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Abstract

Missoula's Community Planning, Development & Innovation department processes a wide range of building permits, but current reporting methods are manual, limited, and not easily accessible to the public. This project aims to design and implement an automated building permit metric dashboard as well as community development summary reporting. The solution will involve engineering a data pipeline from the department's SQL database to ArcGIS dashboards. The project also involves engineering metrics and visualizations that effectively support long-term goals.

A logo of a city

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Missoula Building Permit Tracking

Developing a Building Permit Metric Dashboard

& Community Development Summary Reporting

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# Document control

|  |  |  |  |
| --- | --- | --- | --- |
| Version | Date | Modifier | Description |
| V1 | 2/12/25 | Luke | Defined the overall setup of the BRD. Started working on the conversion of requirements to data points. Set up my timeline so we are aware of work being completed on my end. |
| V2 | 2/19/25 | Luke | Added the list of stakeholders to the document. Written the executive summary. Conitinuing to add onto the conversion of requirements to data points. |
|  |  |  |  |

Options for data access: Request a dump of the database from Accela, remote desktop into the ERD server, give me a laptop that has vpn service so I can remote into the ERD server

# Stakeholders

|  |  |  |
| --- | --- | --- |
| Person | Title | Project Roles |
| Walter Banziger | Deputy Director, CPDI | Project Sponsor |
| Cristina Coddington | Chief Building Official, CPDI | Project Sponsor |
| Kirsten Hands | Business and Finance Manager, CPDI | Data Stakeholder |
| Lee Macholz | GIS Manager, GIS Services | Data Expert, Mentor |
| Maggie McCarthy | Permit and Business Licensing Manager, CPDI | Data Stakeholder |
| Aaron Bowman | Plans Examiner Supervisor, CPDI | Data Expert, Mentor |
| Rachael Kropp | Operations Specialist, CPDI | Project Tracker |
| Jesse Neidigh | IT Director, Information Technologies | Lead on City Data Proposals to University of Montana |
| Luke Wyman | Business Analytics Student, University of Montana COB | Dashboard Builder |

# Executive Summary

The Missoula Community Planning, Development & Innovation department currently relies on manual reporting methods for sharing building permit information with the community. To enhance accessibility and transparency, this project will develop and implement an automated building permit metric dashboard and community development summary reporting. By integrating data from the department's SQL database into ArcGIS dashboards, the solution will provide real-time insights and visually effective reports.

**MAIN GOAL:** Enhance transparency and efficiency by providing real-time insights into the status of active building permits and showcasing the historical performance of permits processed by the city.

**DATA PRODUCTS:** At the end of this project, two key deliverables will be produced. The first is a Building Permit Metric Dashboard, which will focus on permit counts to provide insights into the operational performance of the permitting process. The second is a series of community development summary reports, which will analyze financial data across various time frames to support decision-making and community planning efforts.

**What are the questions you are trying to answer or the problems you are trying to solve?**

Two Main “Data Products”

* [Building Permit Metric Dashboard Inspiration](https://dallascitydata.dallascityhall.com/views/SingleFamilyResidentialPermits_16747435220440/SingleFamilyResidentialPermits?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3Arefresh=yes&%3AisGuestRedirectFromVizportal=y&%3Aembed=y): Focus on Counts
* [Community Development Summary Reporting Inspiration](http://www.ci.missoula.mt.us/3113/Development-Data): Focus on Financials

**Why is this interesting and/or valuable?**

* Provides real-time visibility of permit processing efficiency.
* Identifies bottlenecks by analyzing teams involved in processing.
* Enhances transparency and accountability for both the city as the issuer and applicants at various stages of the permit cycle.
* Supports up-to-date, data-driven decisions on community development.

**What is the status of your work?**

* Requirements Gathering: Product Descriptions
* Permit Metric Dashboard Data Points: In Progress
* Community Development Summary Reporting Data Points: TBD but likely similar to above, just calculated
* [Mock-up for Building Permit Metric Dashboard](https://cityofmissoula.maps.arcgis.com/home/item.html?id=ed49059424d845b8b0b20a790297f6b9): This data set does not meet all our needs.
* Community Development Summary Reporting: Look into using ArcGIS StoryMap? Or just a dashboard?
* Defined Data Sets: TBD develop SQL Query/ies from needed Data Points

**What challenges have you already faced, or do you expect to face?**

* Data exists in SQL database called Accela.
  + Accessibility
  + Data Connector in ArcGIS
  + Complex Querying
  + Update Schedule
* Unfamiliar with
  + ArcGIS: Dashboard Tool
  + Arcade: Coding Language

**What questions do you have? What do you not know or need to figure out?**

* How can we get the data out of the system? What will our queries look like?
* How can we ensure that we get full coverage of important metrics & visualizations?
* What’s the process for auditing results (outliers) if we have live connection to database?

# Introduction

<TBD: Set stage for the project by quickly defining purpose, scope, rationale, and key stakeholders.>

## Purpose

<TBD: >

## Scope

<TBD: >

## Motivation & Inspiration

<TBD: >

## Stakeholders

<TBD: >

# Product Descriptions

A screenshot of a phone

AI-generated content may be incorrect.<TBD: >

Permit Tracking metrics/points (red are internal metrics and not shared with public)

Private side - for internal use only

* Type of permits – typically as categorized in the Monthly Development Data Report and in Accela.  IE Single Family detached, Single Family attached, Industrial, ADU(which is an important one to capture)
* Volume of each type of permit per month and totals for the year.
  + Received by the month (Dallas)
  + issued by month (Dallas)
  + Volume trend by month
* Permits in the queue (Dallas)
  + Permits in queue by staff vs applicant
  + Permits in Queue by stage  (Dallas)
* 1st Cycle review days – upon acceptance how long is the permit in our possession before it returned to the applicant (the end of either consolidate/issue permit or consolidate/corrections required)
  + For the month and total for year.
  + What were the cycle review days for each review team.
  + # and % of permits completed within 3 weeks (15 Business days), 6 weeks,  8 week, and more than 8 weeks (residential new construction, addition and renovation permits)
  + # and % of permits completed within 8 weeks (15 Business days), 10 weeks,  12 week, and more than 12 weeks (commercial new construction, addition and renovation permits)
  + Median and average cycle review time
* Permits by number of revisions, resubmission Rate – # and % of total permits returned for correction (Dallas)
  + For the month and total for year.
  + # of permits returned for correction by each review team
    - Reason for return – not critical but would be nice to have if easily achievable.
  + # and % of permits returned for a 2nd cycle review, 3rd cycle review, 4th cycle review, and 5+ cycles  (both residential and commercial new construction, addition and renovation permits)
  + Median and average duration in days for each subsequent resubmission cycle.  (from time we accept the corrected return to the end of either consolidate/issue permit or consolidate/corrections required)
  + # and % of permits completed (permit issued)  on 1st cycle, 2nd cycle, 3rd cycle, 4th cycle, and 5+ cycles
  + Total time in days from issuance of permit to final inspection/occupancy.
    - # and % meeting target ranges (Dallas Permits by number of revisions chart)
* ~~Total time in days (business) from initial application accepted for review to permit issued~~
  + ~~For the month and total for the year.~~
  + ~~How many days with staff vs how many days with applicant. – if multiple review cycles required.~~
  + Median issued days by month (Dallas)
* Total time in days from initial acceptance of permit to final inspection/occupancy

Part II valuations.

* Data as displayed and shown on city development site
* Ability to look back years for comparison.

## Permit Metric Dashboard

<TBD: >

|  |  |  |  |
| --- | --- | --- | --- |
| Requirement | Description | Visualization | Data Points |
| Permit Types Filter | Display the different types of building permits to allow for filtering the rest of the data visualizations. | Filter | Permit Type |
| Time Frame Filter | Display common data aggregations to allow for filtering the rest of the data visualizations by time frame. | Filter | Cycle Date |
| Project Type Filter | Display the different types of projects to allow for filtering the rest of the data visualizations | Filter | Project Type |
| Permit Cycle Filter | Display the different cycles to allow for filtering the rest of the data visualizations related to cycles. Note this might have to be an unconventional filter in the dashboard, as opposed to the tab which will be mainly global filters. | Filter | Cycle |
| Permits Received by Month | Displays the count of all building permit applications by month. | Vertical Bar Chart | Status = “Applied”, COUNT(Permit ID), Cycle Date |
| Permits Issued by Month | Displays the count of all building permit issuances by month. | Vertical Bar Chart | Status = “Issued”, COUNT(Permit ID), Cycle Date |
| Permits Received by Year | Displays the count of all building permit applications by year. | Vertical Bar Chart | Status = “Applied”, COUNT(Permit ID), Cycle Date |
| Permits Issued by Year | Displays the count of all building permit issuances by year. | Vertical Bar Chart | Status = “Issued”, COUNT(Permit ID), Cycle Date |
| Permits in Queue | Displays the count of all open building permits. | Indicator | Status = "Applied" OR Status = "Open", Latest Permit Record = True, COUNT(Permit ID) |
| Permits in Queue by Staff/Applicant | Displays the count of all open building permits by the responsible party. As a 100% bar chart, this chart will indicate proportion of permits in queue that are in city vs. non-city hands. | Horizontal Bar Chart 100% (Single Element) | Status = "Applied" OR Status = "Open", Latest Permit Record = True, COUNT(Permit ID), Responsible Party |
| Permits in Queue by Cycle and Staff/Applicant | Displays the count of all open building permits by cycle. This chart will indicate proportion of permits at various cycles that exist in queue that are in city vs. non-city hands. Each bar is a cycle broken into the counts of permits being handle by party, sorted. | Horizontal Bar Chart (Multiple Elements) | Status = "Applied" OR Status = "Open", Latest Permit Record = True, COUNT(Permit ID), Cycle, Responsible Party |
| First Cycle Review Days by Month | Displays the number of days for a permit to undergo an initial review. Show the median number of days in each month. | Vertical Bar Chart | Status = “Applied”, Latest Permit Record = False, MEDIAN(Days in Cycle Responsible Party), Cycle Date |
| First Cycle Review Days by Year | Displays the number of days for a permit to undergo an initial review. Show the median number of days in each year. | Vertical Bar Chart | Status = “Applied”, Latest Permit Record = False, MEDIAN(Days in Cycle Responsible Party), Cycle Date |
| Median Cycle Review Days | Displays the median number of go through a permit cycle. | Indicator | Open Cycle = False, MEDIAN(Days in Cycle) |
| Average Cycle Review Days | Displays the average number of go through a permit cycle. | Indicator | Open Cycle = False, MEAN(Days in Cycle) |
| Distribution of Cycle Review Days | Displays the distribution of days it takes to go through a permit cycle. | Vertical Bar Chart | Open Cycle = False, Count(Days in Cycle), Days in Cycle |
| Commercial Permit Issuance Expectation | Displays the time it takes for commercial new construction and addition/remodel permits that have been issued. Puts them into time categories for baselining goals. | Table | Status = "Issued”, Permit Type = "Commercial" |
| Residential Permit Issuance Expectation | Displays the time it takes for residential new construction and addition/remodel permits that have been issued. Puts them into time categories for baselining goals. | Table | Status = "Issued”, Permit Type = "Residential" |
| Issued Permits by Number of Cycles | Displays the number and percent of total permits returned for each cycle. | Horizontal Bar Chart | Status = “Issued” |

## Community Development Summary Reporting

### Monthly Development Report

### Quarterly Development Report

### Yearly Development Report

# Data Architecture & Pipelines

## Data Sources

<TBD: >

## Data Extractions

<TBD: >

Permit Metric Dashboard Data

This data needs to be a log of all permit activity. Thus, each row represents a change of permit status. If someone applies for a permit and the team accepts the permit, then 2 records for that permit should show: one for initial application and one for the issuance.

