

Maquoketa Pocket Neighborhood Final Design Report

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Faculty Advisor: Richard Fosse
Course: Project Design & Management
Department of Civil & Environmental Engineering

In partnership with
East Central Intergovernmental Association





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UNIVERSITY OF IOWA

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Project Design & Management

(CEE:3084:0001)

Final Design Report

Pocket Neighborhood



Morgan Kinney

2.2.2018

Morgan Kinney, Moment Inc. Project Manager



Executive Summary

The following report outlines the recommended site designs as well as alternative options considered for the pocket neighborhood in Maquoketa, Iowa. The purpose of the pocket neighborhood is to provide affordable housing while also creating a sense of ownership among residents and incorporating sustainable and green building concepts. The Maquoketa pocket neighborhood project includes ten 1,064 sq. ft. homes that have options for two or three bedrooms and will be priced at \$160,000-\$170,000. The homes will include LED lighting and high efficiency appliances.

The homes are designed to face a community common ground which includes a gazebo and appealing flower beds that also act as rain gardens. There is space on the east side of the lot to add an additional gazebo in the future or if ECIA wishes to do so, but is not included in the final site plan designs.

Moment Inc. developed preliminary drawings for the site plan, grading plan, utility sizing and location, and road and pavement design. Our goal was to keep cost down while creating an aesthetically appealing housing layout and community area.

Moment Inc. considered alternative designs for the pocket neighborhood including duplex housing, separating garages from housing units, as well as a range of housing placements on the site including placing the houses along the roads to eliminate the access road which would reduce costs.

The preliminary design plans Moment Inc. developed can be found in the attached appendices.

Editor's note: Moment Inc. is a fictitious consulting firm developed by the student team to satisfy course requirements.

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I. Organization Qualifications and Experiences

Name of Organization

Our engineering team, Moment Inc., is determined to provide various design aspects for the requested pocket neighborhood. We are eager to offer differing designs for on and off site utility location and size, site layout, foundation and basement layouts, interior roads, access management to existing roadways, and cost estimate.

Organization Location and Contact Information

Moment Inc. is located in the Seamans Center Engineering Building at 103 South Capitol Street, Iowa City, IA 52242. The pocket neighborhood will be located at 7600 Commerce Park, Asbury, IA 52002, at the corner Commerce Park and S Westbrook Dr. Our engineering team consists of three pristine, hard-working University of Iowa students ready for the tasks at hand surrounding the project. Morgan Kinney is the project manager who can be contacted by email or phone with any questions or concerns during the design period at morgan-kinney@uiowa.edu or (319) 930-1821. The editor for our project team is Mayra Corona who can be contacted at mayra-corona@uiowa.edu or (847) 754-8285. Finally, Tanner Schropp is the team's tech support who can be reached by email or phone at tanner-schropp@uiowa.edu or (630) 995-1139.

Organization and Design Team Description

Morgan is a student majoring in structural engineering at the University of Iowa. Mayra and Tanner are both students majoring in civil practice engineers, broadening their skillset over all the subcategories of civil engineering at the University. Morgan is the project manager, Mayra is the editor, and Tanner is the tech support of Moment Inc.

Description of Experience with Similar Projects

All Moment Inc. engineers have completed a stormwater reduction project in a real Iowa town for the course Water Resource Design. Having previous experience with a stormwater reduction project will help immensely in designing the drainage basin and rain gardens to mitigate the stormwater runoff within the pocket neighborhood.

II. Design Services

Project Scope

A pocket neighborhood is best defined as a cluster of economical homes that share a landscaped common area and aim to fortify the connection among the residents. The idea of a more condensed housing development is guided by the intention to create a more tranquil and sustainable living environment while providing a strong sense of community. Moment Inc. will contribute to the proposed pocket neighborhood by providing a site plan design with documents, multiple options for a site layout, design of a site grading, rain gardens, pavement, storm water management, and utility extensions for potable water and sanitary sewer service.

Work Plan

Figure (1) shown below outlines the time taken to complete each component of the project and the dates in which they were completed. A larger version of the Gantt chart can be found in *Appendix B* for visual clarification.

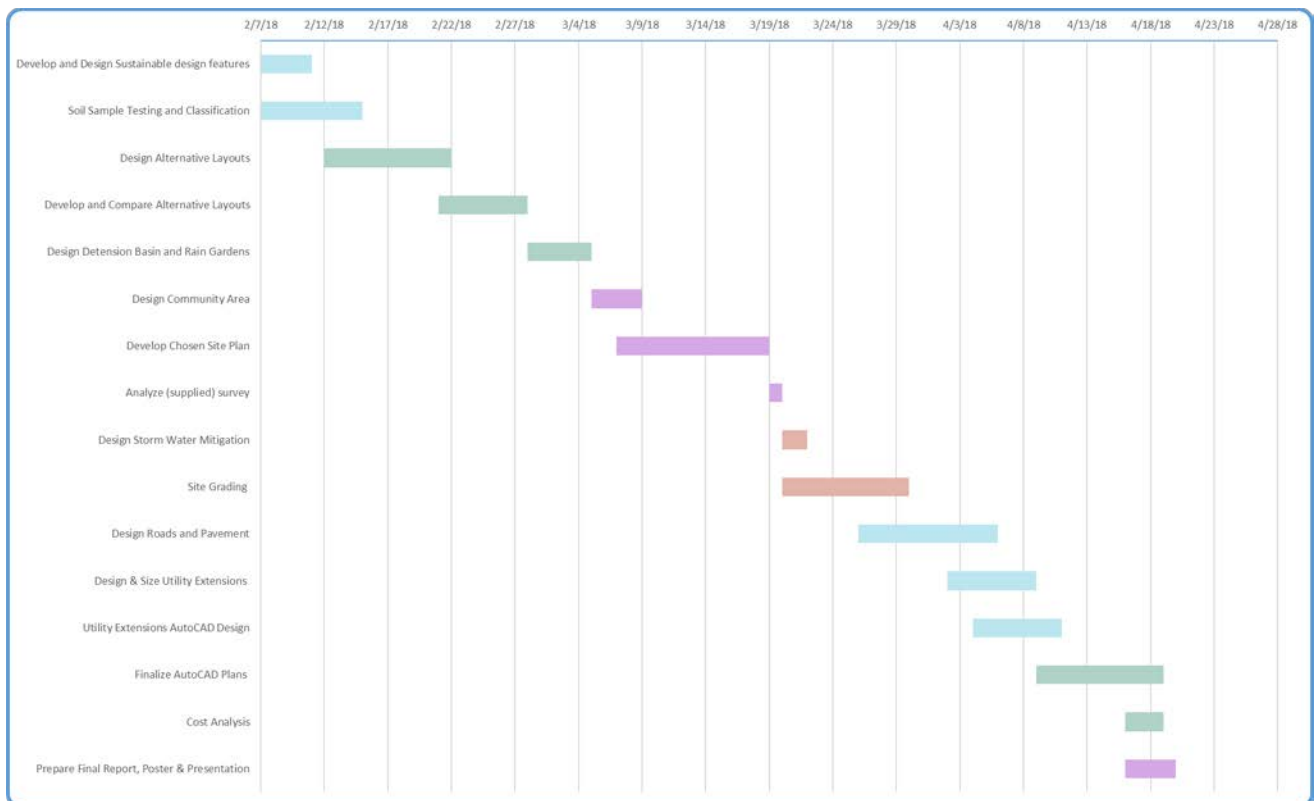


Figure 1: Gantt chart of project tasks completed

Methods and Design Guides

Moment Inc. utilized a series of methods while designing the project. Drainage calculations were completed in accordance with the Iowa Stormwater Management Manual specifications. The road was designed in compliance with Iowa Statewide Urban Design and Specifications (SUDAS) and the Asphalt Paving Association of Iowa (APAI). The team also used the USDA - Natural Resources and Conservation Services to identify the soil type of the project area and compare it with our own soil sampling when performed in the lab. RS MEANS was used to calculate costs for the project.

III. Constraints, Challenges and Impacts

Constraints

The constraints associated with the project included cost, time for completion of the designs, land space, and soil type. The total cost of the project cannot exceed the budget of \$2.6 million, nor can the final housing price exceed \$160,000 – \$170,000, excluding site work which is anticipated to be paid for by a grant. The project must also be designed for the given area of approximately 2.16 acres. This limits the amount of common space, number of units, alternative parking, road access, and size of the detention basin available for the site. The soil type is SUDAS type C, which does not infiltrate water easily. Therefore, rain gardens are designed with a drain to the storm sewer.

Challenges

The main challenge our team encountered was depth of bedrock on the site. Digging into bedrock was not preferred to save on costs. The depth of the bedrock varied throughout the site, so the re-grading of the site plan was carefully considered.

Societal Impact within the Community and/or State of Iowa

The pocket neighborhood will include ten housing units that will service families, elderly, and first time buyers in search of an affordable home. Residents living in the pocket neighborhood will enjoy a comfortable living environment in a small urban community that is at walking distance from daily necessities such as, daycare, medical center, markets, hardware and convenience stores. The project's sustainable features will also aim to improve the town's aesthetics and start similar development trends in the surrounding neighborhoods.

IV. Alternative Solutions That Were Considered

Attached Vs. Detached Garages - The location of the garages could be attached to the house or lined up in a separate location. Attached garages will provide convenience to the homeowner but will increase costs due to additional concrete. Having detached garages could also provide space for additional houses to be build.

Basement Vs. Safe Rooms - Safe rooms would be cheaper than building basements into the ground, however, a basement would provide additional square footage to the house, which could increase the value to the house and is important to buyers.

Townhouse/Duplexes Vs. Stand-Alone House - Townhouses would allow for more units to be built, which would cut down on costs per unit and would reduce maintenance fees for the homeowners. Stand-alone homes, however, provide ownership of land and more privacy than townhouses. There is also a greater demand and resale value to stand-alone homes than townhomes.

Community Space Vs. Additional Housing - Offering a common space for homeowners enhances the aesthetic appeal of the neighborhood and provides a sense of community and ownership of the area. Additional Housing in place of the community space would cut down on costs per unit and maintenance fee costs.

We chose to have Stand-Alone houses with basements and attached garages because ECIA believes that will appeal to their target market the most. We also chose to incorporate community instead of additional housing because the additional housing was not necessary, and the community space is essential in pocket neighborhood designs and creating a sense of ownership for the homebuyers.

V. Final Design Details

The final site plan design was chosen to best accommodate the client's needs. The site includes ten homes arranged to face a community common ground, attached garages, side walkouts connecting a side of the home to the driveway, an access road, a gazebo, and rain gardens for sustainable features. The orientation of the homes and the shared gazebo in the center of the layout will provide a stronger sense of community among the residents. Each home also offers personal space by having individual driveways, garages, and room for gardening.

Road Design

When designing the roads, we based our design off the SUDAS residential standards but took into account the road acts mainly an extended driveway for the south-side neighborhood houses. The speed limit of the road will be 15 mph although it is assumed that vehicles will slow down when turning the southwest corner. The curve radius was designed using AutoCAD to ensure a vehicle as large as a garbage truck would be able to make the turn. HMA will be used over concrete because it is durable and offers enough flexibility to accommodate underlying surface imperfections. Maintenance of HMA is also more cost effective than that of concrete. The thickness of the access road was designed to be 7" on a 6" base to ensure the road provides enough strength for larger vehicles that will use the road frequently such as the garbage truck. The road width is designed to be 24 feet to allow parking on the far side of the road from the houses.

Rain Gardens

The rain gardens were designed following the Iowa Rain Garden Design Manual. We first found the impervious area of that will contribute runoff to the rain garden. We then multiplied the area by a factor of 0.1 as stated in the design manual for a 6-inch rain garden. Finally, we split the calculated area into four rain gardens that run along the common ground sidewalk. We increased the total area an extra 240 ft² to avoid ponding and allow for proper drainage into the storm water pipe.

Depths of Utilities

The minimum depth standards outlined in SUDAS were followed when designing the water main (Ch. 4B-1, 4C-1), storm sewer (Ch. 2B-2 – 2B-4), and sanitary sewer (Ch. 3B-1, 3C-1) depths. The storm sewer is 3 feet deep, the water main is 5 feet deep to avoid pipe freezing from frost and to be 2 feet below the storm sewer, and the sanitary sewer in 12 feet deep to be below the basement foundations of the houses. We used AutoCAD software to create profile views of the pipes.

The minimum horizontal clearance between the water main to sanitary and storm sewer is 3 feet. We designed our utilities to be in separate trenches. The water main to storm sewer is at a horizontal clearance of 17 feet and our storm sewer to sanitary sewer is at 15 feet.

Pipe Sizing

The pipe sizing was designed according to the standards outlined in SUDAS. Water main and sanitary sewer was designed to have a pipe diameter of 8 inches while the storm sewer pipe diameter was 15 inches to account for our peak discharge calculated using the rational method.

Cost Analysis

We used RS MEANS to estimate costs for housing and construction.

VI. Preliminary Estimate of Project Cost

Table 1: Preliminary Cost Estimate of Site Work Excluding Land

ITEM	MATERIAL	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	HMA Pavement, 7-in thickness	624.8	TONS	\$ 70	\$ 43,800
2	Subbase, 6-in	25	CY	\$ 40	\$ 1,000
3	Curb and Gutter	77.36	CY	\$ 90	\$ 6,975
4	Concrete Pavement	25	CY	\$ 90	\$ 2,250
5	Grading	1208.92	CY	\$ 3	\$ 3,650
6	Rain Gardens	1088	SF	\$ 4	\$ 4,375
7	Permeable Soil	20	CY	\$ 12	\$ 240
8	Fire Hydrant Assembly	1	EA	\$ 5,000	\$ 5,000
9	Top Soil, Strip, Salvage, Spread	5905	CY	\$ 10.00	\$ 59,000
10	Erosion Control	1	LS	\$ 2,000	\$ 2,000
11	Seeding and Mulching	3700	SF	\$ 0.50	\$ 1,850
12	Gazebo, Vinyl Belle Roof Hexagon	1	LS	\$ 6,900	\$ 6,900
13	Connection to Existing Water Main	1	EA	\$ 800.00	\$ 800
14	15-in Reinforced Concrete Storm Sewer Mainline	629	LF	\$ 9.41	\$ 18,300
15	Storm Sewer Grate Intakes Type SW-501	4	EA	\$ 110.00	\$ 440
16	8-in PVC Sanitary Sewer Mainline	310	LF	\$ 6.30	\$ 1,975
17	4-in PVC Sanitary Sewer Service lines	718	LF	\$ 80.00	\$ 57,500
18	8-in Ductile Iron PIPE Water Main	336	LF	\$ 120.00	\$ 40,400
19	6-in Ductile Iron PIPE Water Main	50	LF	\$ 110.00	\$ 5,500
20	1-in Ductile Iron Water Main Service Lines	656	LF	\$ 60.00	\$ 39,400
21	15 in Reinforced Concrete	629	LF	\$ 9.41	\$ 5,950
				TOTAL	\$ 307,500

Note: This cost estimate does not include the cost of offsite utilities. Additional information regarding the location of existing utilities is needed to complete the estimate.

Table 2: Preliminary Cost Estimate of Single Family Houses

ITEM	MATERIAL	QUANTITY	UNIT	UNIT PRICE	TOTAL
25	RS MEANS, Housing Units	10	LS	\$ 163,500	\$1,635,000
26	Shrubs	20	EA	\$ 70	\$ 1,400
27	Tree	10	EA	\$ 200	\$ 2,000
28	Mulch	500	SF	\$ 0.50	\$ 250
29	Perennials	20	EA	\$ 15	\$ 300
				TOTAL	\$1,639,000
				(Unit Cost)	\$ 163,900

Table 3: Preliminary Project Cost Estimate

Site Work Cost	\$307,500.00
Residential Housing Cost	\$1,639,000.00
Contingencies (10%)	\$194,650.00
Engineering & Administration (15%)	\$46,125.00
Total Project Cost	\$2,187,275.00

VII. Bibliography

“Environmental Protection.” *Iowa Department of Natural Resources*,
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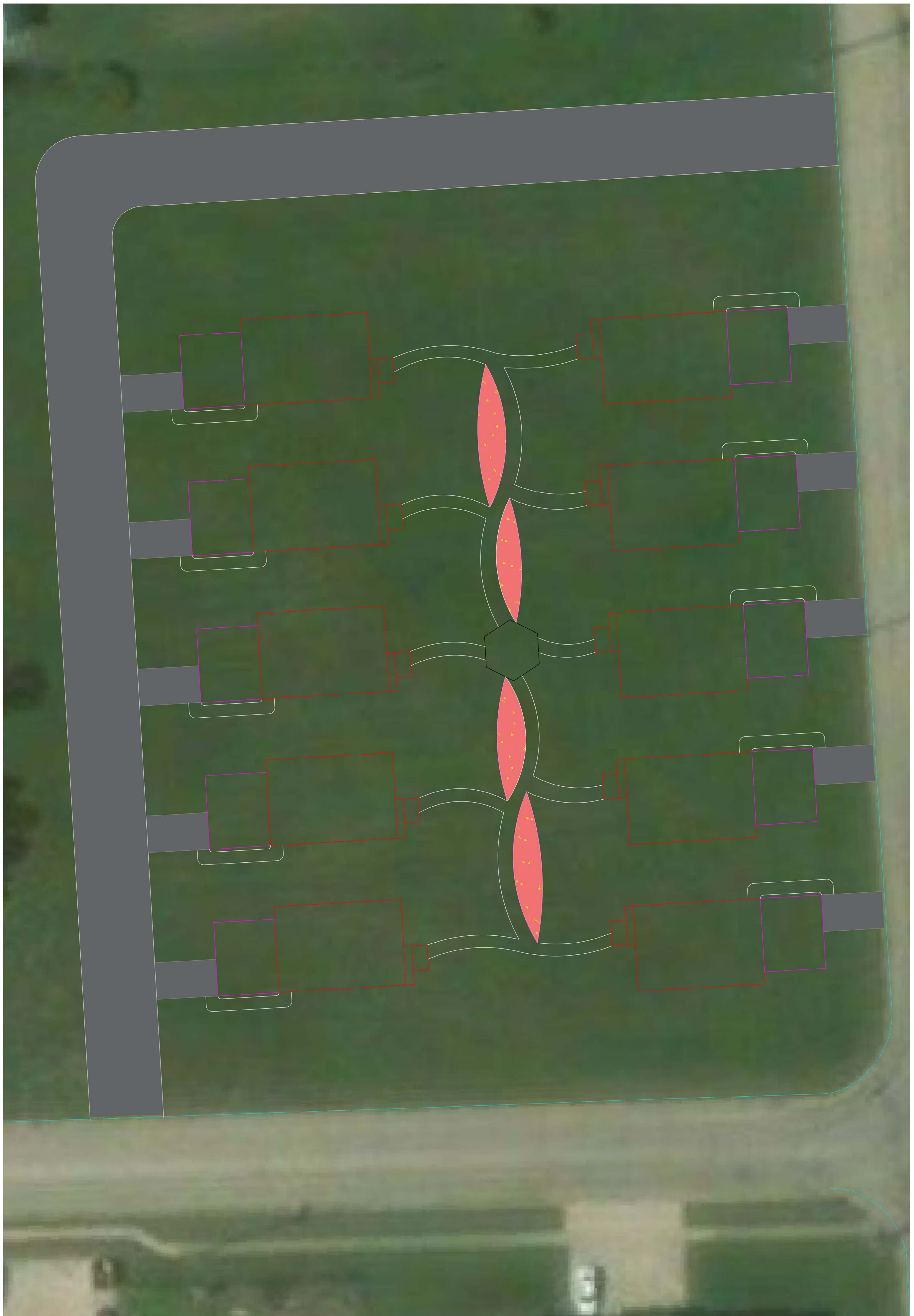
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Appendices: Design Sheets

The following design sheets are attached: Site, Road, Sanitary Utility, Stormwater, Water Utility.



P01

SHEET NO.

Plan View

SHEET NAME

POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
7600 Commerce Park, Dubuque, Iowa 52001

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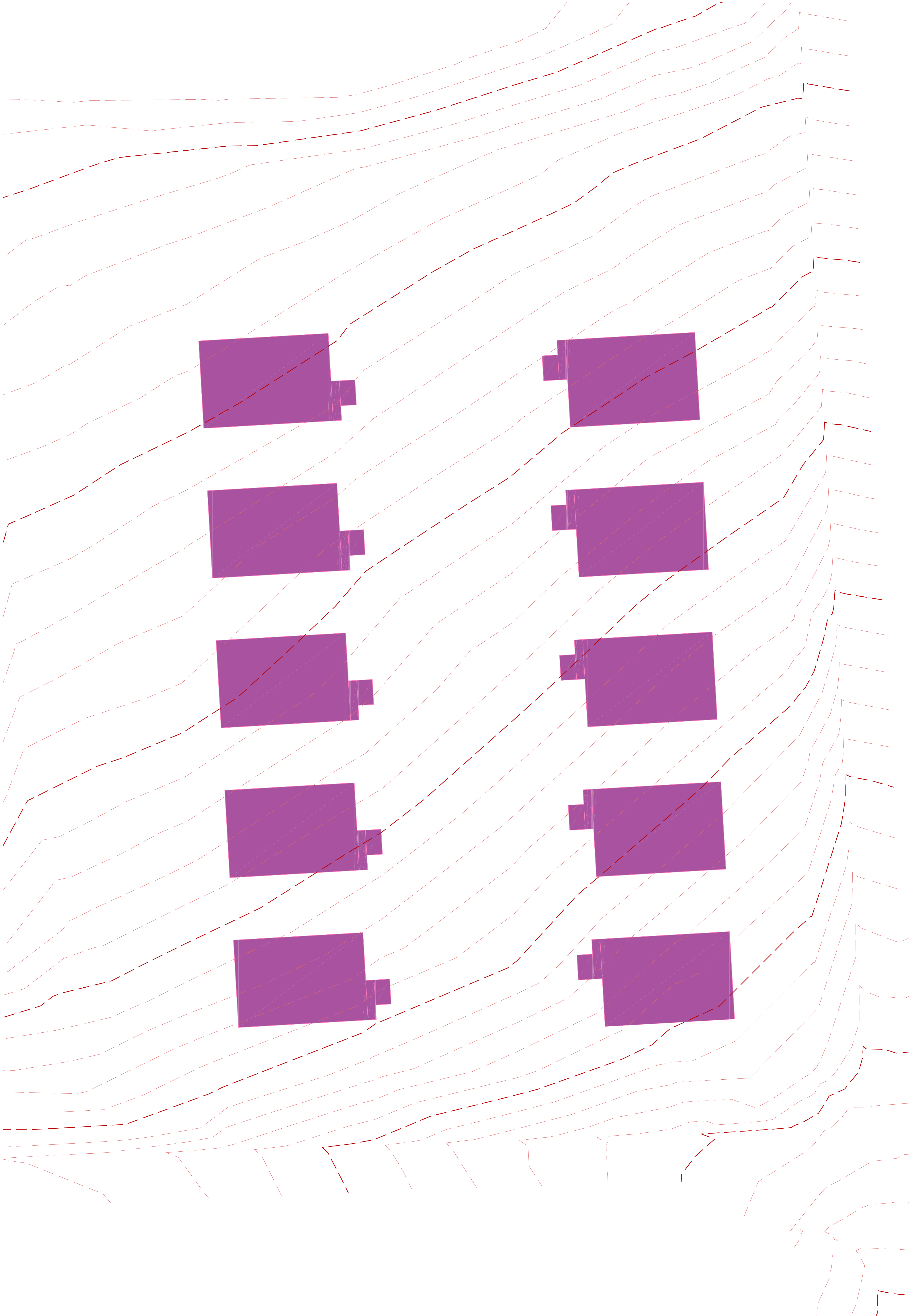
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FAX: 319.335.5660
EMAIL: civil-hawks@uiowa.edu

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DATE : 04/20/2018

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C01

SHEET NO.

SHEET NAME
Existing Contours
Plan View

POCKET NEIGHBORHOOD

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C02

SHEET NO.

SHEET NAME
New Contours

SHEET NAME

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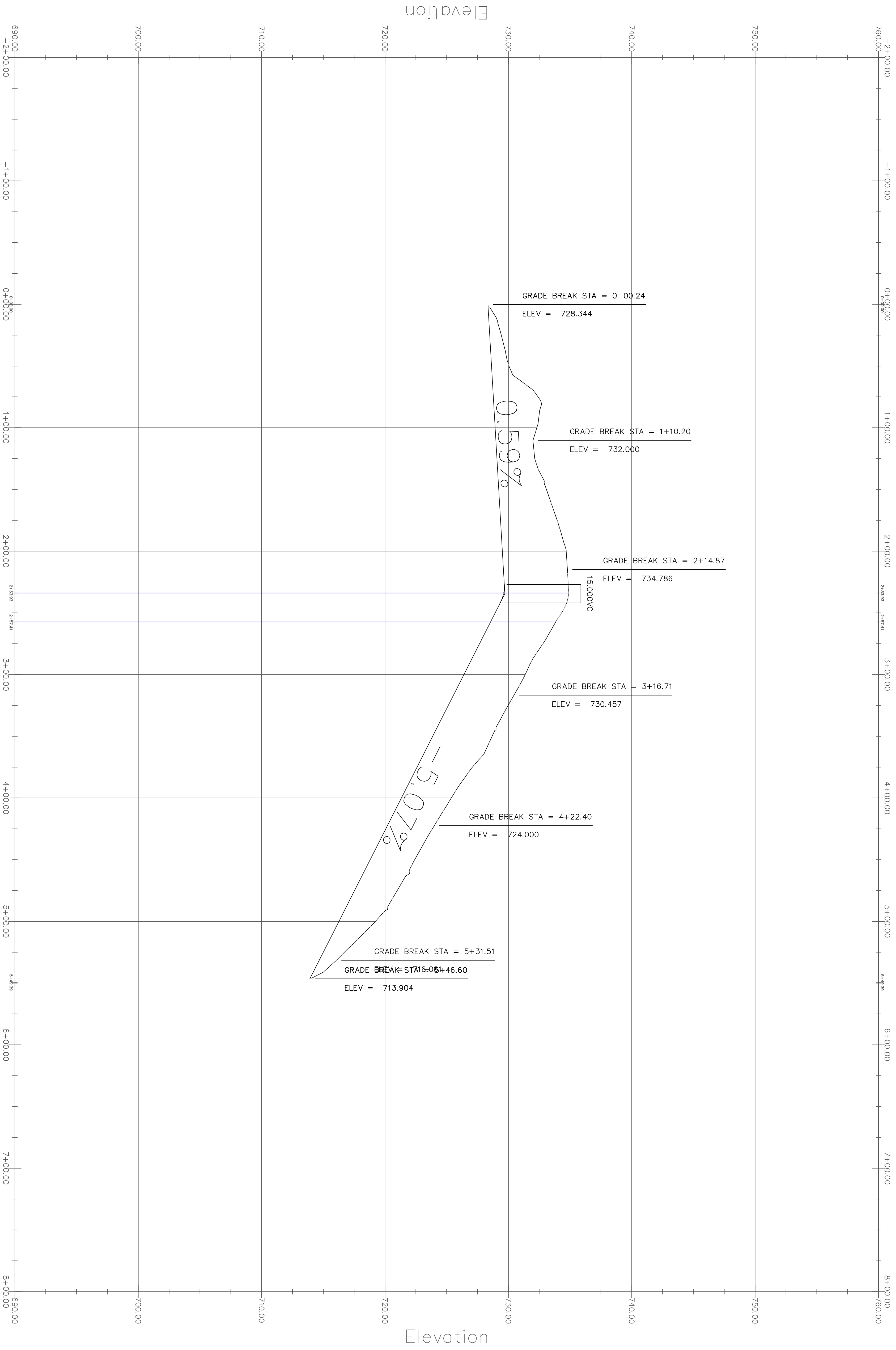
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Profile View of Alignment Road

Station



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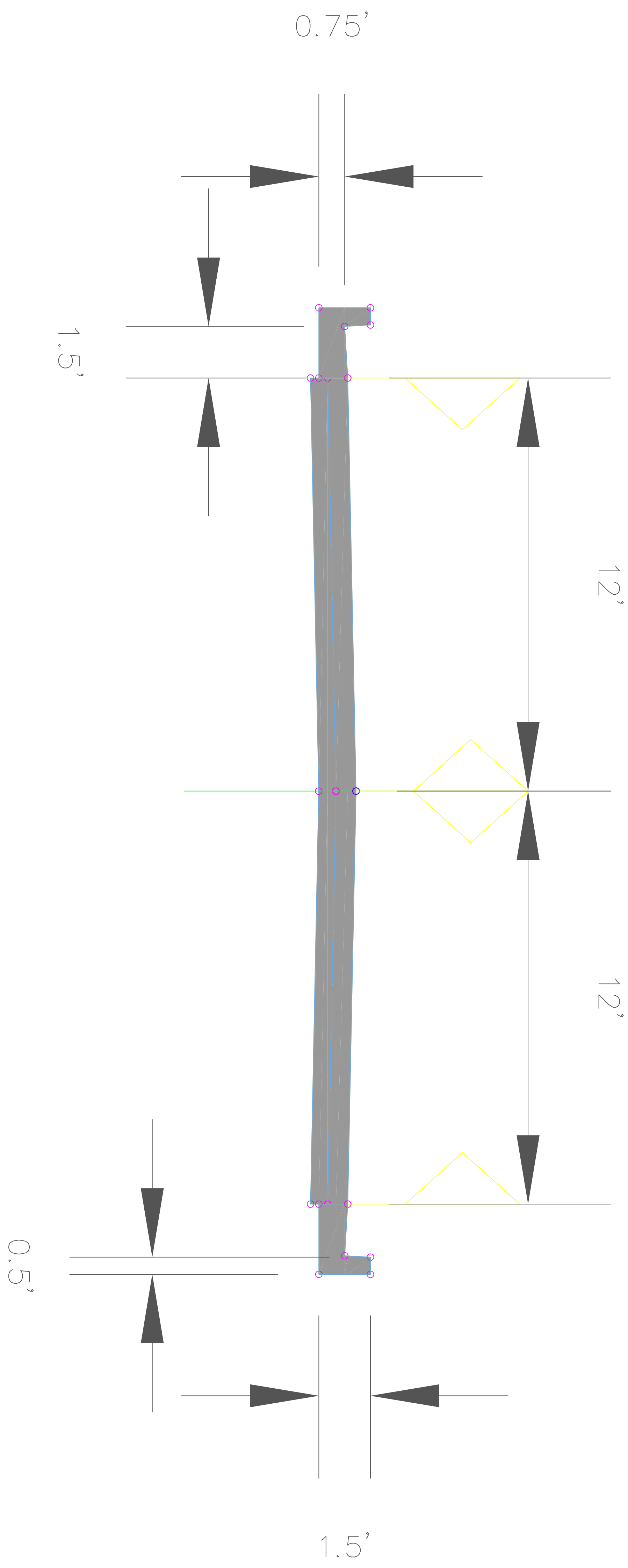
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SHEET NAME

Road Profile

SHEET NO.

R01



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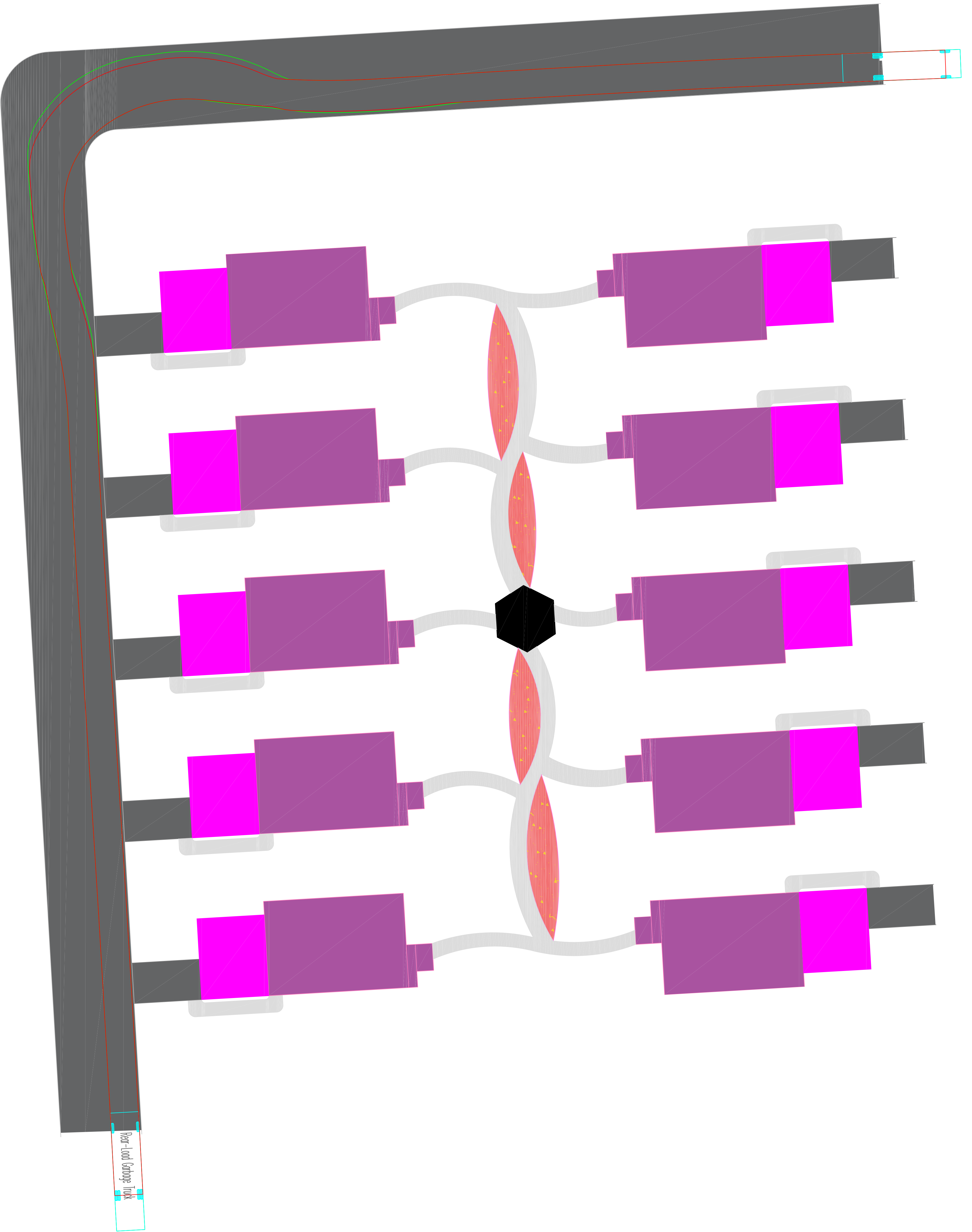
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POCKET NEIGHBORHOOD
 German St & Creslane St, Maquoketa, Jackson County, IA
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SHEET NAME
 Road Assembly

SHEET NO.

R02



Paper-Land Garbage Truck

POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
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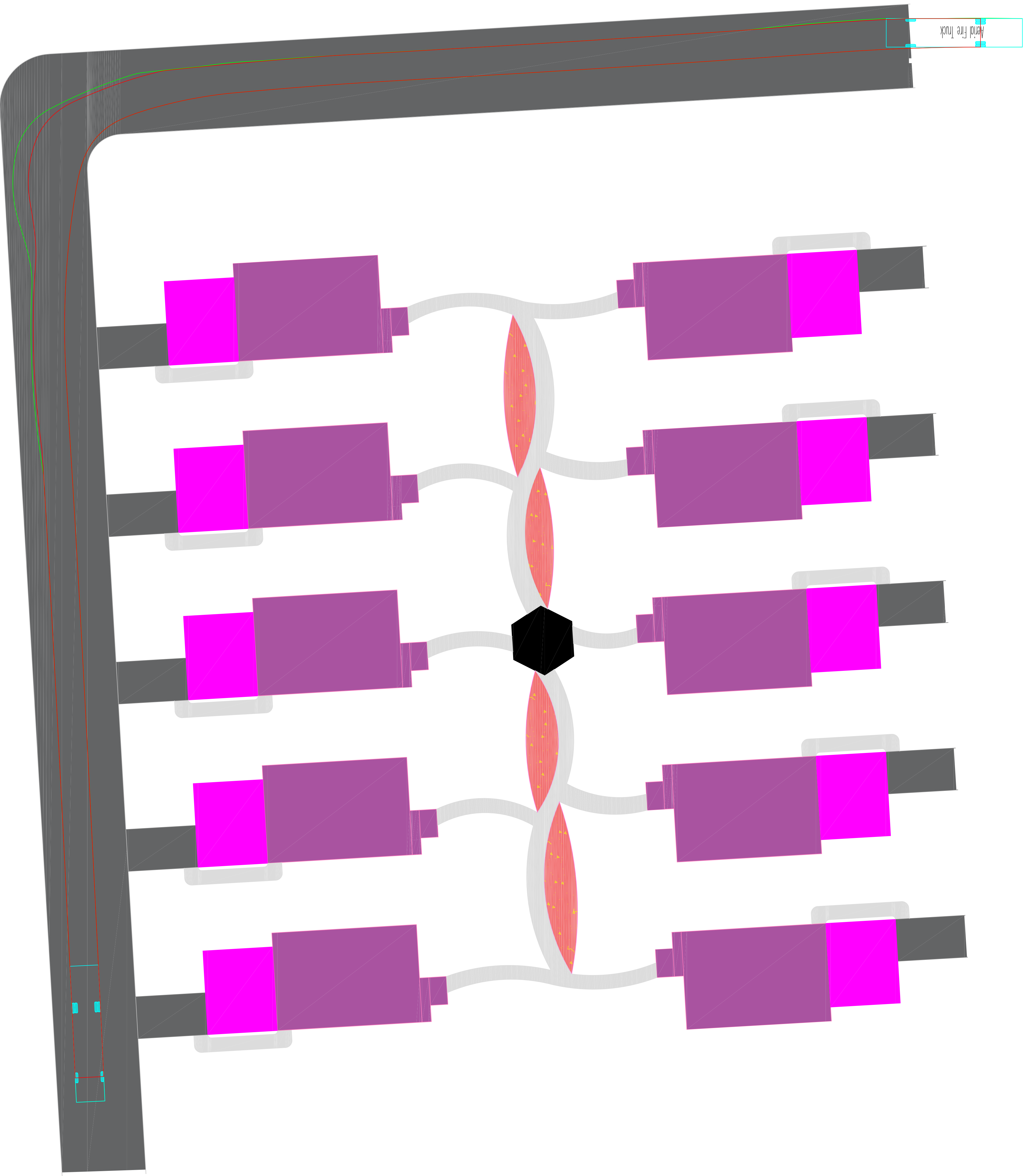
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Aerial Fire Truck

SHEET NO.
R04

SHEET NAME
 Swept Path Analysis
 Fire Truck

POCKET NEIGHBORHOOD

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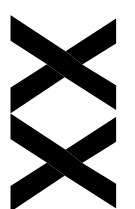
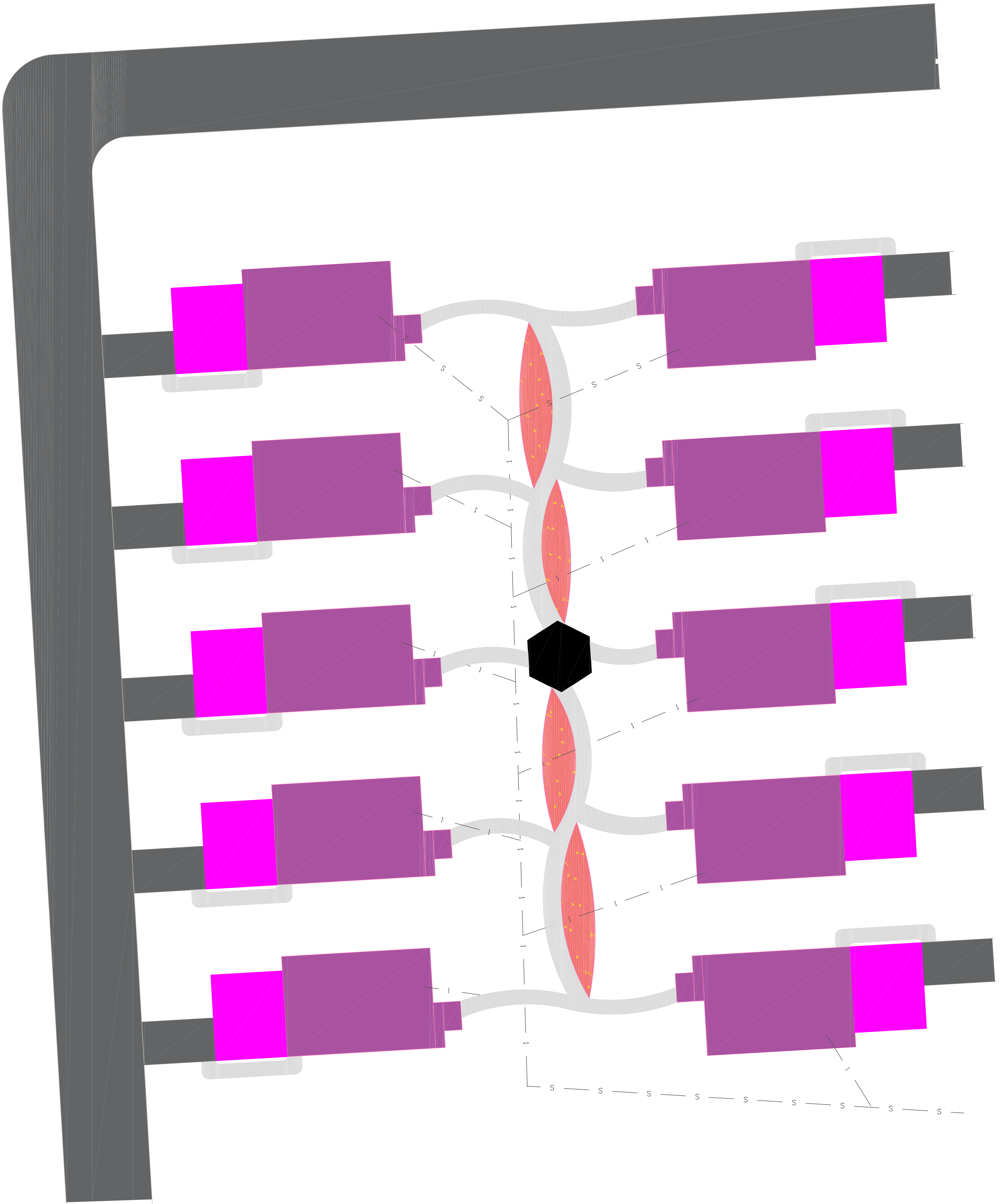
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SHEET NO.

SHEET NAME 1
SHEET NAME 2

SHEET NAME

POCKET NEIGHBORHOOD

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Elevation

730.00
720.00
710.00
700.00
690.00

GRADE BREAK STA = 0+00.25
ELEV = 713.184

GRADE BREAK STA = 0+00.00
ELEV = 724.568

GRADE BREAK STA = 1+05.16
ELEV = 717.000

GRADE BREAK STA = 2+06.92
ELEV = 710.369

GRADE BREAK STA = 3+10.38
ELEV = 705.000

GRADE BREAK STA = 1+87.56
ELEV = 699.533

187.43'

121.67'

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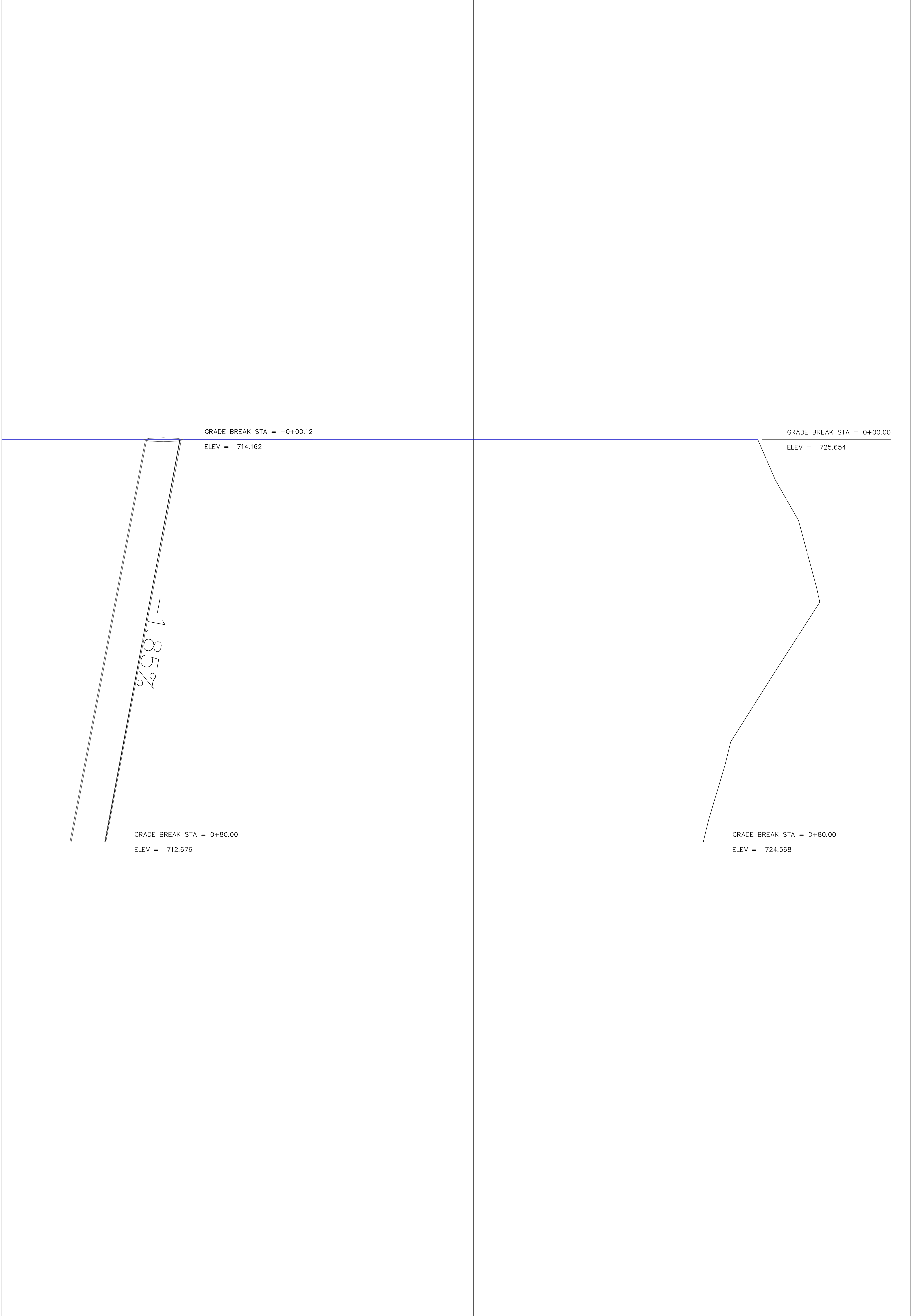


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POCKET NEIGHBORHOOD
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SHEET NAME
 Sanitary Sewer
 Mainline Profile

