Infrastructure – from A-Z and back to: ‘P’ for PLANNING
Goals

• Understand what infrastructure includes
• Gain an understanding of how septic systems, water systems, roadways and drainage, and electrical systems work
• Understand what a CIP is, how it is implemented and how it is used as a tool
• Gain basic maintenance knowledge
Infrastructure – what’s included?

- Land
- Buildings
- Roads
- Electrical service
- Landscaping
- Culverts/Basins
- Playground
- Community Center
What you can’t see...

- Closed Drainage Systems
- Sewer Collection System
- *Septic Systems*
- Wells and Water Mains
- Building Service Laterals (water & sewer)
Roads – what do they do?

• Load support – carries vehicle loads unpaved roads cannot
• Drainage – drains water away from driving surface
• Smoothness – higher speeds
What makes up a roadway section?

- **Structure**
  - Surface course
  - Base course
  - Subbase course
  - Subgrade
What impacts roads?

- Subgrade
- Loads
- Environment
Without maintenance ...

- Cracking
- Surface Deformation
- Disintegration
- Surface Defects
Pavement Cracking - Cont’d

- Edge damage – lack of support of the shoulder from weak material or excess moisture
- Trench failure – settlement of poorly compacted utility trenches
Pavement Maintenance/Repair

• Timely maintenance extends the roads life
• No maintenance = 2.5 x higher life cycle cost

* assumes crack sealing
** assumes Mill & Overlay with no drainage or curbing improvements
Sign of Deficient Drainage

- Standing water in ditchlines
- Concentrated weed growth in ditchline or edge of pavement
- Evidence of water ponding on shoulder
- Deteriorated joint or crack sealants
- Any evidence of pumping
Roadway Culverts

- Culverts convey water under roadway
- May be round, elliptical, arch or box shaped
- Three locations
  - Bottom of Depression (no watercourse)
  - Natural stream intersection with roadway (Majority)
  - Locations where side ditch surface drainage must cross roadway
Gravel Roads

• Shoulder Maintenance is Important
Maintenance

- Annual street sweeping – have debris removed from trenches
- Crack sealing – every 2-3 years
- Saw cut and patch deteriorating areas
- Keep water away from roads
- Keep shoulders properly compacted
Electrical

• What it is made of and how it works:
  – Electrical service is provided from a utility company via electrical poles and wires to the meter stand. *communities should identify ownership of poles
  – Meter stands with mounted meters (sometimes the meters are mounted on homes eliminating the stand all together).
  – Electrical service wires protected in conduit run underground from the meter to the home through a stub/sleeve into the homeowner’s electrical panel. *Some pre-HUD homes do not have stubs and are wired directly through the walls.
Maintenance of Electric Systems

• The shocking news is, the utility company owns the meter 😊
• Routinely inspect the meter stands and backboards for deterioration. Weatherproof staining will extend the life of the wood.
• Check with local fire and electrical code for the most up to date code for meter stand replacement/upgrade.
• When wiring directly into an electrical panel, homeowner’s should always use conduit for electrical wires exposed to the outside elements (even underneath a home).
Sewers vs. Septic Systems

• Public sewers accept most home-generated sewage waste with no issues provided sewers, manholes, and pump stations are properly designed.

• Septic systems accept limited home-generated sewage waste with their function seriously impaired if not used properly.

• [https://www.youtube.com/watch?v=udBaGyzJyU8](https://www.youtube.com/watch?v=udBaGyzJyU8)
Typical Septic System
Septic Waste Disposal Systems

• “On-Site Disposal” or “Septic Systems”
  – Includes waste disposal pipes, a septic tank, a distribution box, and a leach field.
  – Requires good soils, adequate setbacks from buildings, wells, water service, and property lines.
  – Requires periodic maintenance for optimum performance.
  – In NH regulated under Env-Wq 1000.
Typical Septic Tank
Septic Tank

• Serves 3 functions:
  1) Remove solids by slowing flow;
  2) Supports bacterial action (anaerobic) to break down the waste;
  3) Provides sludge and scum storage until pumped out.
Distribution Box

• Distributes liquid evenly to leach field beds or chambers
• Should be sized properly for current/future loads
• Can trap solids from tank before getting to leach field
• Should be inspected annually when tank is inspected
Typical Leach Field Beds
Leach Field

- Evenly disperses liquid for percolation through septic stone and into the soil.
- Sized for flow from anticipated number of persons using the system
- Several alternatives for leach field design
- Must include “washed” septic stone for additional treatment before reaching the soil
Properly Functioning System

- Tank slows sewage flow, settles heavy solids (sludge) at bottom, traps floating “scum” at or near surface; breaks down waste before D-box.
- D-box evenly distributes liquid to leach field beds.
- Leach field slowly percolates liquid through septic stone and soil for “polishing” treatment.
What Failed Here?
Causes of Septic System Failure

- Grindings from garbage disposal cause clogs
- Excessive bulky wastes and grease overload tank
- Toxic materials flushed down drain/toilet (strong acids, strong caustics, bleach, pesticides, paint, paint thinner)
- Too much water or sustained high water use
- Heavy external loads on system components
- Backwash from home water treatment systems (brine)
- Soil no longer capable of supporting leach field
Signs of Failure

- Sewage backup in house lateral pipe, drains, or toilets
- Slow flushing of toilets or slow drains
- Surface flow of wastewater (visible seepage or pooling)
- Lush green grass over leach field (especially during dry months)
- Presence of nitrates or bacteria in nearby well
- Unpleasant odors around (outside) home
- Excessive weeds/algae in nearby surface water
Septic System Maintenance

- Check pipe connections from home to tank;
- Annually inspect tank and measure scum and sludge layer thickness (should be <1/3 tank volume);
- Uncover and inspect D-box (should be free of solids);
- Walk over leach field (always protect from heavy traffic);
- Periodic pumping/cleaning of the septic tank is essential to maintain proper function!
Septic System Cost

• Capital cost varies with size; can range from $8,000 to $25,000

• Annual maintenance cost for pumping tank, inspection of D-Box, and visual inspection of leach field $250 to $500.
## Septic Tank Pumping Chart

<table>
<thead>
<tr>
<th>Tank Size (gals)</th>
<th>Household Size (number of people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>750</td>
<td>9.1</td>
</tr>
<tr>
<td>1000</td>
<td>12.4</td>
</tr>
<tr>
<td>1250</td>
<td>15.6</td>
</tr>
<tr>
<td>1500</td>
<td>18.9</td>
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<tr>
<td>1750</td>
<td>22.1</td>
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<tr>
<td>2000</td>
<td>25.4</td>
</tr>
<tr>
<td>2500</td>
<td>31.9</td>
</tr>
</tbody>
</table>

Source: National Environmental Service Center – (800) 624-8301
Municipal Vs. Community Water

• Municipal water is a water supply provided from a central source and piped to individual users under pressure. The municipality is tasked with ensuring all drinking water quality standards are met. 
  
  https://www.youtube.com/watch?v=85bnJ9ZqREA

• A Community systems typically refers to wells that tap into underground water aquifers also known as sources. Well water typically contains minerals and nutrients that are local to the area’s soil. Any treatment is the responsibility of the community owner, which is also the system owner.

  https://www.youtube.com/watch?v=592Aw_ExaaY
Private Well Water Supply System

- pressure tank
- ground surface
- frost line
- well casing
- pitless adapter
- cement grout
- submersible pump
- pressure gauge
- circuit breaker

(not to scale)
Well, what’s included?

• A well is a structure created in the ground by boring, drilling, digging, or driving to access aquifers.
• For water sustainability, it is important to have more than one well. Each well should tap into a separate aquifer or water source.
• The submersible water pump pulls the water from the aquifer into the water line. The water line is protected within the well casing. The well casing lines the drilled well.
• The casing is protected by cement grout. The grout seals the outside of the casing to prevent water from the surface contaminating the aquifer or the commingling of aquifer sources.
H2O my!

- The water line supplies water to the pressure tank. The water pulled from the ground needs to be pressurized before it reaches individual homes.
- Prior to distribution, each system may require various treatments (chlorination, softening, arsenic removal, etc.)
- Based on individual systems, back up generators and storage needs should be evaluated.
- Once the water enters the distribution system it is pumped to individual homes through water mains. Each home is serviced through a service lateral.
Distribution System

• All systems, municipal or community, have distribution systems that feed the flow of water from the source to the individual homes.

• Believe it or not, the distribution system makes up to 80% of the entire system – the water source is the remaining 20%. Don't neglect your distribution system!

• Flush the system annually
• Install isolation valves
• Install individual curb stops
• Install individual ball valves
Well, where is that?

- Most leaks in a distribution system occur at the joint fittings.
- When in doubt, map it!
- If your community does not have a current map of where and what the underground infrastructure is, make sure to mark it as you find it. Use any maps found in your Property Conditions Report.
Maintenance

- Annual flushing of water lines
- Annual valve exercise
- Extra parts on hand
- Have operator create an annual maintenance plan for specific system needs
Two types of infrastructure expenses

1. Annual maintenance (upkeep) = operating budget

2. Capital improvement expenditures = replacement reserves
Operating or capital expense?

**Personal budget**

- Broken window repair
  - Operating expense (regular budget)
- Roof replacement
  - Capital expense (long-term savings)
- New oil tank
  - Capital

- Furnace cleaning
  - Operating
- Snow removal
  - Operating
- Snow plow/blower
  - Capital
- Pump septic system
  - Operating
Operating or capital expense?

Cooperative budget

- Replace septic
  - Capital expense
- Test water system quality
  - Operating expense
- Build a community center
  - Capital
- Repave roads
  - Capital
- Pump septic tank
  - Operating
- Snow removal
  - Operating
- Seal road cracks
  - Operating
Capital improvement planning

Plan to replace long-lasting items that maintain or enhance park’s value

• Includes large, tangible items
• 10-year span
• