Temple site by regrading and constructing infiltration basins when the site is developed.
		Cut pavement and construct vegetated infiltration areas in Value Village parking lot to capture runoff instead of using two catch basins in center of parking lot.
7	1253	There is potential for onsite management of stormwater and partial disconnection from storm drains at Wonder Park School (East 4th Avenue near Camelot Drive).
		There is a plan for capital improvements along Muldoon Road. Stormwater LID concepts could be incorporated with drainage upgrades; coordinate this development with Alaska Department of Transportation and Public Facilities.

Priority	Subbasin	Potential LID Projects
		Construct vegetated infiltration basins within the Carrs Shopping Center parking area to retain stormwater on site and disconnect from the 4 catchbasins to the north of the site.
		Consider diverting stormdrain to wetland area in the southwest of subasin instead of discharging directly into the Middle Fork of Chester Creek.
		Investigate ways to disconnect this urban area from the stormdrain system.
8	175	Possibly disconnect catch basins at Municipal Tudor Road Complex (School bus barn). Consider diverting sheet flow from parking lot to surrounding vegetated areas or rebuilding the parking lot to include an infiltration area, disconnected from the existing catch basins.
		Consider parking lot size requirements and utilization in this strip mall to determine if part of the paving could be removed for stormwater infiltration.
		Investigate LID opportunities for the MOA building.
		Use wetlands north of subbasin near the stream to divert some of the flow from the stormdrain before it enters the creek. The connection between the wetland and stormdrain should be verified.
		State Crime Lab is a recent development and may already have incorporated LID, but if not, investigate ways to retain stormwater on site.
		The Office of the State Veterinarian is a relatively new development and may have implemented LID, but it not, investigate ways to incorporate LID in site.
9	515	Consider the Costco parking lot drainage. Evaluate the potential for disconnection/ stormwater management in vegetated areas to the northeast
		Consider redesigning the parking lot so that water can infiltrate at vegetated areas, rather than draining toward the paved driving lanes.
		Williwaw Elementary School could use the same vegetated area as Costco for onsite stormwater management.
		Consider infiltration in vegetated areas for runoff from parking areas in the south end of this subbasin.
10	616	The vegetated areas to the north of North Star School offer the potential for onsite stormwater management.
		Consider parking lot size requirements and utilization in the area along Arctic and Northern Lights and determine if there are oversized lots where part of the paving could be removed and used for stormwater infiltration.
11	133	Evaluate the potential for disconnection of catch basins (2 on west edge of lot and 5 on east edge) along the edge of parking lot of First National Bank between Gambell Street and Ingra Street; vegetated ditches between the parking lot and streets could be good location for stormwater runoff percolation.
		A parking lot expansion is planned for Sullivan Arena; this offers a good opportunity to include LID in the design considerations.
		This will be part of the Highway to Highway project and LID/Storm Drain Improvements could be included in that project.
12	623	This subbasin contains many disconnected impervious areas with vegetated buffers on the UAA and Providence Medical campuses. Consider redirecting parking lot runoff to these areas and disconnect catch basins to minimize direct transport of stormwater to the creek.
		It might be possible to use the wetland buffer between UAA and the South Fork of Chester Creek to the northeast of this subbasin for stormwater runoff management .
		Some of the impervious areas in this subbasin, such as the Alaska Psychiatric Institute, are relatively recent developments and may already have LID implemented.
13	504	Planned improvement of Spenard Road in this subbasin (between Northern Lights and Hillcrest) could identify potential to include LID in this design plan.

Priority	Subbasin	Potential LID Projects
		Consider utilizing the vegetated buffers of the Romig Middle School parking lot for stormwater runoff management.
		Consider parking lot size requirements and utilization along Northern Lights Boulevard to determine if part of the paving could be removed and used for storm water infiltration.
		Consider parking lot size requirements and utilization in this subbasin along Spenard Road and determine if there are oversized lots where part of the paving could be removed and used for stormwater infiltration.
14	1251	The Alaska Native Tribal Health Consortium property is actually not DCI because LID was incorporated into its development. The site drains into the pond to the east.
		Investigate parking requirements for the Alaska Native Medical Center, the Anchorage Native Primary Care Center, and the Diplomacy Building, to determine if any pavement could be removed for stormwater infiltration.
15	992	Use the wetland buffer at the southeast side of this subbasin to manage stormwater runoff from the Alaska Department of Public Safety parking areas.
		The Public Health Laboratory is a relatively new development and may have implemented LID, but it not, investigate ways to incorporate LID in site.
		Investigate opportunities to redevelop parking at AHFC to retain stormwater onsite.
16	130	The wetland to the west of Carrs Shopping Center at Muldoon and Northern Lights could help manage stormwater runoff from the Carrs parking lot and from Susitna Elementary School property to the North.
		Consider the potential for onsite management of stormwater runoff at Baxter School in the west portion of this subbasin.
		Implement LID at Scenic Park Elementary School.
		Utilize vegetated buffers in the Church's parking area to retain stormwater onsite.
		Implement LID at Susitna Elementary School
17	479	This subbasin contains many small parcels with dense DCI without points for simple disconnection. It appears that stormwater from this subbasin is directed to the wetland to the south. This would be beneficial for the quality of stormwater that eventually enters Chester Creek, and would make this subbasin low-priority.
		This MOA / Heritage Land Bank parcel has only one catch basin and may have the potential for disconnection.
		Consider parking lot size requirements and utilization in this subbasin along Mountain View Drive and determine if there are oversized lots where part of the paving could be removed and used for stormwater infiltration.
18	554	Consider redirecting all or a portion of stormwater drainage exiting the subbasin at Eagle Street and East 21st Avenue to the wetlands to the west.
		Consider diverting all or part of the flow from the storm drain along 22nd Avenue to the wetlands to the west.
		This site will be redeveoped by CIRI in the future. Investigate ways to disconnect this impervious area from the catchbasins.
		This area has been redeveloped in recent years and stormwater improvements may have been made.
19	127	Investigate LID opportunities for Wendler Middle School
		Investigate LID opportunities for Lake Otis Elementary School
20	167	Investigate opportunities to divert runoff from Providence Hospital parking areaas to adjacent wetland areas.



Legend

- Subwatersheds
- Stormwater Network
- Wetlands
- Lakes
- Open Space*
- Chester Creek

* Open Space based on MOA 2010 General land use designations of "Parks / Other Open Space" and "Vacant"

0 0.5 1 2 Miles

Data source: MOA
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 11/13/2012

Chester Creek Watershed LID

Anchorage, AK

Figure 1

Chester Creek Watershed Components

HDR Alaska

MIDDLE FORK CHESTER CREEK

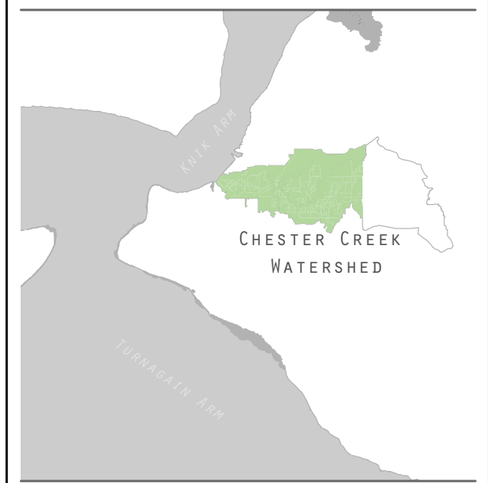
NORTH FORK CHESTER CREEK

LOWER CHESTER CREEK

SOUTH FORK CHESTER CREEK

Legend

- Subwatersheds
- Subbasins
- Directly Connected Impervious (DCI) Area
- Lakes
- Chester Creek
- 527 — Subbasin Numeric Identifier



0 0.5 1 2 Miles

Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 11/27/2012

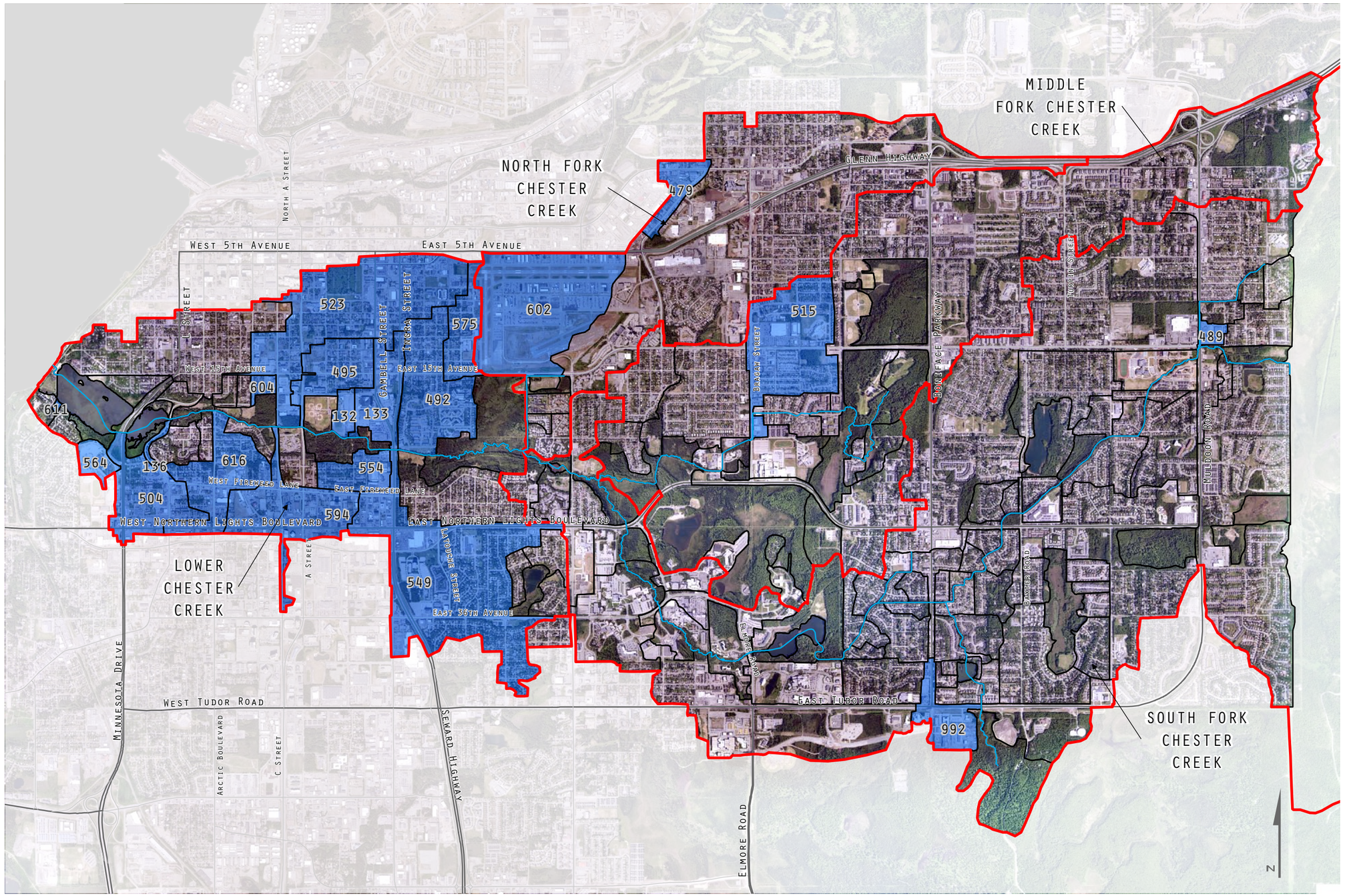
Chester Creek Watershed LID

Anchorage, AK

Figure 2

Subbasins of Chester Creek

HDR Alaska



Legend

- Chester Creek
- Subwatersheds
- Subbasins
- 20 Subbasins With Largest DCI %
- 515 — Subbasin Numeric Identifier