SHEET NO.
Sa00



Sa01

SHEET NO.
SHEET NAME
Sanitary Sewer 1
Profile

POCKET NEIGHBORHOOD

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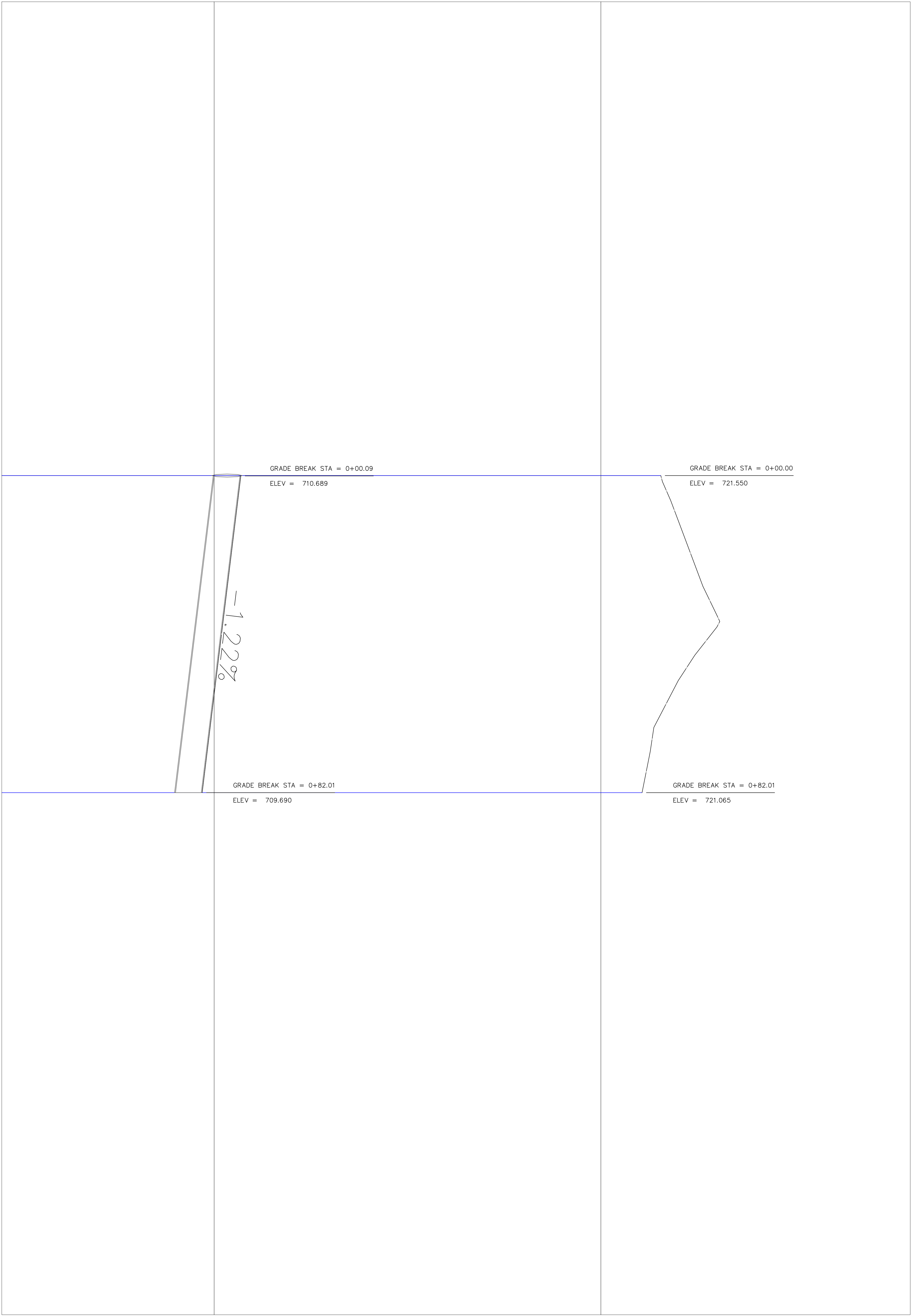
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Sa02

SHEET NO.
 SHEET NAME
 Sanitary Sewer 2
 Profile

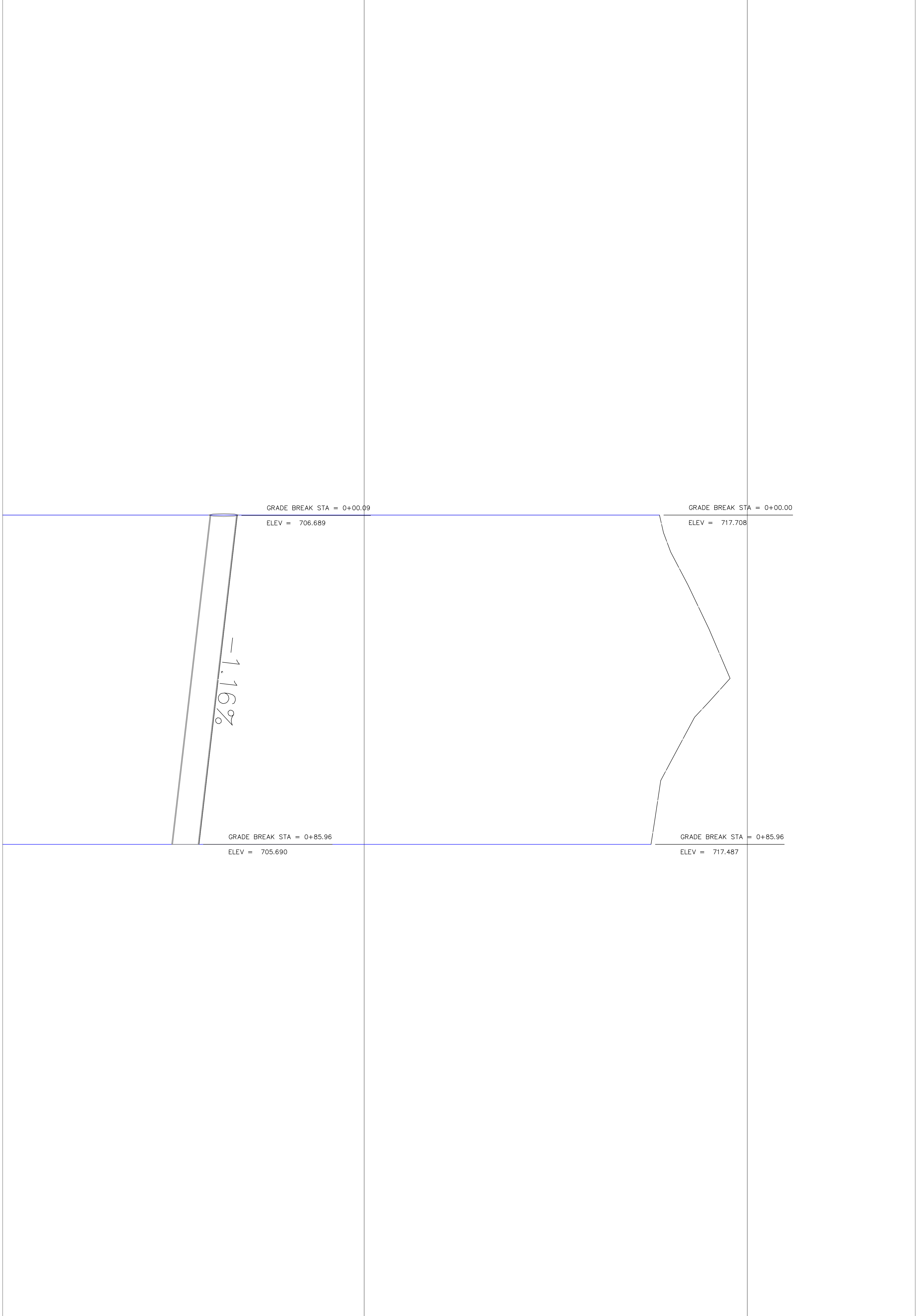
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Sa03

SHEET NO.

SHEET NAME
Sanitary Sewer 3
Profile

SHEET NAME

POCKET NEIGHBORHOOD

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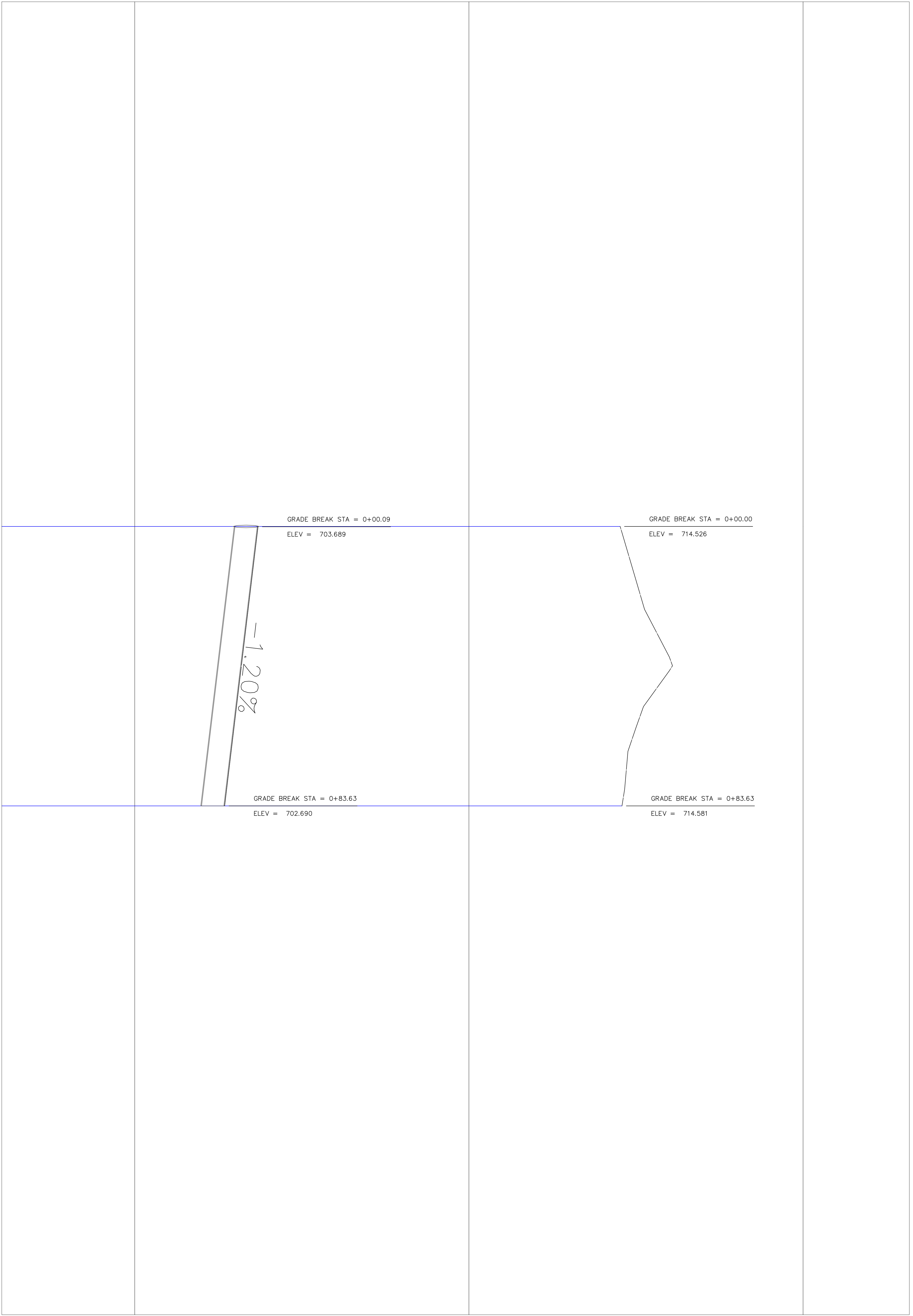
4105 SEAMANS CENTER FOR THE
ENGINEERING ARTS AND SCIENCES
103 S CAPITOL ST
IOWA CITY, IOWA 52242
PHONE: 319.335.5647
FAX: 319.335.5660
EMAIL: civil-hawks@uiowa.edu

PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:



Sa04

SHEET NO.
 SHEET NAME
 Sanitary Sewer 4
 Profile

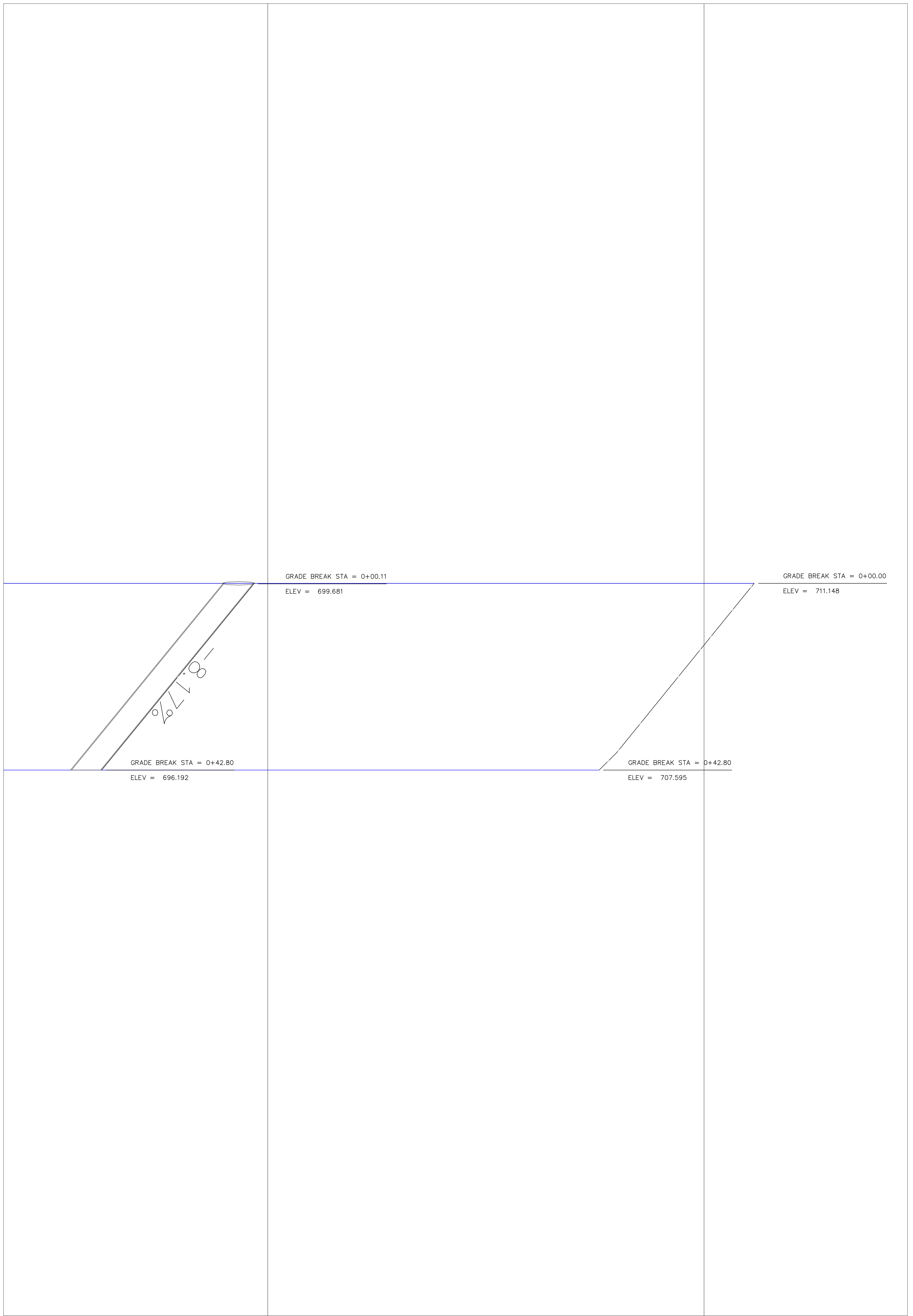
POCKET NEIGHBORHOOD
 German St & Creslane St, Maquoketa, Jackson County, IA
 7600 Commerce Park, Dubuque, Iowa 52001

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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

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POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
7600 Commerce Park, Dubuque, Iowa 52001

SHEET NAME

Sanitary Sewer 5
Profile

SHEET NO.

Sa05

Elevation

710.00

720.00

730.00

GRADE BREAK STA = 0+00.11
ELEV = 720.679

GRADE BREAK STA = 0+00.00
ELEV = 732.263

GRADE BREAK STA = 0+80.26
ELEV = 712.694

GRADE BREAK STA = 0+80.26
ELEV = 724.568

-9.96%

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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:

POCKET NEIGHBORHOOD

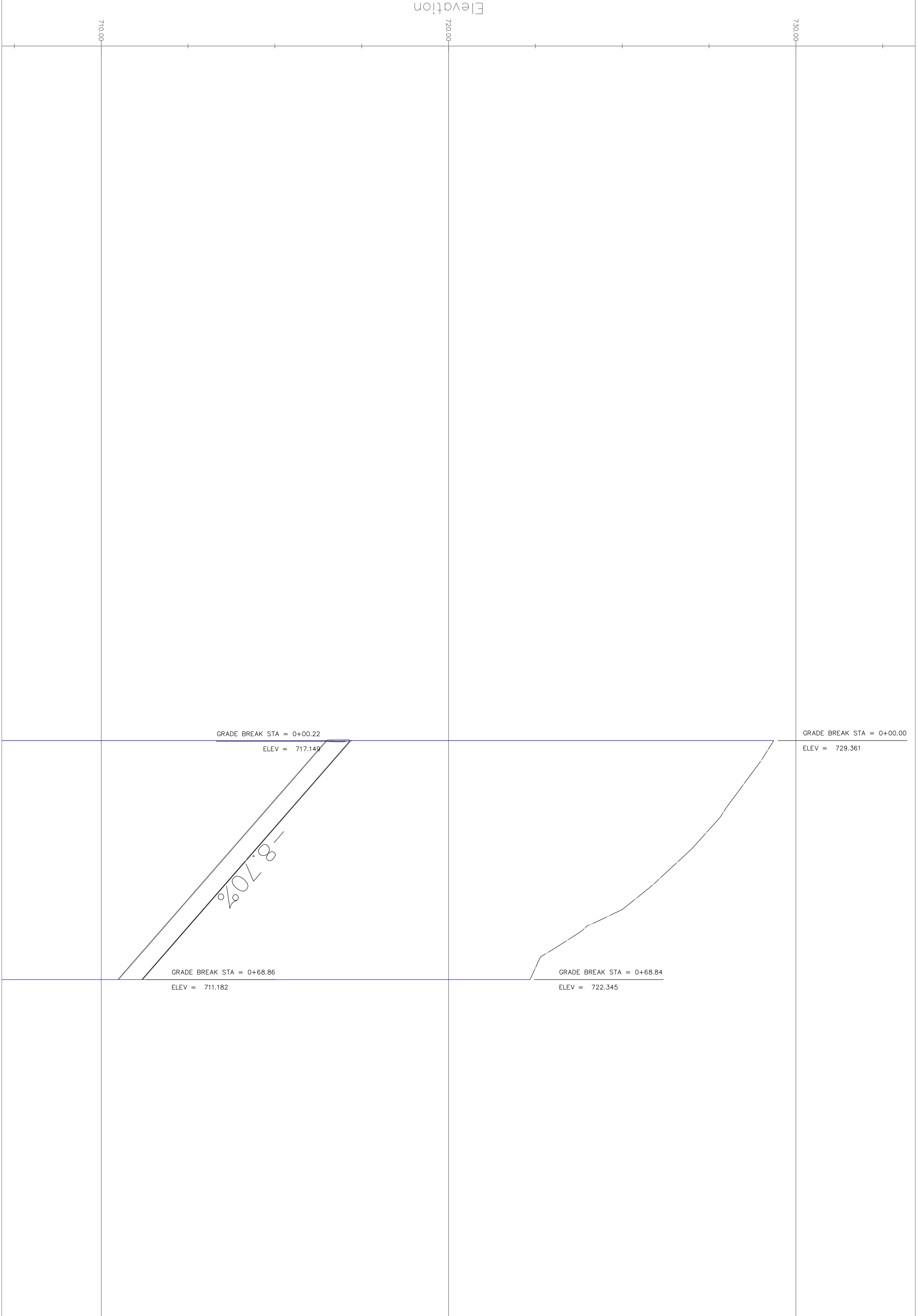
German St & Creslane St, Maquoketa, Jackson County, IA
7600 Commerce Park, Dubuque, Iowa 52001

SHEET NAME

Sanitary Sewer 6
Profile

SHEET NO.

Sa06



SHEET NO.
Sa07

SHEET NAME
 Sanitary Sewer 7
 Profile

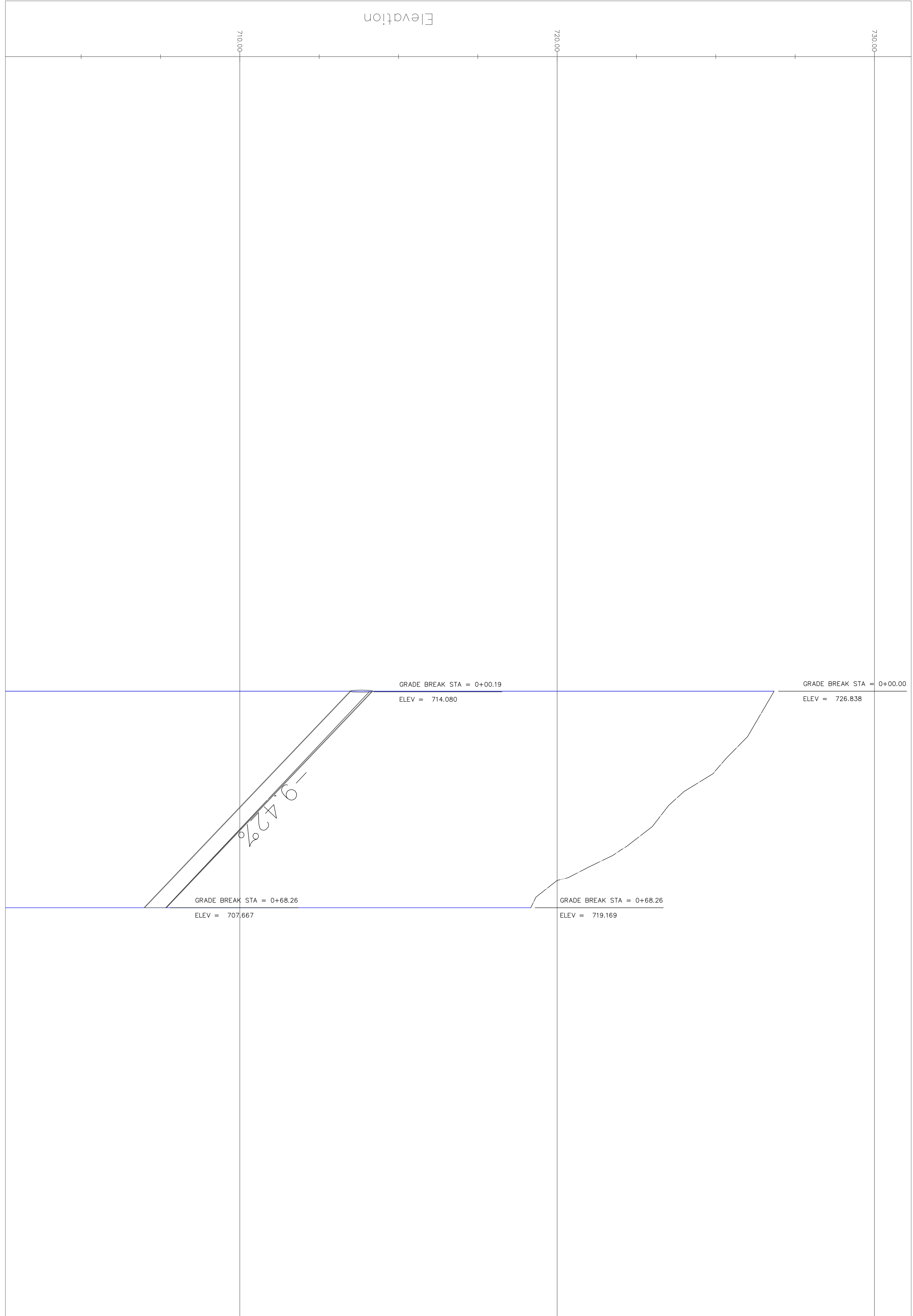
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PROJECT:	POCKET NEIGHBORHOOD CEE:4850
DATE :	04/20/2018
DRAWN BY:	MOMENT, INC.
REVISION:	



Sa08

SHEET NO.

SHEET NAME
Sanitary Sewer 8
Profile

SHEET NAME

POCKET NEIGHBORHOOD

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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:

Elevation

700.00

710.00

720.00

GRADE BREAK STA = 0+00.25
ELEV = 710.124

GRADE BREAK STA = 0+00.00
ELEV = 723.615

GRADE BREAK STA = 0+62.60
ELEV = 704.191

GRADE BREAK STA = 0+62.60
ELEV = 716.274

-9.52%

Sa09

SHEET NO.

Sanitary Sewer 9
Profile

SHEET NAME

POCKET NEIGHBORHOOD

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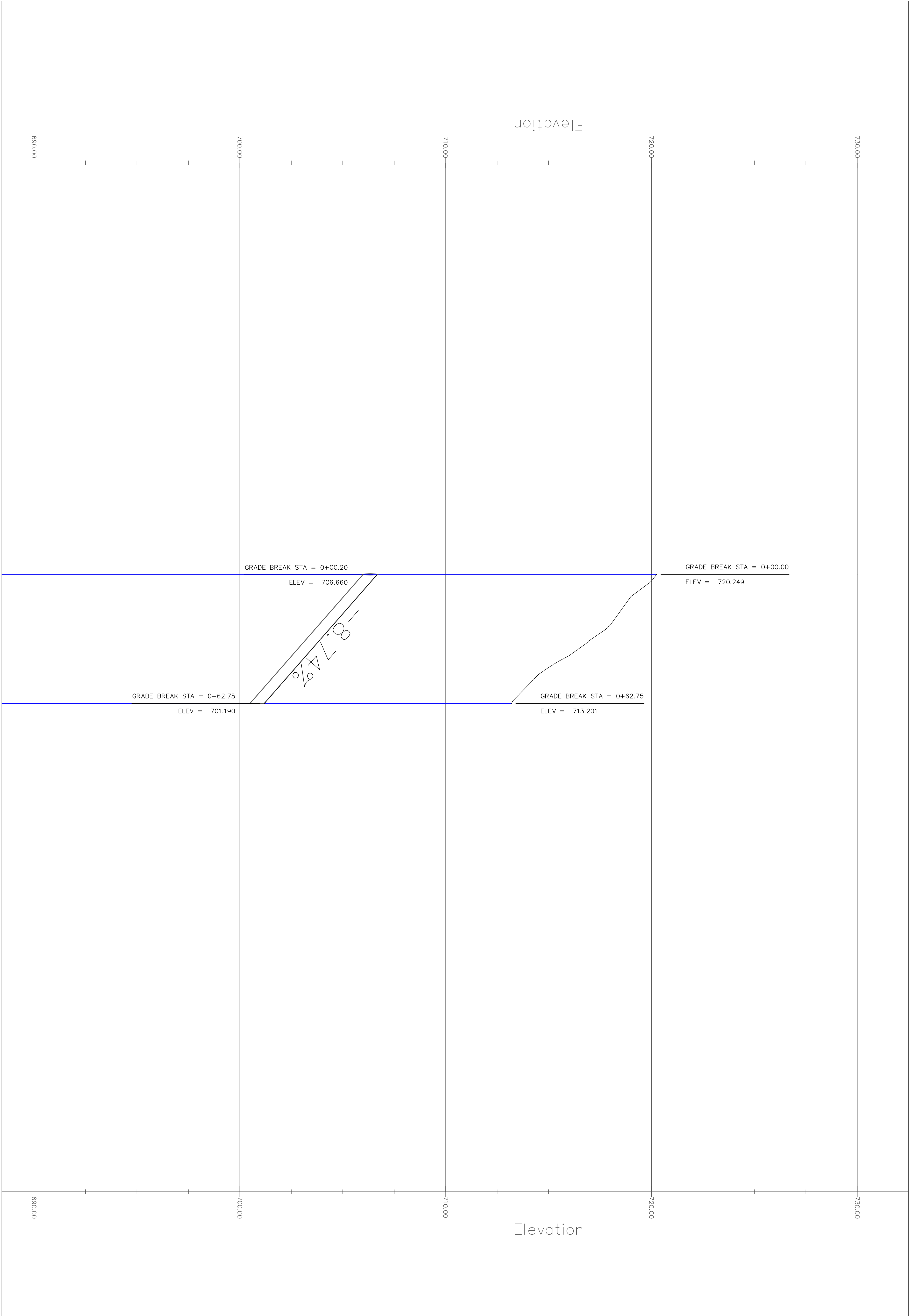
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DATE : 04/20/2018

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REVISION:



XXX

SHEET NO.
SHEET NAME
SHEET NAME 1
SHEET NAME 2

POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
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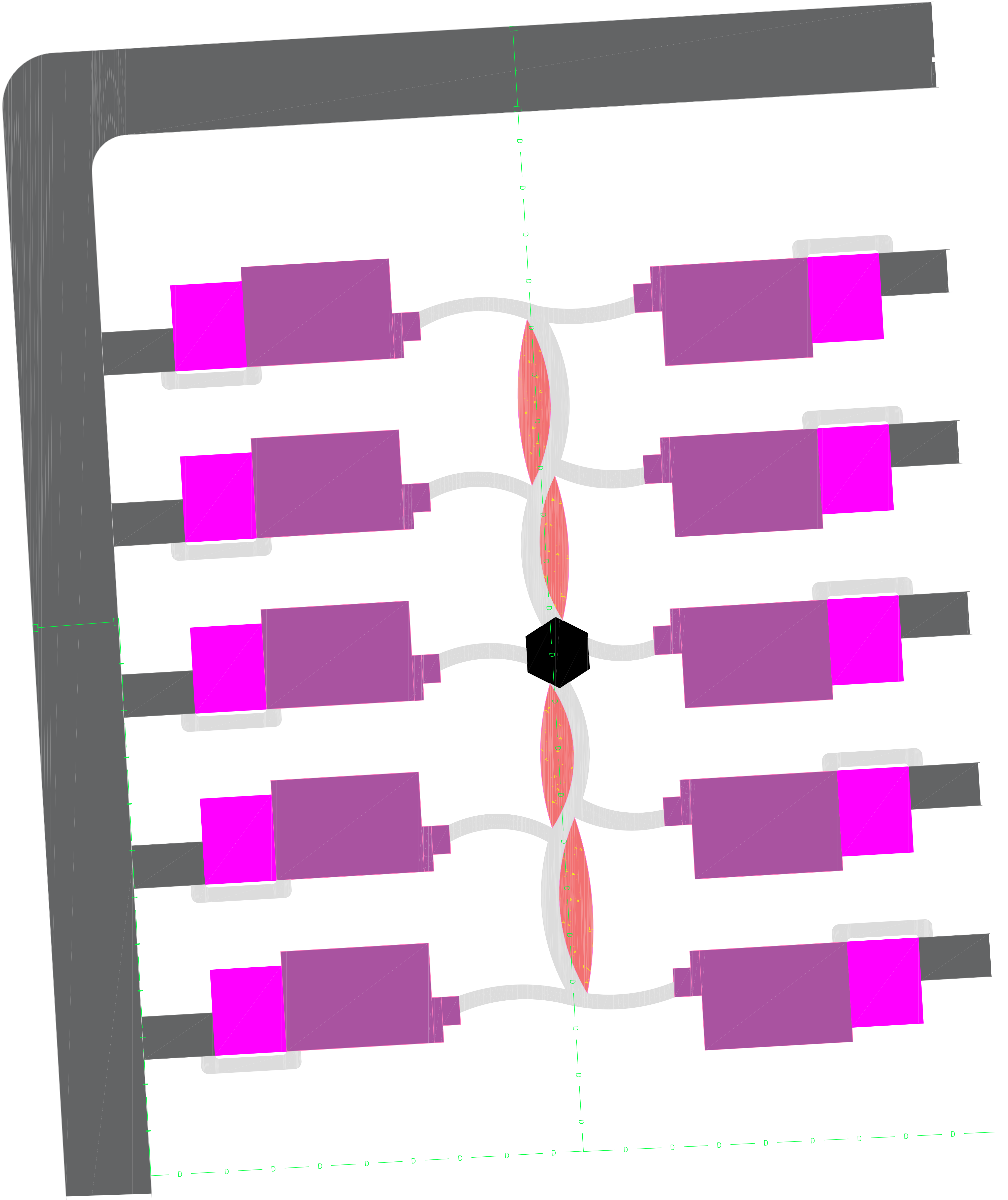
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DATE : 04/20/2018
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REVISION:



St

SHEET NO.

SHEET NAME
Storm Sewer
Plan View

SHEET NAME

POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
7600 Commerce Park, Dubuque, Iowa 52001

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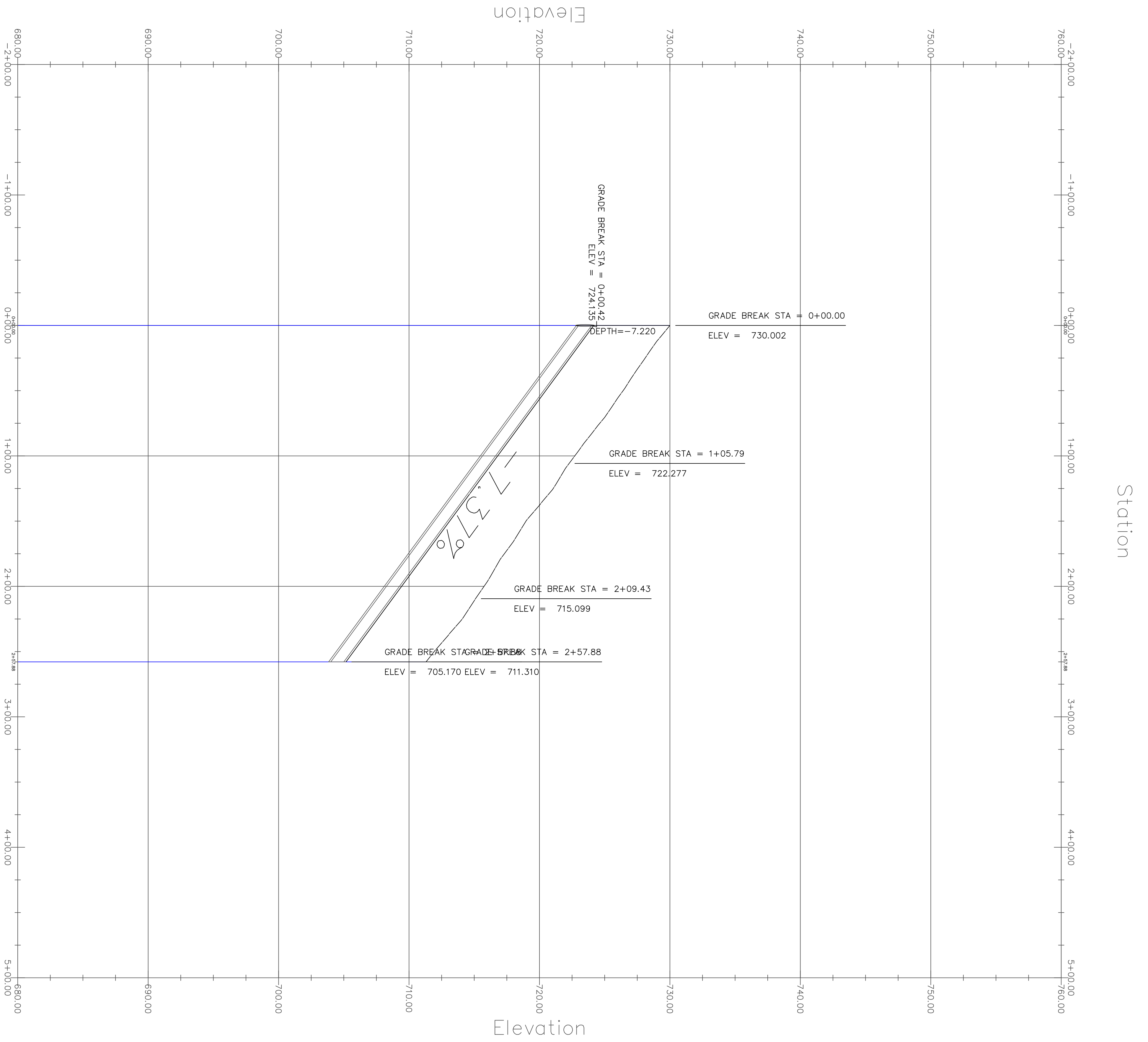
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DATE : 04/20/2018

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REVISION:



Station

Elevation

Elevation

StS01

SHEET NO.