|  |  |  |
| --- | --- | --- |
| Data Field | Values | Derivation |
| Permit ID | ID |  |
| Permit Type | IE Single Family detached, Single Family attached, Industrial, ADU, … |  |
| Review Team | ? |  |
| Days to Issue | # |  |
| Latest Record | True, False |  |
| Status | Applied, Open, Issued |  |
| Cycle Date | MM/DD/YYYY |  |
| Cycle | # |  |
| Responsible Party | Staff, Applicant |  |
| Days in Cycle Responsible Party | # |  |

<TBD: >

Development Summary Reporting Data

|  |  |  |
| --- | --- | --- |
| Data Field | Values | Derivation |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Data Transformations

<TBD: >

## Data Update Cadence

<TBD: >

# Timeline

<TBD: I need to do both my timeline as well as our deliverable timeline.>

2025-Jan-22 | Course introduction & project check ins (lecture as time permits)

2025-Jan-28 | 1-on-1 meeting scheduled, syllabus quiz completed, & prep form submitted before Noon

2025-Jan-29 | 1-on-1 meetings (meeting slots during class hours)

2025-Feb-05 | Work sessions in class (lecture as time permits)

2025-Feb-12 | Work sessions in class (lecture as time permits)

2025-Feb-19 | Work sessions in class (lecture as time permits)

2025-Feb-26 | Work sessions in class (lecture as time permits)

2025-Mar-05 | Work sessions in class (lecture as time permits)

2025-Mar-09 | First draft of code submissions 1 & 2, and GitHub repo update due before midnight

2025-Mar-11 | 1-on-1 meetings need to be scheduled, confirmation of client presentation scheduling, and proposal for written product outlet before noon

2025-Mar-12 | 1-on-1 meetings (meeting slots during class hours)

2025-Mar-19 | NO CLASS: Spring Break

2025-Mar-23 | First draft of written product due before midnight (feedback returned before Apr. 2)

2025-Mar-26 | NO CLASS: Work on digital products, codes and GitHub repos, presentation, etc.

2025-Mar-30 | First draft of digital product, code submissions 3 & 4, and GitHub repo update due before midnight

2025-Apr-01 | 1-on-1 meetings need to be scheduled before noon

2025-Apr-02 | 1-on-1 meetings (meeting slots during class hours)

2025-Apr-08 | Revised version of written product for peer reviews due before midnight

2025-Apr-09 | NO CLASS: Peer review work this week

2025-Apr-15 | Peer reviews due at midnight

2025-Apr-16 | Presentations in class (1/3 of students go this week)

2025-Apr-21 | Intermediate draft of digital product due before midnight

2025-Apr-23 | Presentations in class (1/3 of students go this week)

2025-Apr-30 | Presentations in class (1/3 of students go this week)

2025-Apr-30 | Final presentation slides for everyone due before midnight

2025-Apr-29 | Attend BMIS 326 for digital product review with students (11:00 AM – 1:50 PM MT)

2025-May-04 | Final draft of written product, digital product, and code submissions/GitHub repo, and video of client presentation due before midnight MT

# Important Links

|  |  |  |
| --- | --- | --- |
| Link | Description | Why is it helpful for project? |
|  |  |  |
| [ArcGIS REST Services Directory](https://services.arcgis.com/HfwHS0BxZBQ1E5DY/ArcGIS/rest/services) | Contains all the FeatureServers that exist currently. | I believe that we will have to develop a FeatureServer for the building permit data. One exists, but it doesn’t quite fit our data needs. |
| [PermitList\_Spatial Specifications](https://services.arcgis.com/HfwHS0BxZBQ1E5DY/ArcGIS/rest/services/PermitList_Spatial/FeatureServer/layers) | Shows the data layer that currently exists and all the specifications. | This is what exists in the on ArcGIS for the data now. We might be able to use this as a starting point. |
| [Excellent Demo](https://www.youtube.com/watch?v=G9PmLPycciI) |  |  |