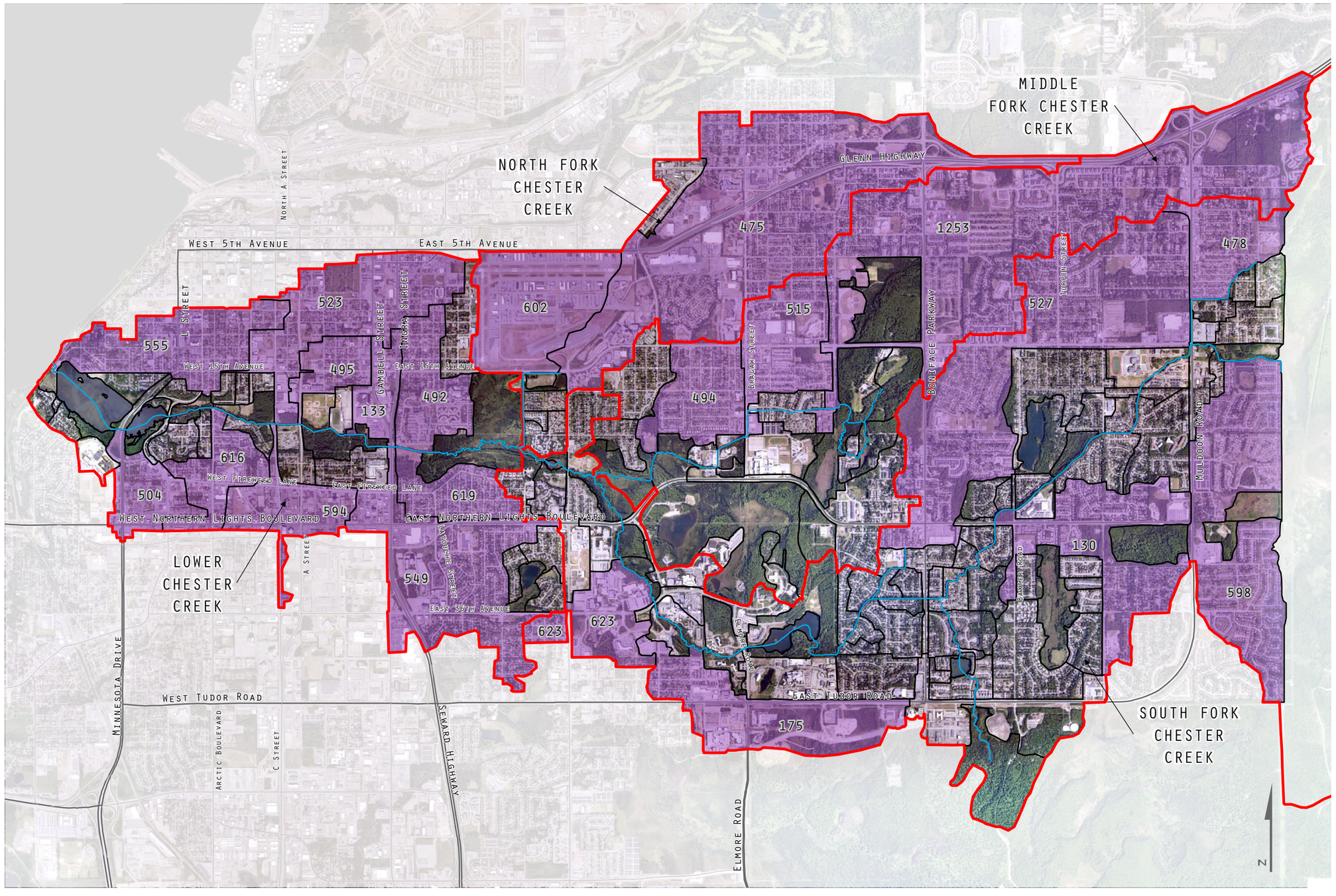
DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 11/27/2012

Chester Creek Watershed LID

Anchorage, AK
Figure 3
LID Priority Subbasins
Highest Directly Connected Impervious (DCI) Percentage

HDR Alaska



Legend

- Chester Creek
- Subwatersheds
- Subbasins
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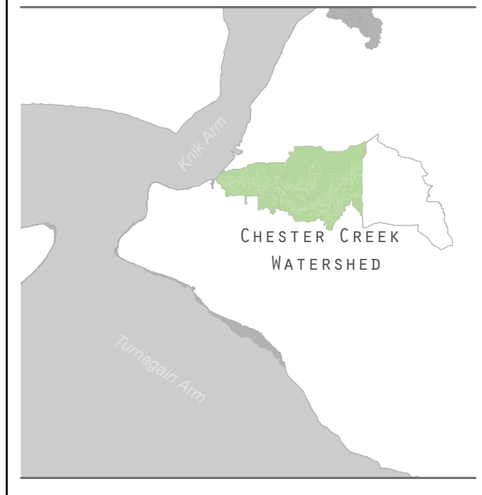
- 527 — Subbasin Numeric Identifier



0 0.5 1 2 Miles

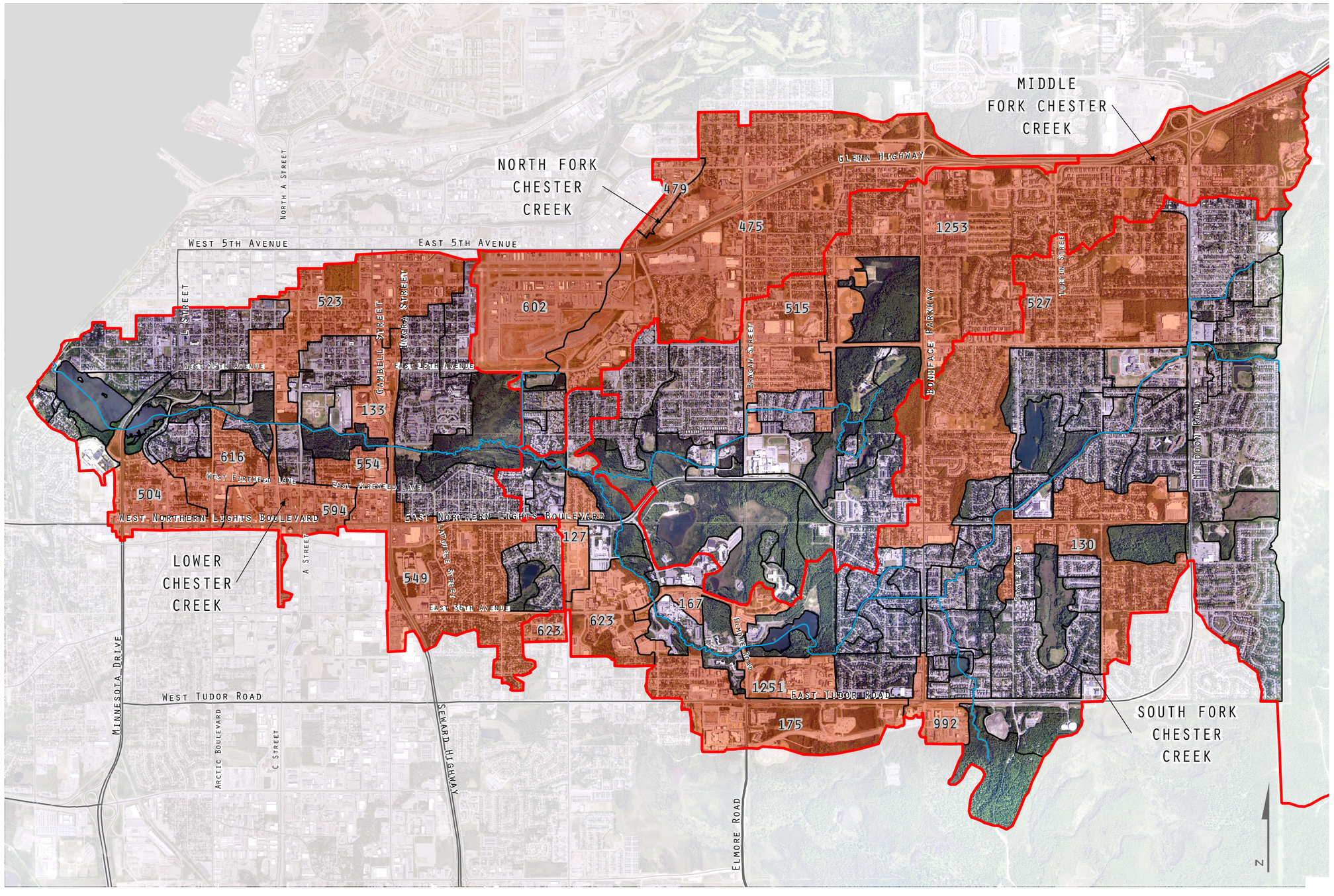
DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 11/27/2012

Chester Creek Watershed LID

Anchorage, AK
Figure 4
LID Priority Subbasins
Highest Directly Connected Impervious (DCI) Area

HDR Alaska



Legend

- Chester Creek
- Subwatersheds
- Subbasins
- 20 Subbasins With Largest DCI Area on Commercial, Industrial, Institutional, and Major Transportation Land
- 527 — Subbasin Numeric Identifier

0 0.5 1 2 Miles

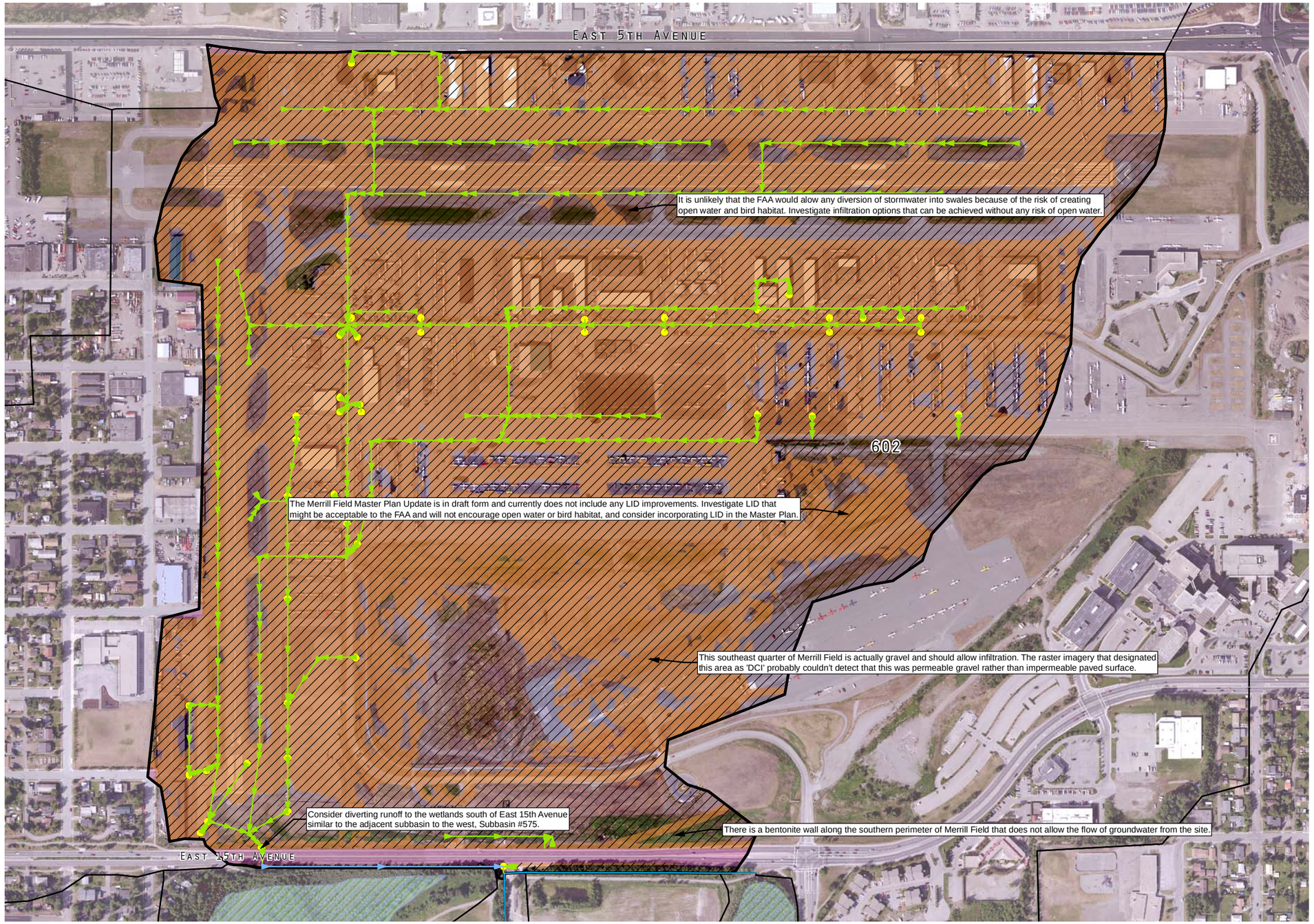
DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 12/14/2012

Chester Creek Watershed LID

Anchorage, AK
Figure 5
LID Priority Subbasins
Highest Directly Connected Impervious (DCI) Area on Selected Land Ownership

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 200

Subwatershed: NORTH FORK CHESTER CREEK

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

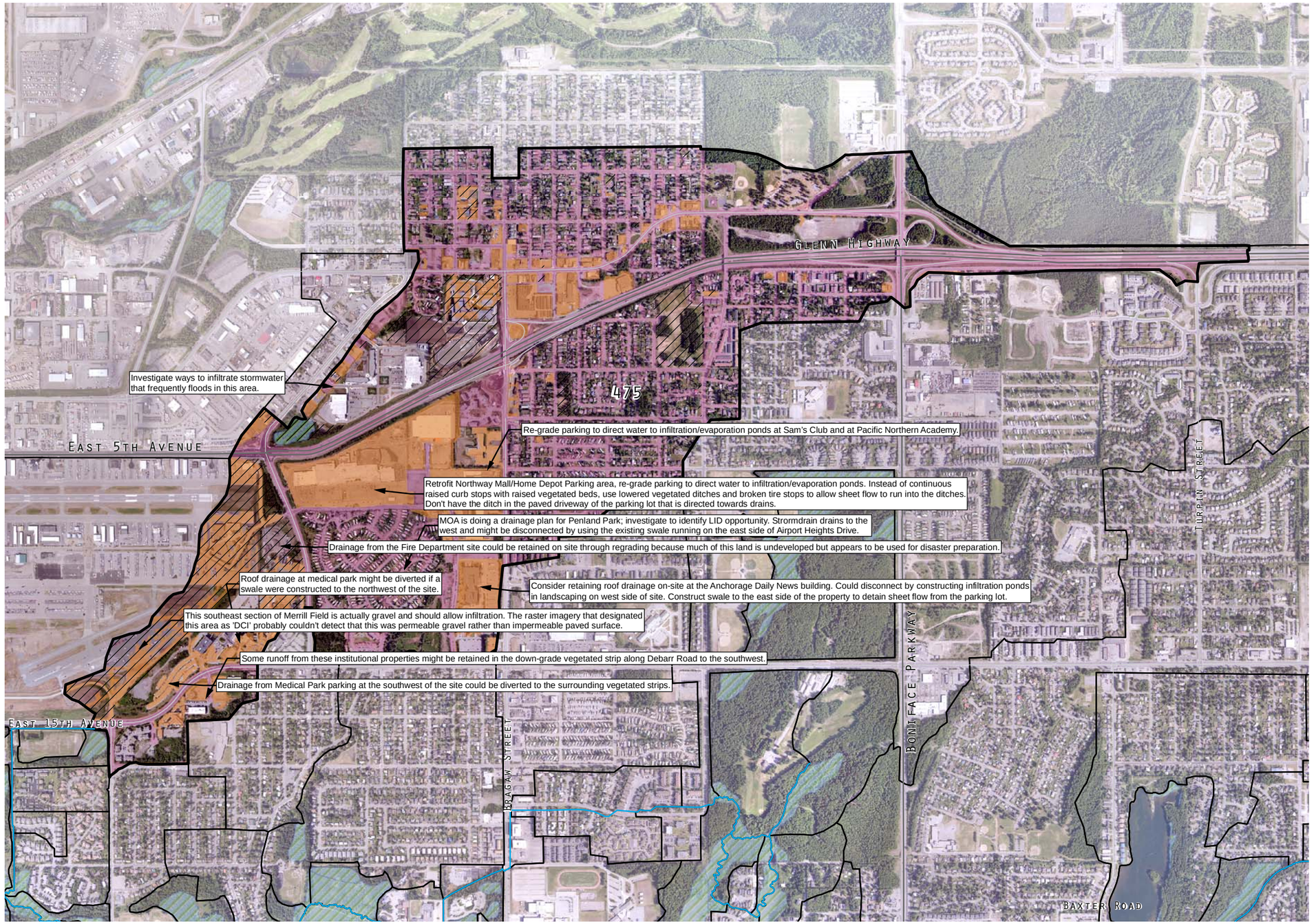
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 1

Subbain ID: 602

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 171

Subwatershed: NORTH FORK CHESTER CREEK

0 0.7 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

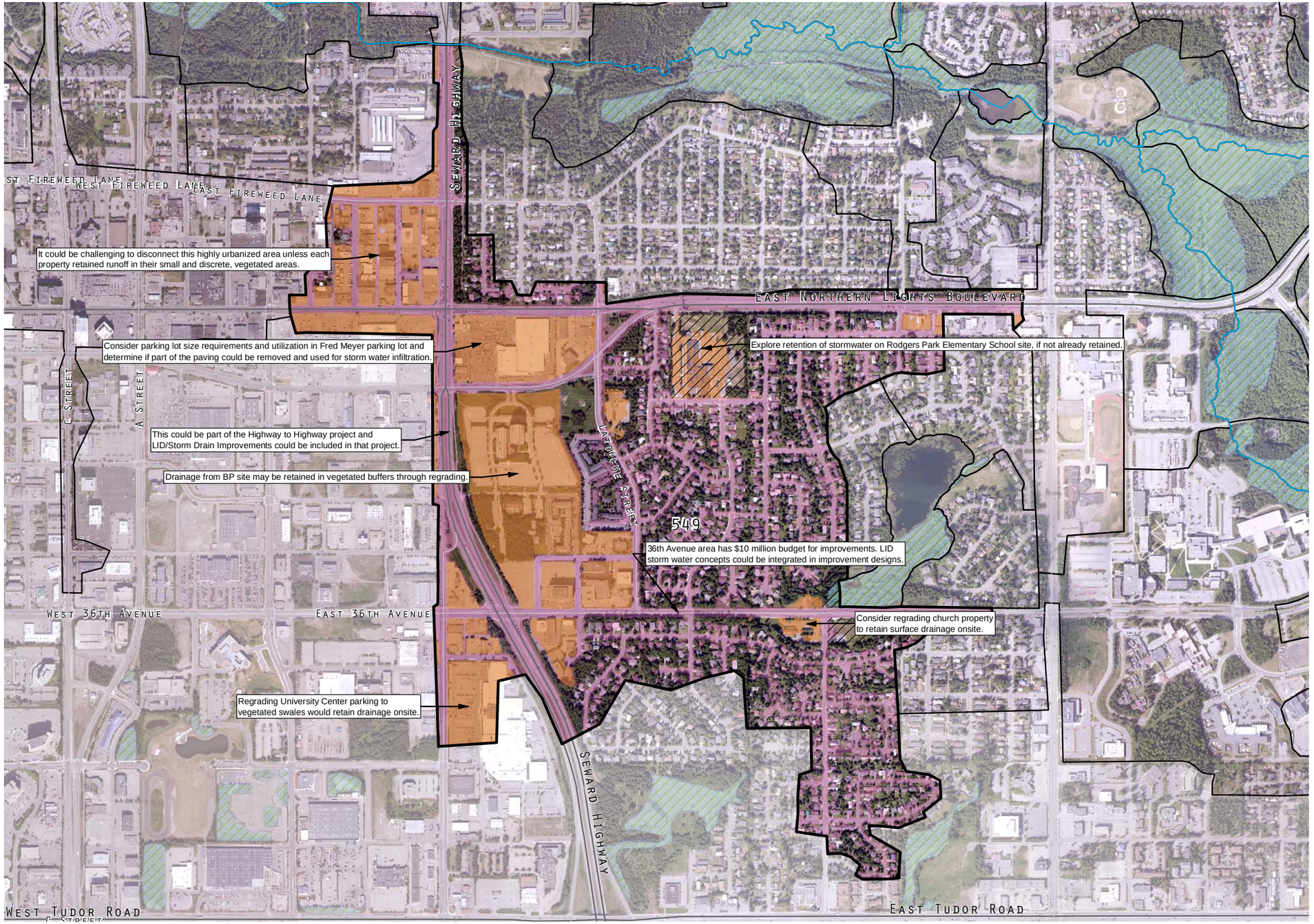
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 2

Subbain ID: 475

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 104

Subwatershed: LOWER CHESTER CREEK

0 0.45 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

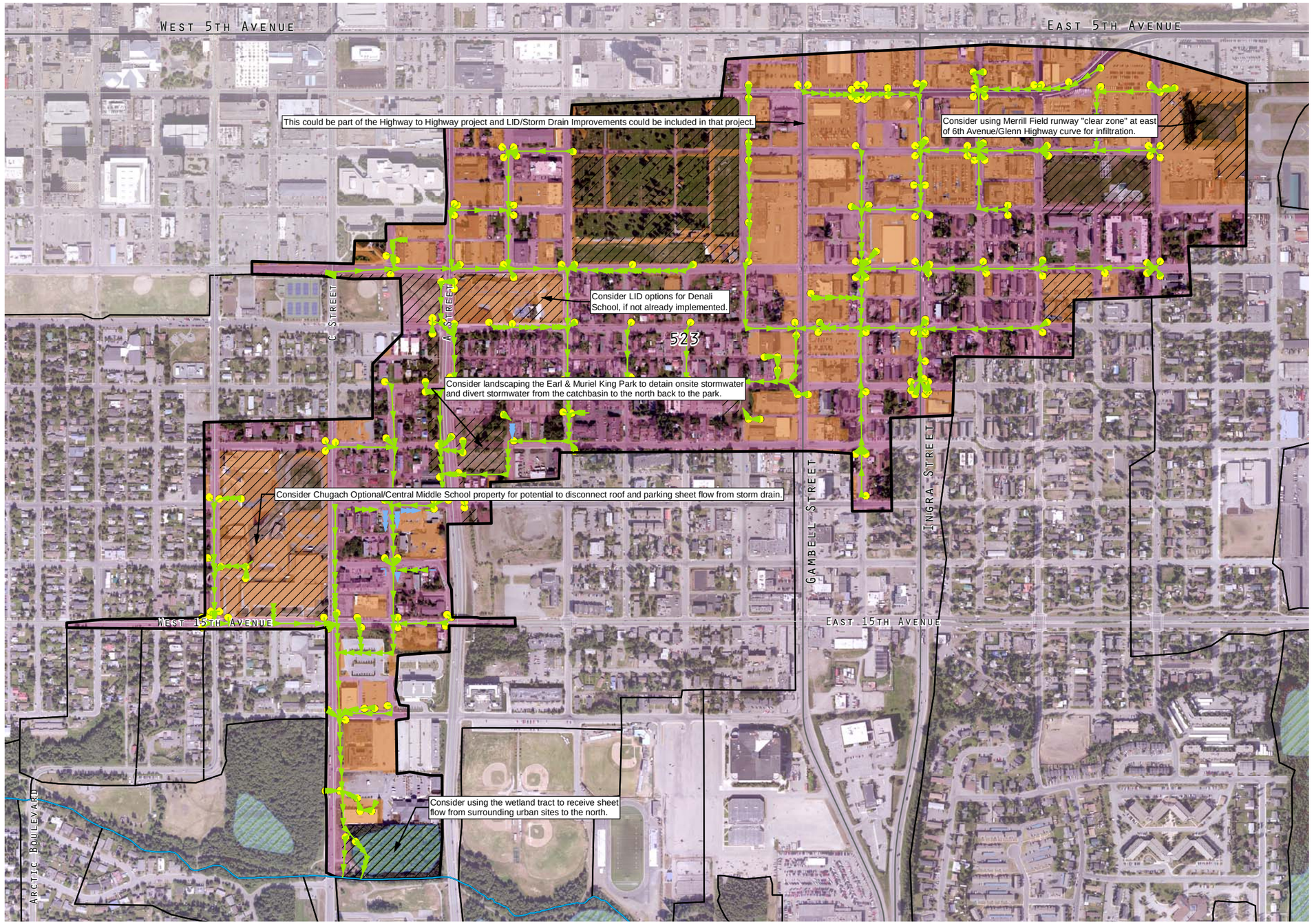
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 3

Subbain ID: 549

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 91

Subwatershed: LOWER CHESTER CREEK

0 0.3 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

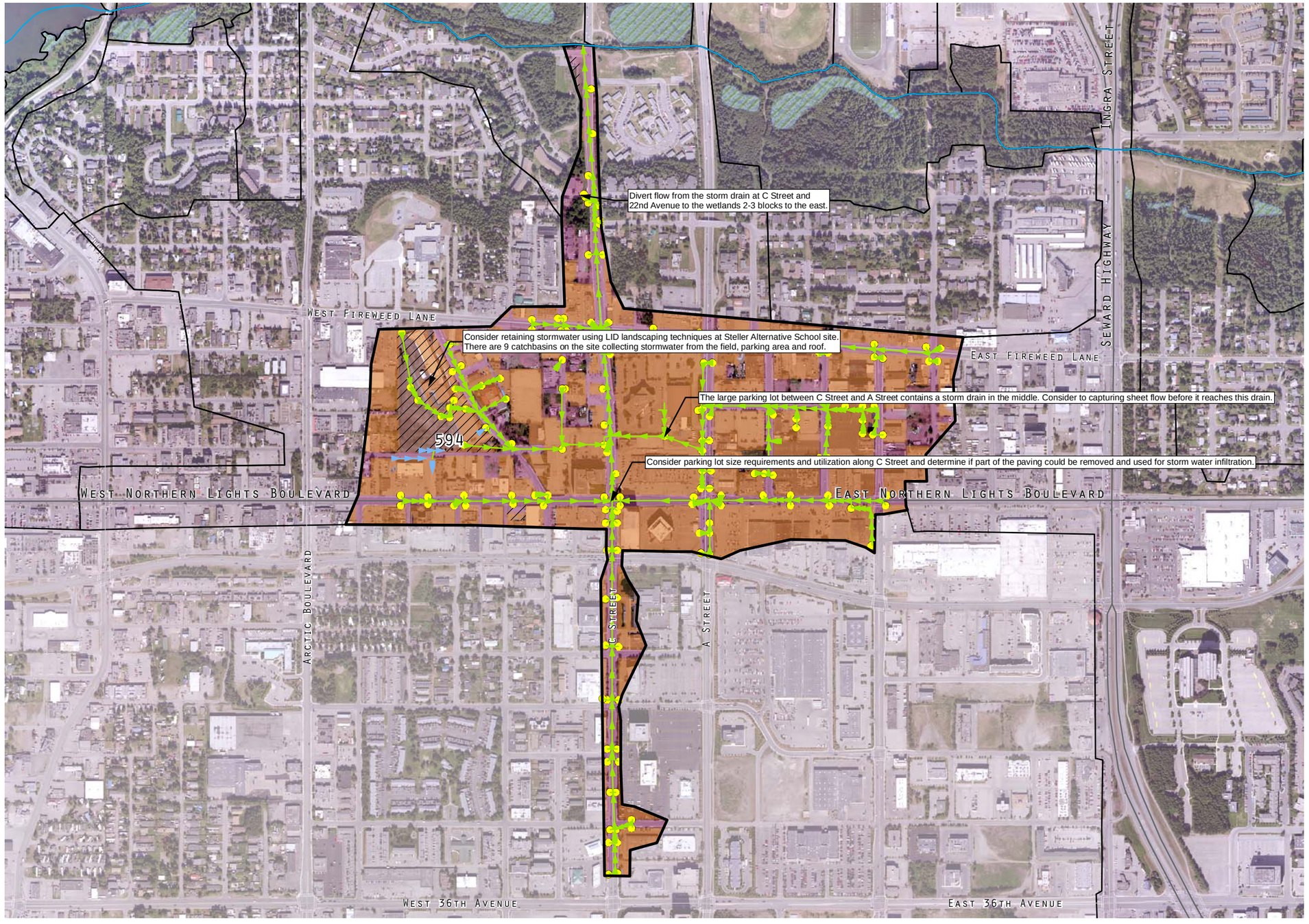
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 4

Subbain ID: 523

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- Wetlands

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 84

Subwatershed: LOWER CHESTER CREEK

0 0.35 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

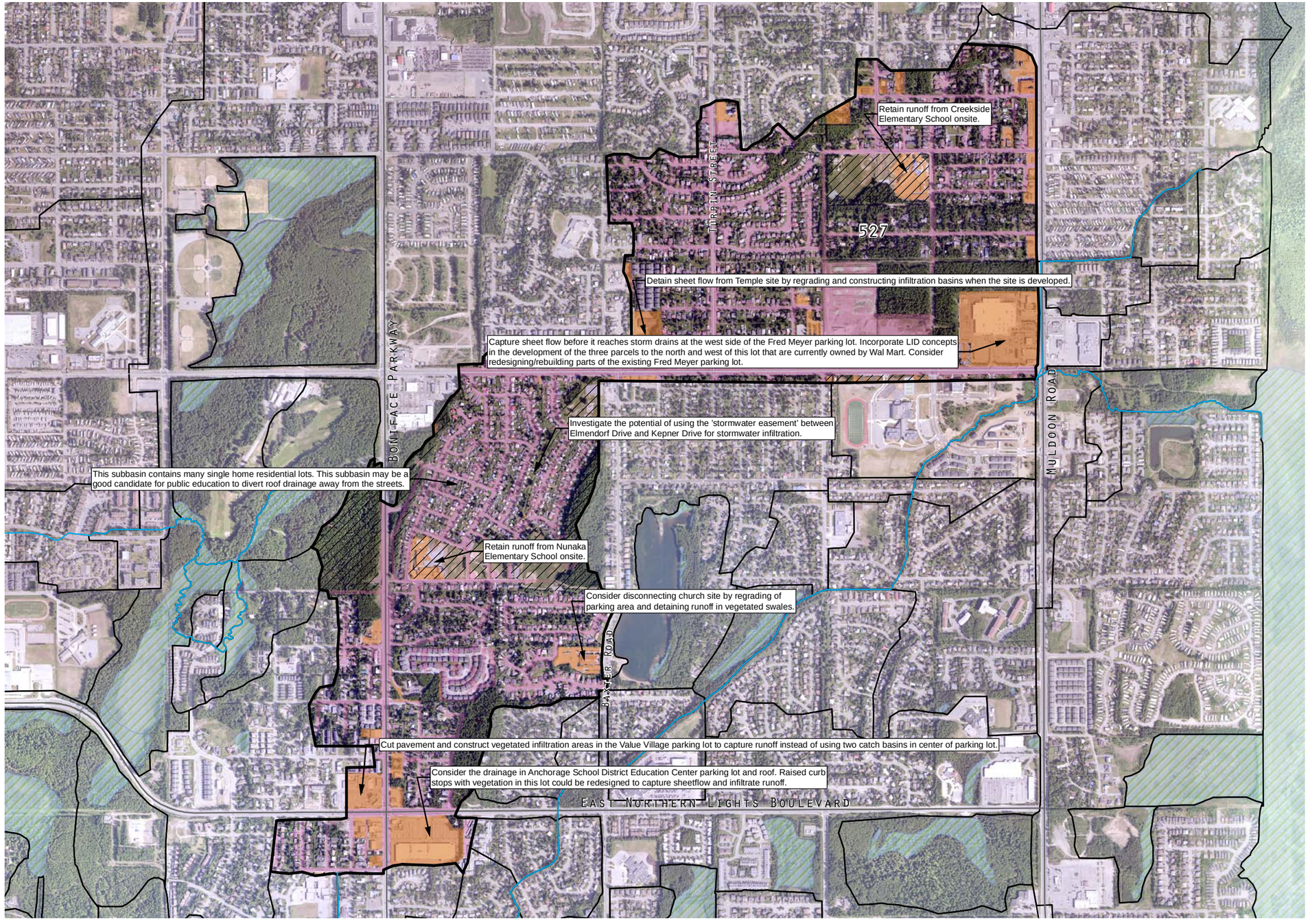
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 5

Subbain ID: 594

HDR Alaska

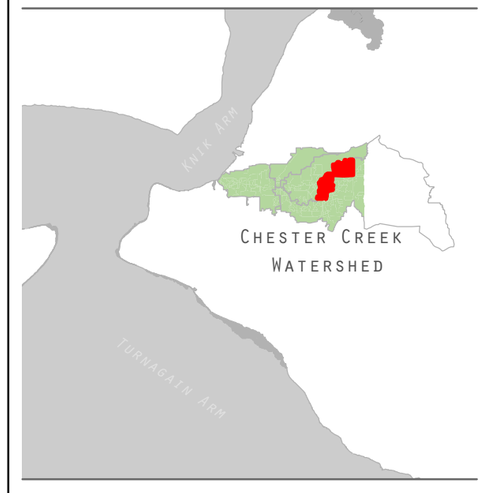


Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- Wetlands

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 79

Subwatershed: South Fork Chester Creek



0 0.65 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

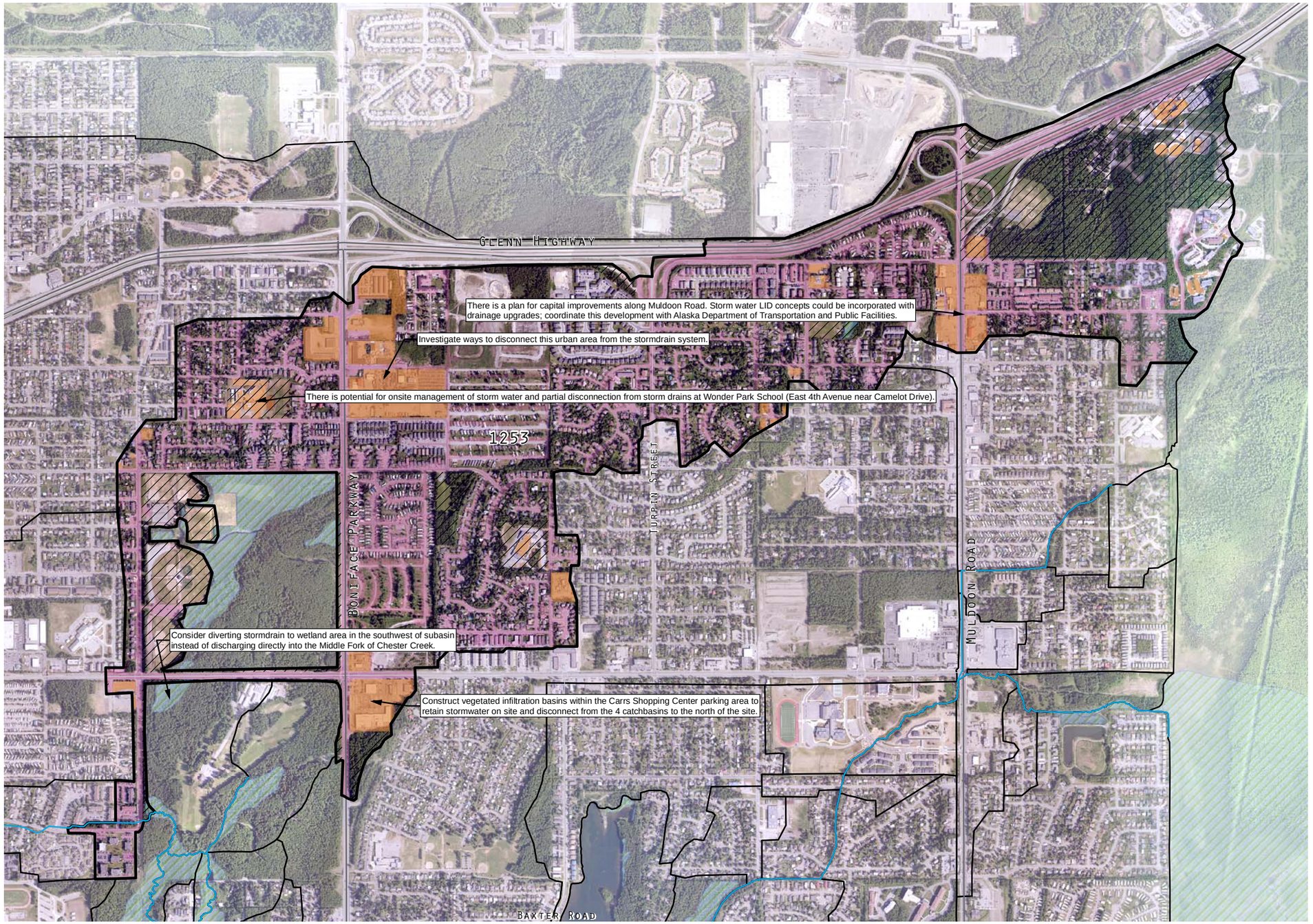
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 6

Subbain ID: 527

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 78

Subwatershed:
MIDDLE FORK CHESTER

0 — 0.7 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

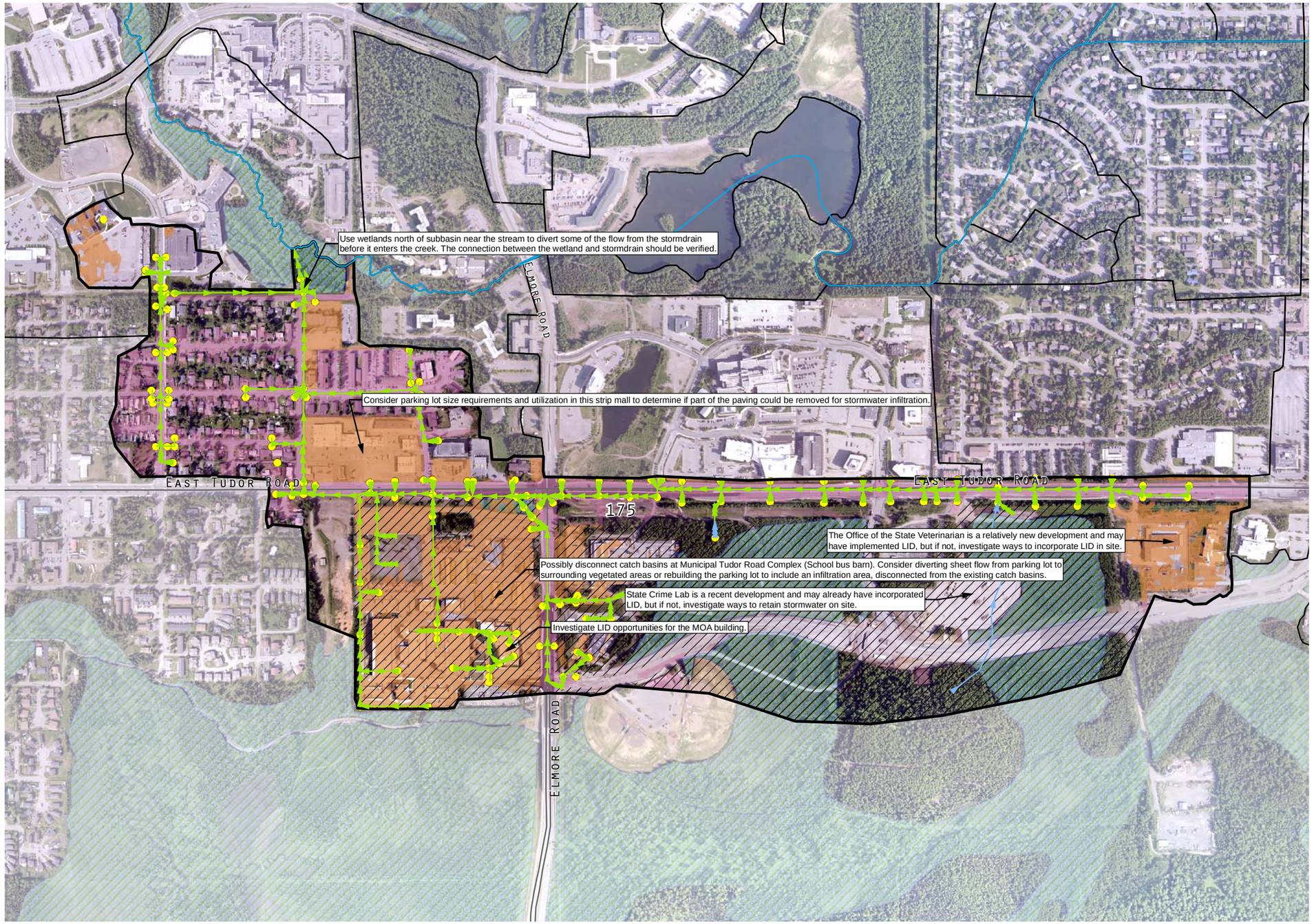
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 7

Subbain ID: 1253

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 57

Subwatershed: SOUTH FORK CHESTER CREEK

Miles
0 0.35

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

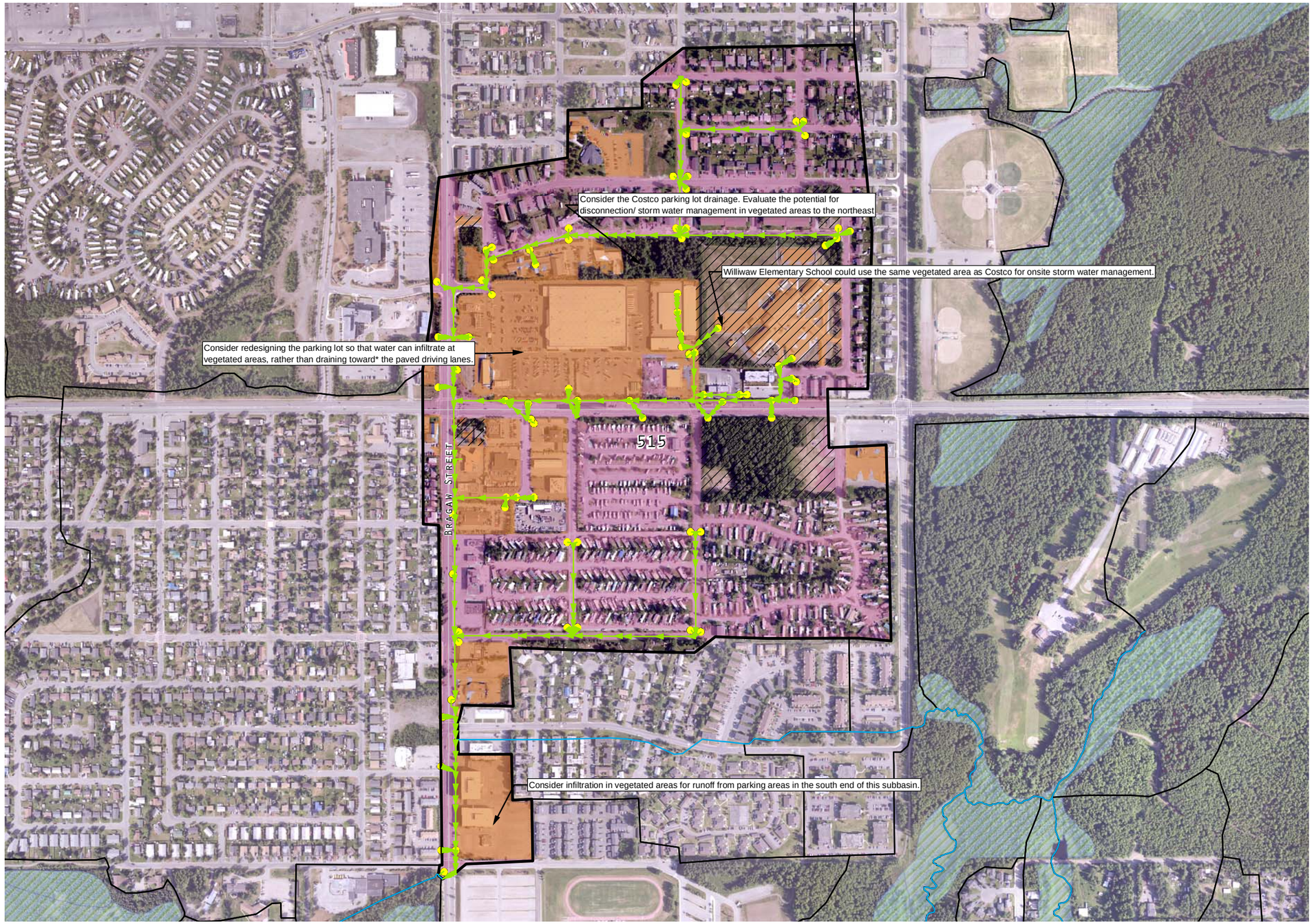
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 8

Subbain ID: 175

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 48

Subwatershed:
MIDDLE FORK CHESTER

Miles
0 0.3

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

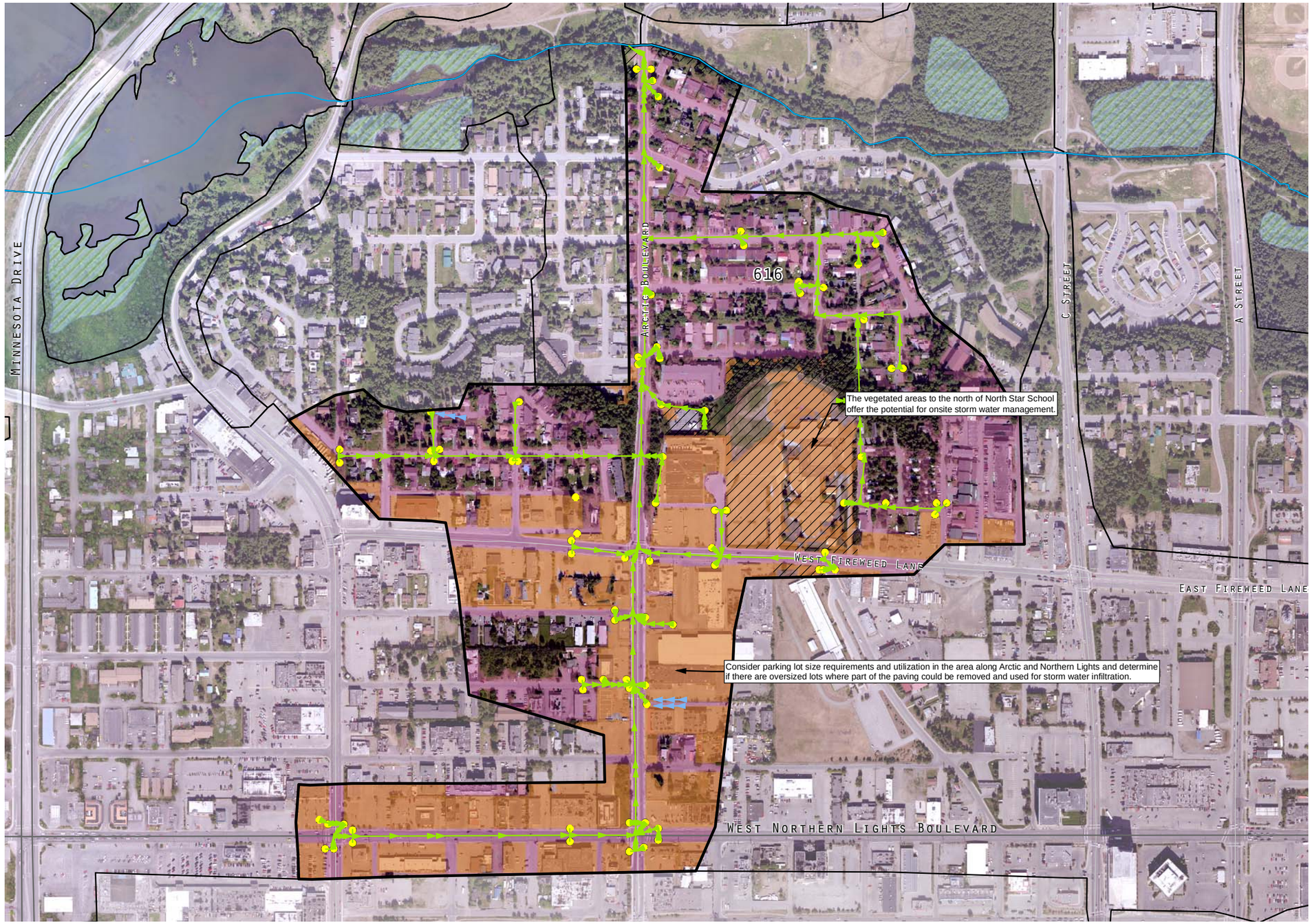
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 9

Subbain ID: 515

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 40

Subwatershed: LOWER CHESTER CREEK

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

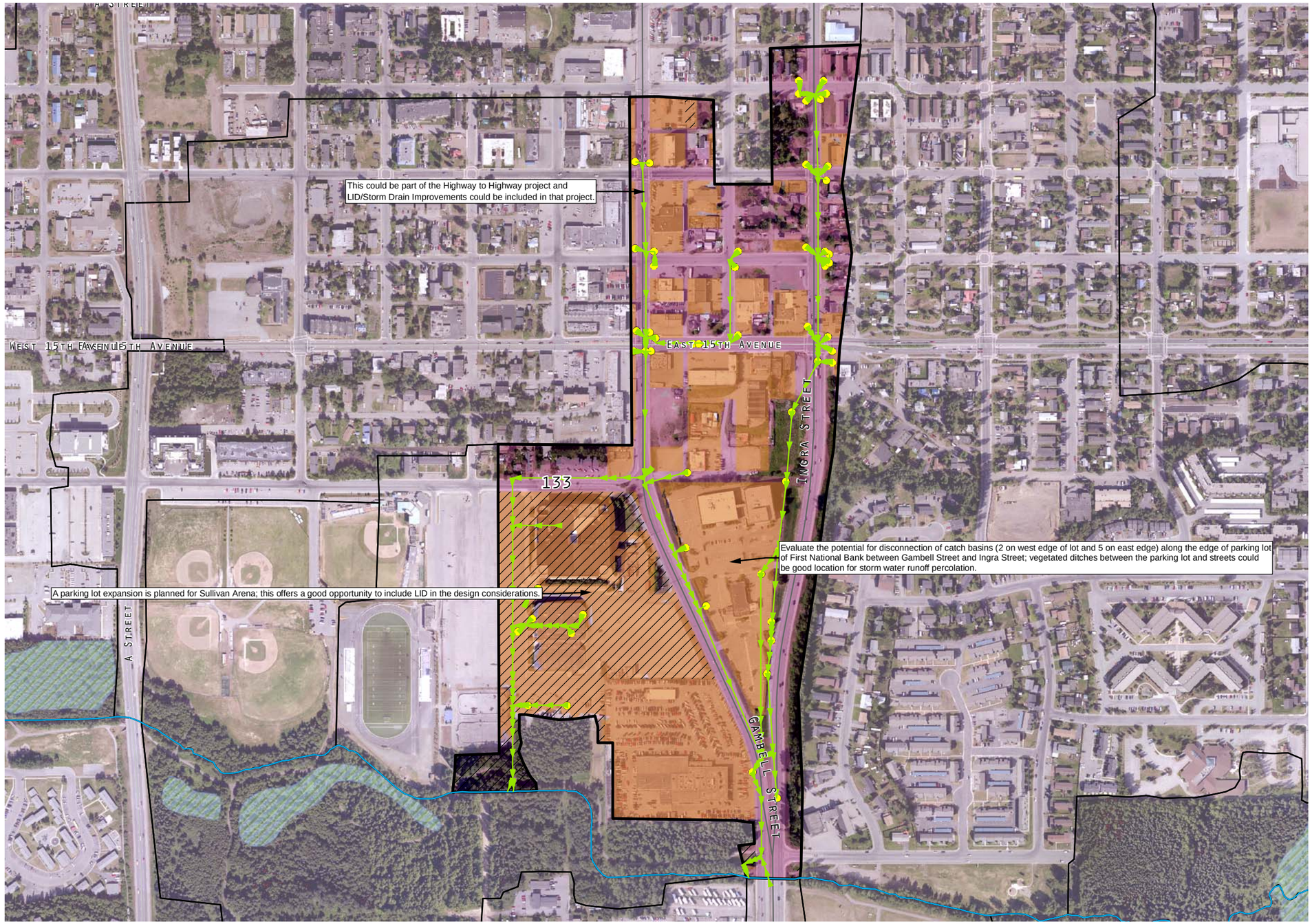
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 10

Subbain ID: 616

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- Wetlands

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 39

Subwatershed: Lower Chester Creek

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

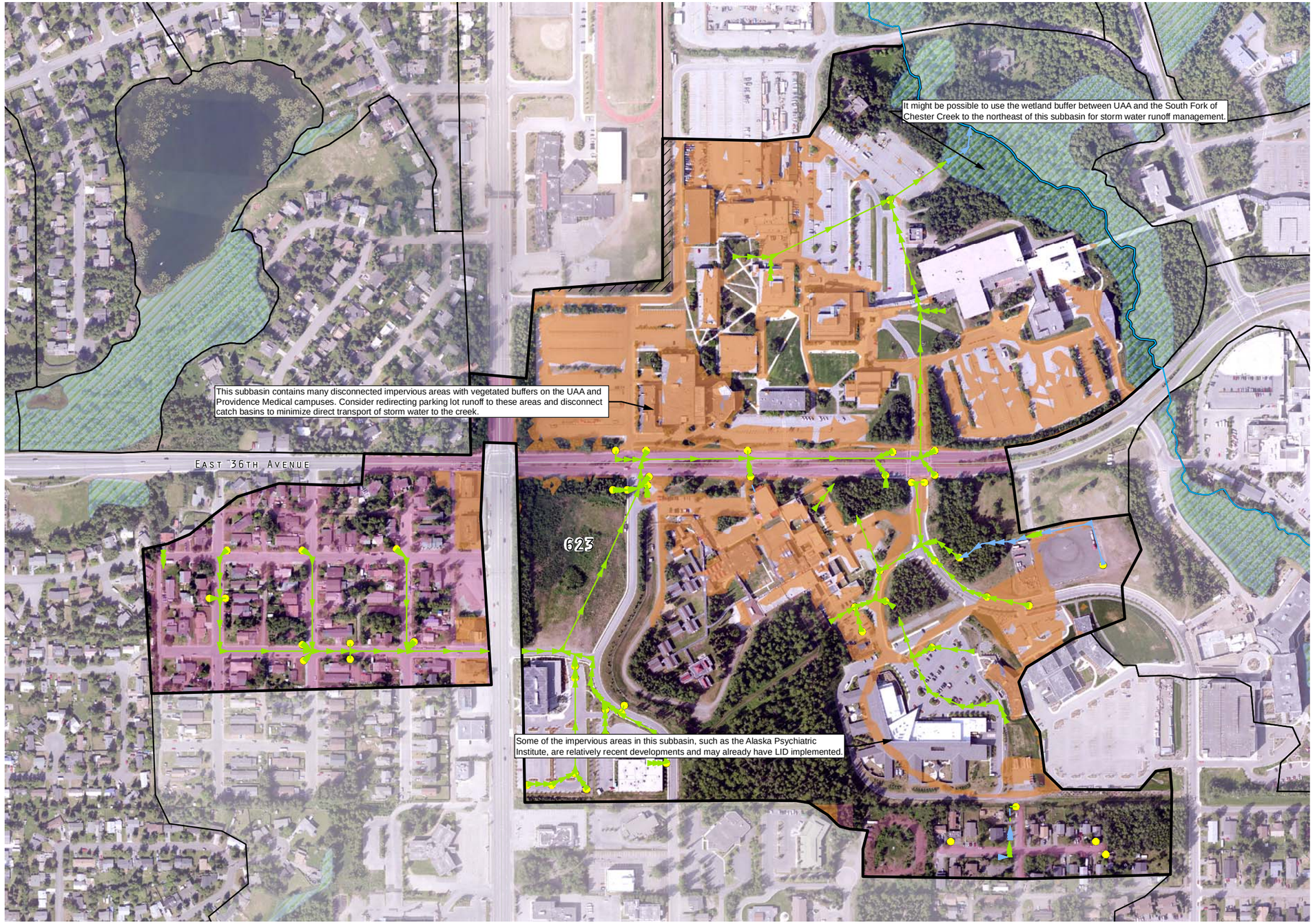
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 11

Subbain ID: 133

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 36

Subwatershed: South Fork Chester Creek

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

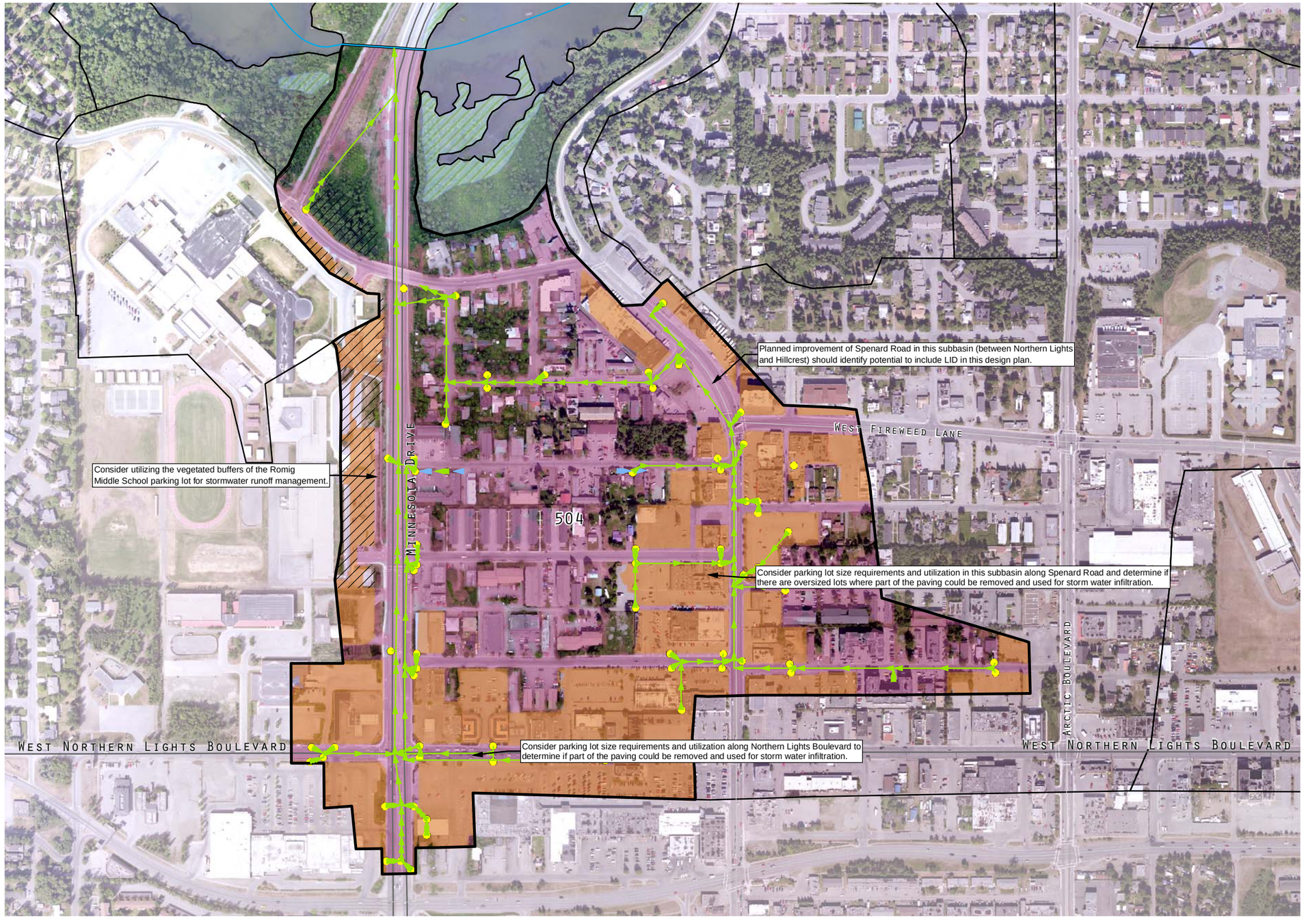
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 12

Subbain ID: 623

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- Wetlands

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 35

Subwatershed: LOWER CHESTER CREEK

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

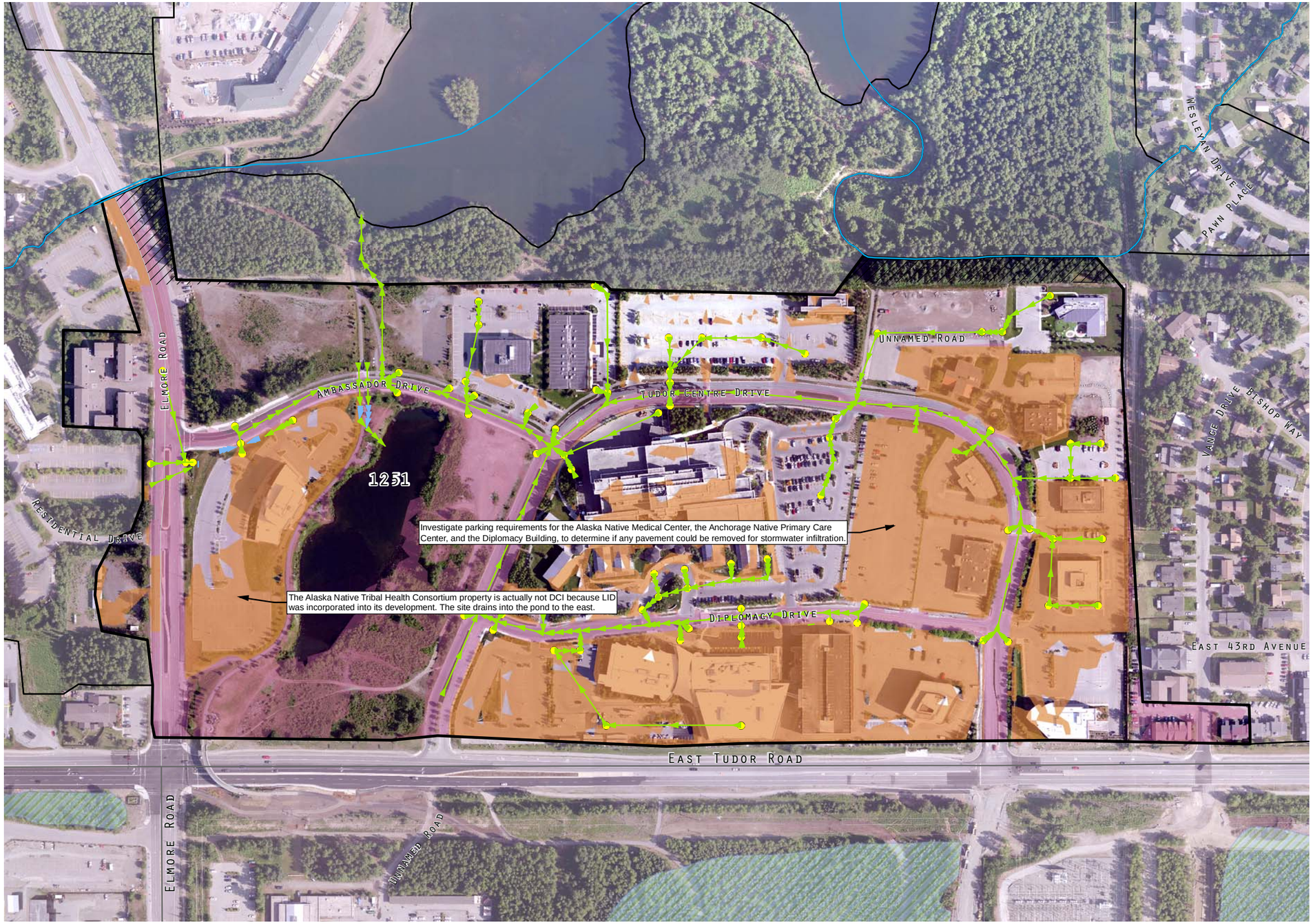
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 13

Subbain ID: 504

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Instituitional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 28

Subwatershed: South Fork Chester Creek

Miles
0 0.1

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 14

Subbain ID: 1251

HDR Alaska

Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 26

Subwatershed: SOUTH FORK CHESTER CREEK

0 0.15 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

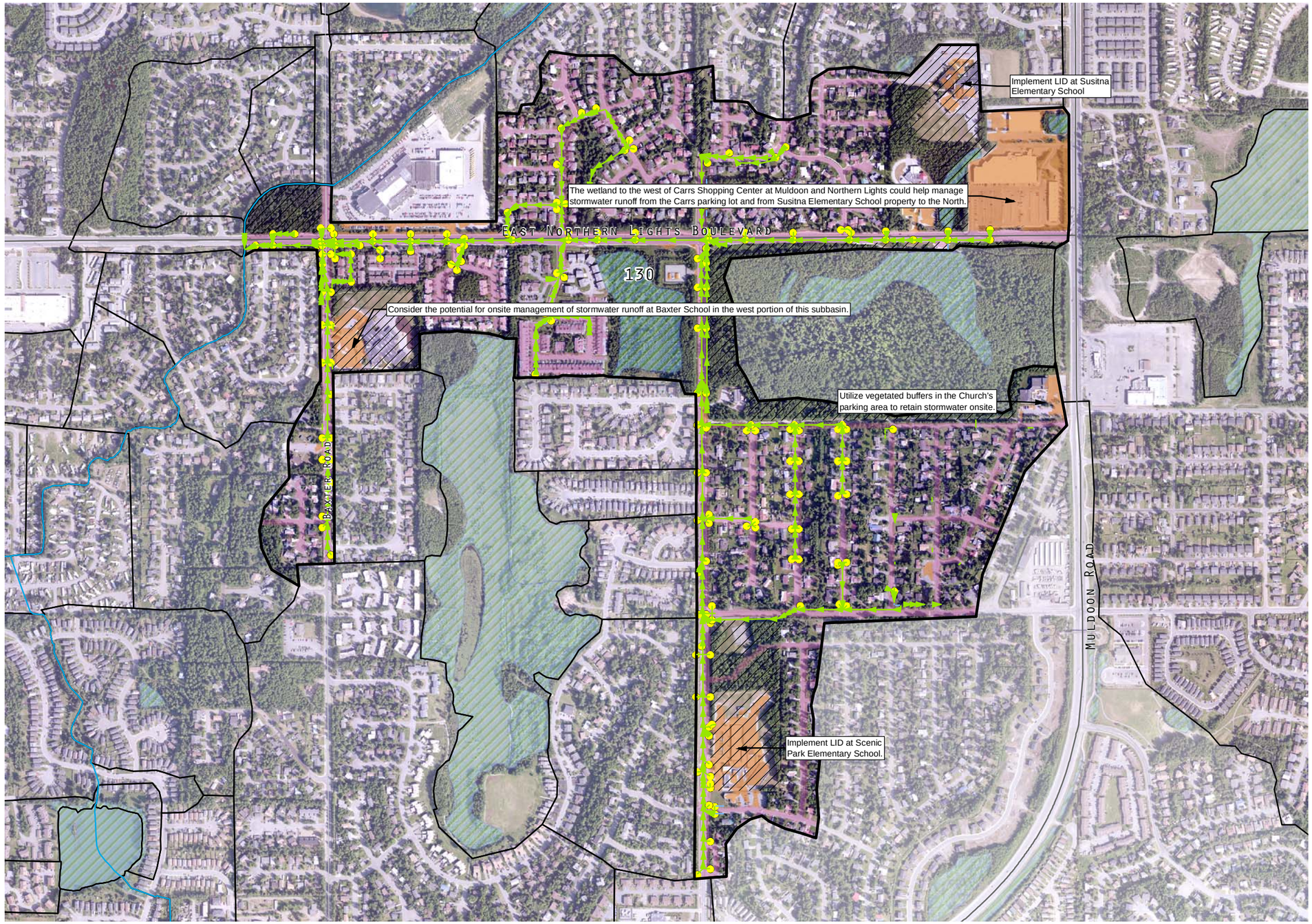
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 15

Subbain ID: 992

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 22

Subwatershed: South Fork Chester Creek

Miles
0 0.35

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

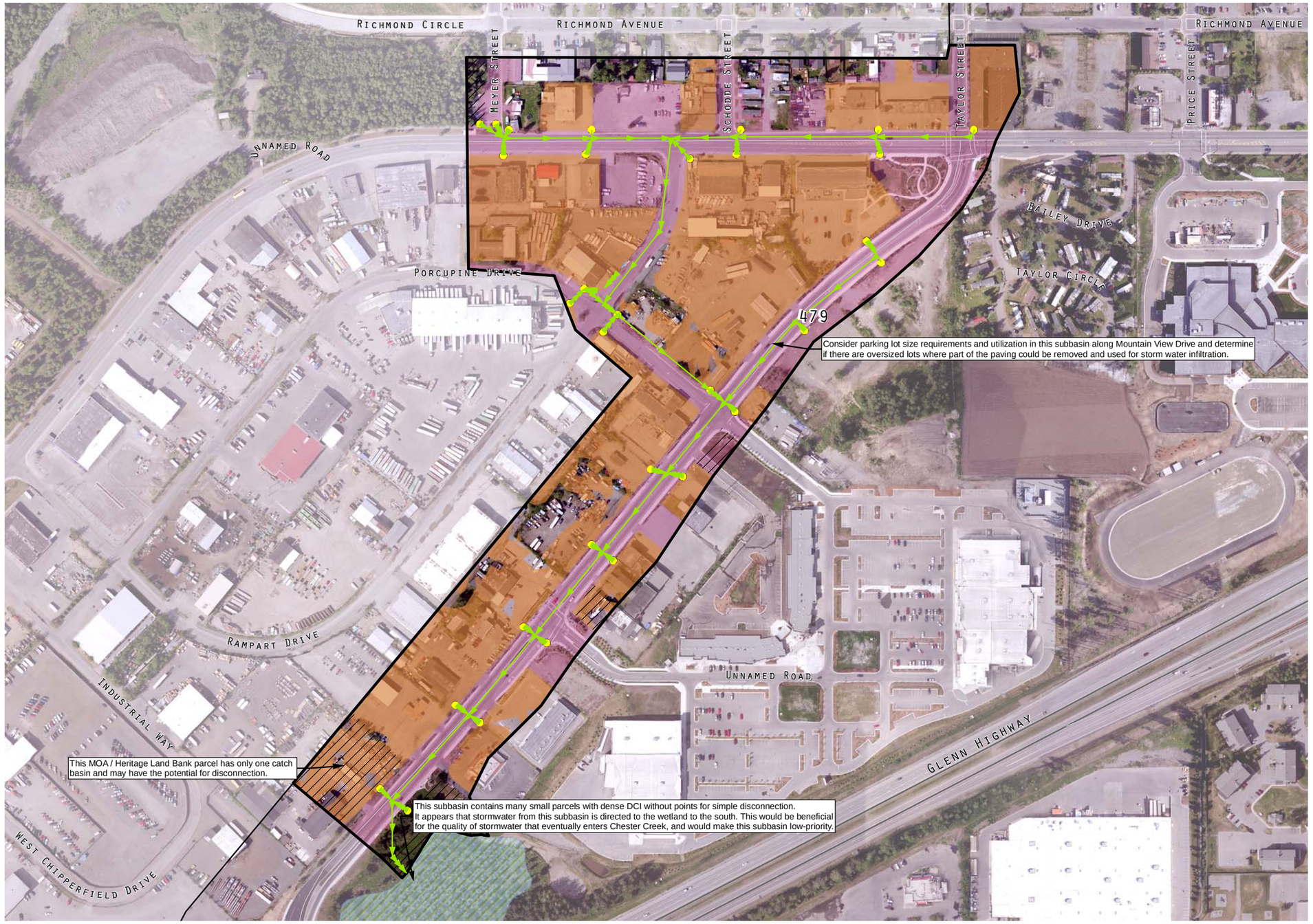
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 16

Subbain ID: 130

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- Wetlands

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 21

Subwatershed: North Fork Chester Creek

0 0.15 Miles

N

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: orthophoto_pictometry_2009

Map Created: 12/13/2012

Chester Creek Watershed LID

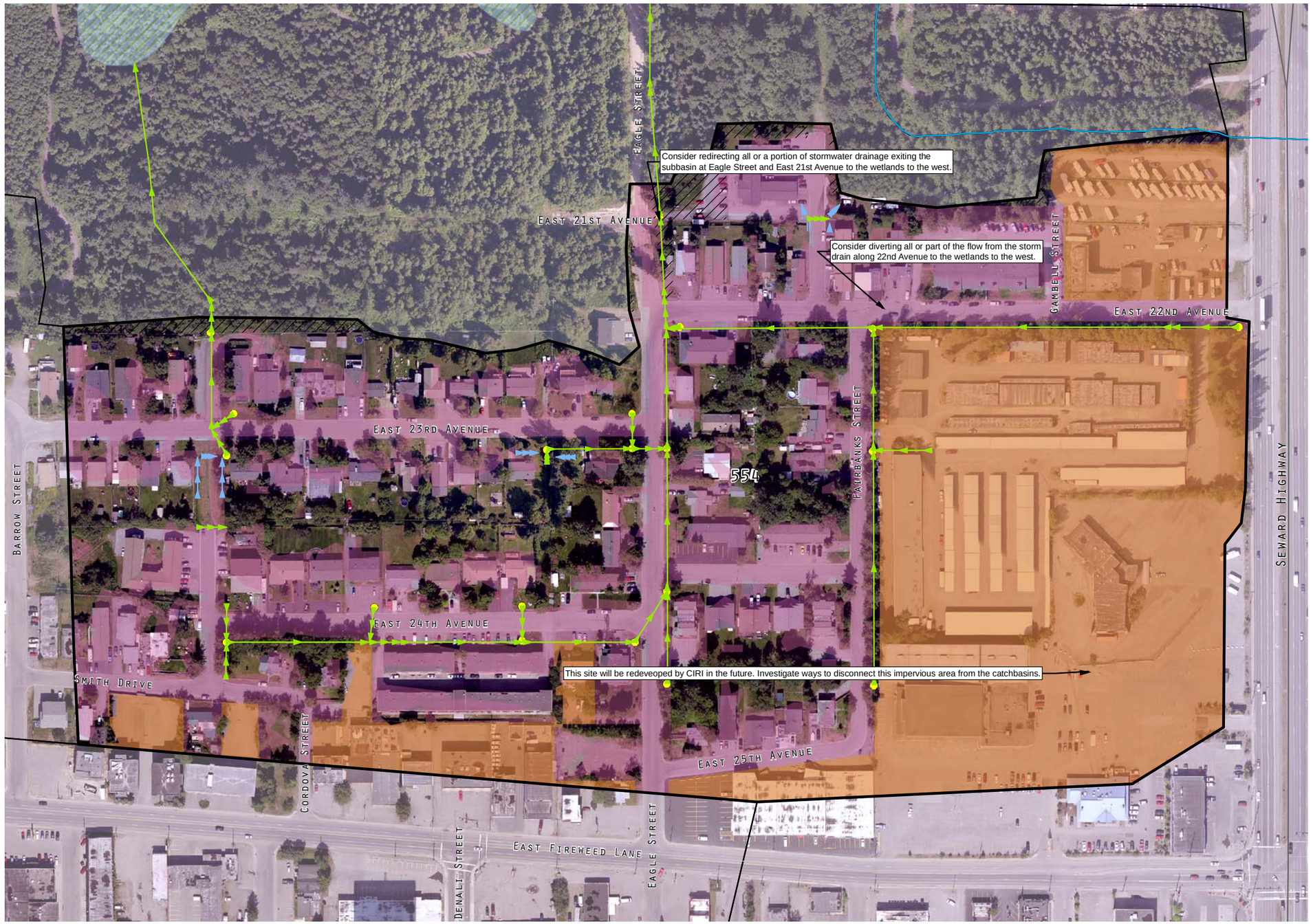
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 17

Subbain ID: 479

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 17

Subwatershed: LOWER CHESTER CREEK

0 — 0.1 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

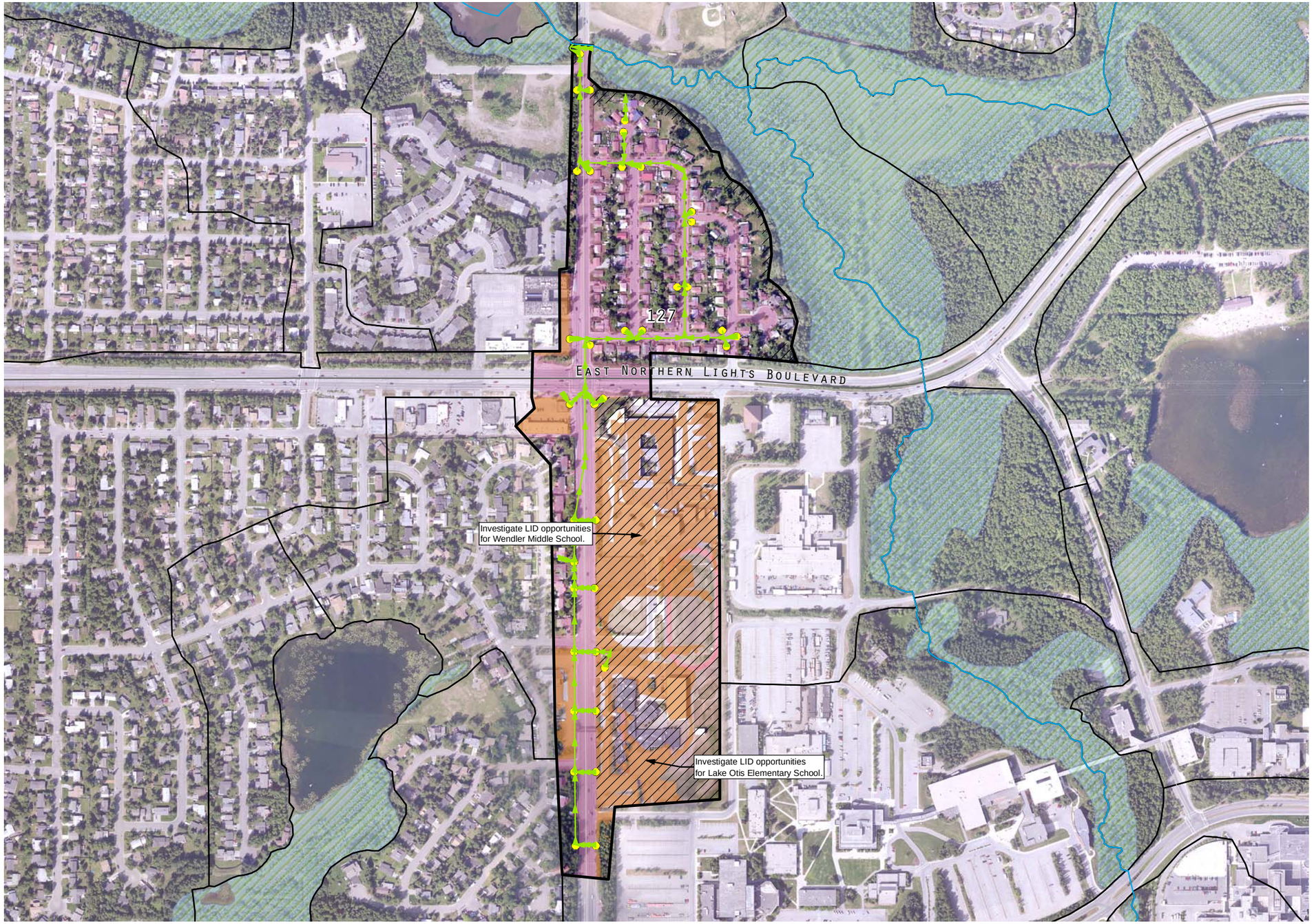
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 18

Subbain ID: 554

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 17

Subwatershed: SOUTH FORK CHESTER CREEK

0 0.25 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

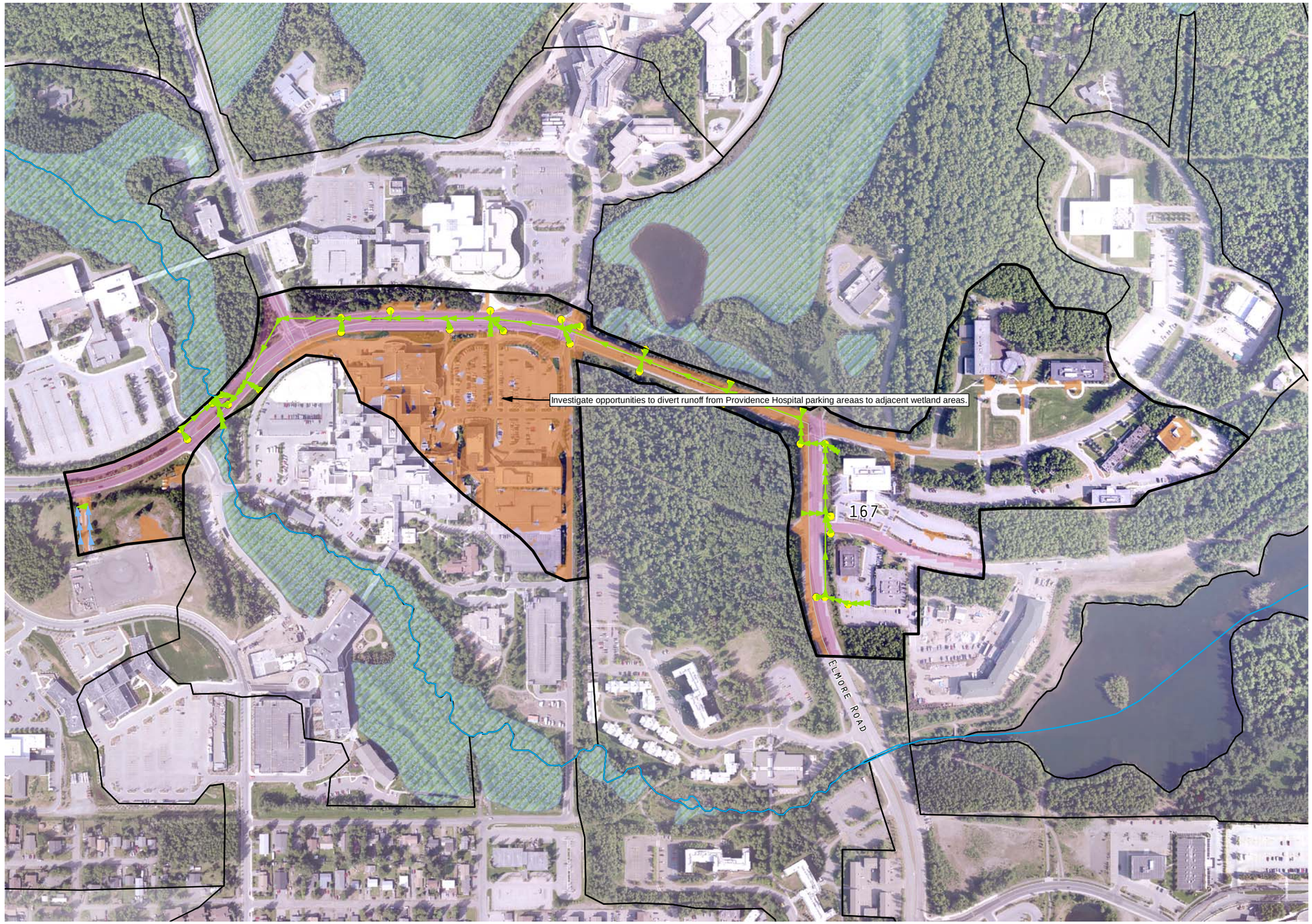
Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 19

Subbain ID: 127

HDR Alaska



Legend

- Chester Creek
- Subbasin
- Directly Connected Impervious (DCI) Area
- DCI Area on Commercial, Industrial, Institiutional, and Major Tansportation land.*
- Owned by MOA
- Catch Basins
- Drainage Pipe
- Open Channel
- WETLANDS

*Acres of Commercial, Industrial, Institutional, and Major Transportation DCI area: 15

Subwatershed: SOUTH FORK CHESTER CREEK

0 0.2 Miles

DCI areas derived from MOA landcover raster, Pro Mitra, GeoNorth LLC., 2001
Hydrography data source: MOA WMS_HGDB, 2007
Imagery: ORTHOPHOTO_PICTOMETRY_2009

Map Created: 12/13/2012

N

Chester Creek Watershed LID

Anchorage, AK

Mapbook Series of Priority Subbasins

Priority: 20

Subbain ID: 167

HDR Alaska