SHEET NAME
Storm Sewer Profile
East-West

POCKET NEIGHBORHOOD

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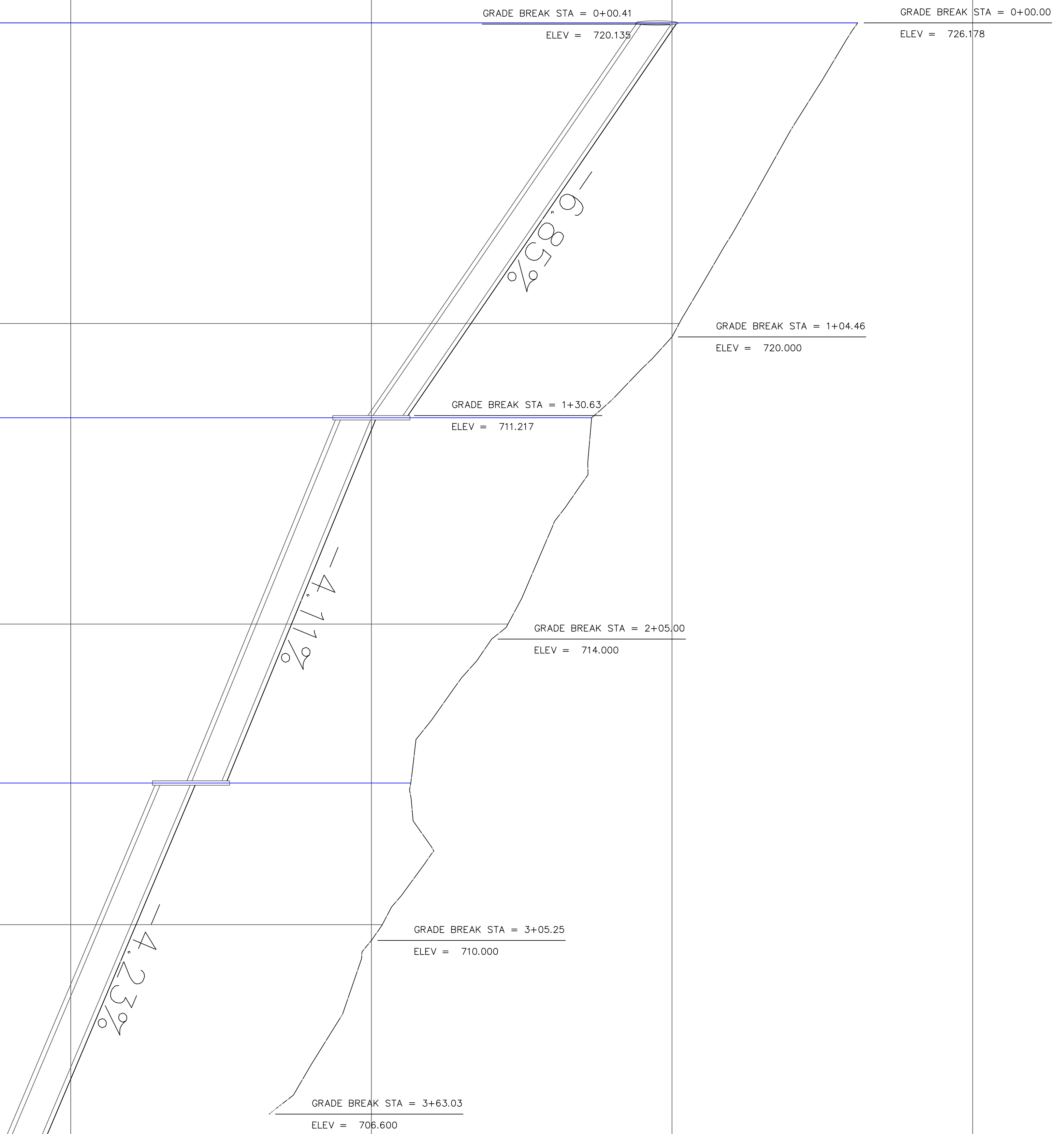
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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

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StS02

SHEET NO.

Storm Sewer
South-North

SHEET NAME

POCKET NEIGHBORHOOD

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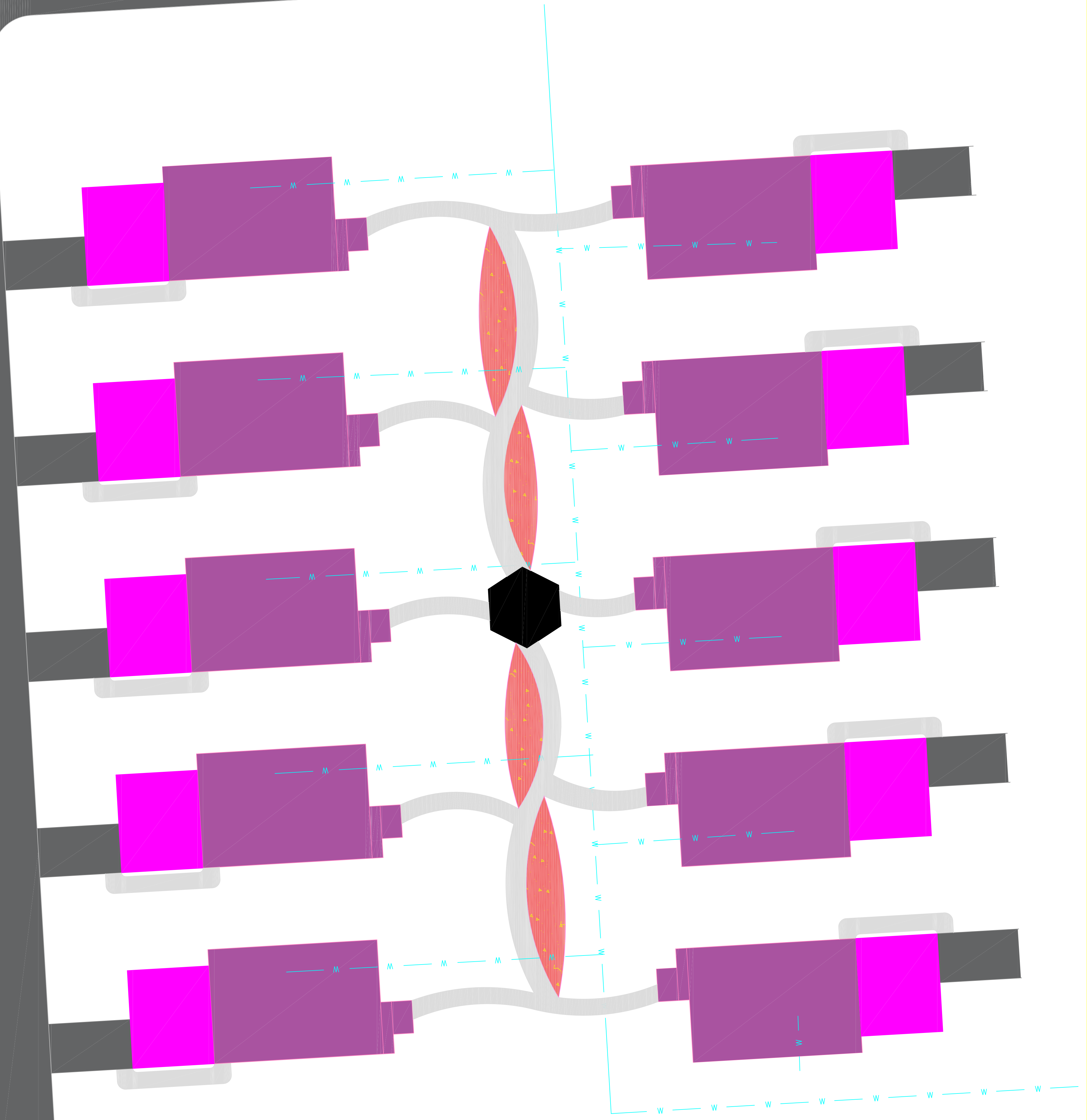
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DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:



W00

SHEET NO.

SHEET NAME
Water Main
Plan View

POCKET NEIGHBORHOOD

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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:

Elevation

700.00

710.00

720.00

730.00

GRADE BREAK STA = -0+00.03

ELEV = 722.663

GRADE BREAK STA = 0+00.00

ELEV = 727.038

GRADE BREAK STA = 0+27.91

ELEV = 720.674

GRADE BREAK STA = 1+01.93

ELEV = 719.651

GRADE BREAK STA = 2+05.53

ELEV = 712.319

GRADE BREAK STA = 3+01.41

ELEV = 707.076

POCKET NEIGHBORHOOD

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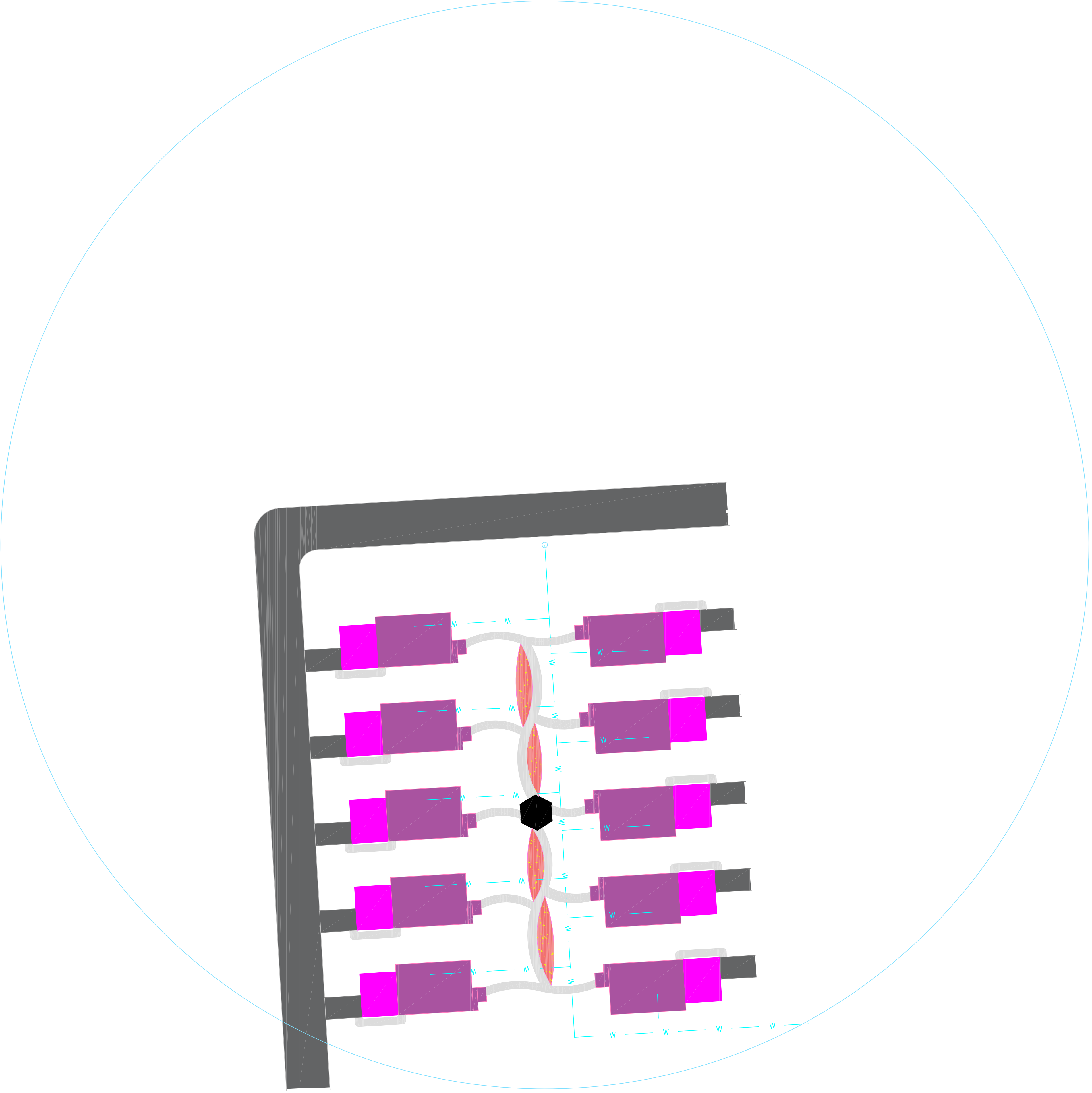
REVISION:

SHEET NAME

Water Main Mainline
Profile

SHEET NO.

W01



POCKET NEIGHBORHOOD

German St & Creslane St, Maquoketa, Jackson County, IA
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PROJECT: POCKET NEIGHBORHOOD CEE: 4850

DATE : 04/20/2018

DRAWN BY: MOMENT, INC.

REVISION:

SHEET NAME

Fire Hydrant Radius

SHEET NO.

W02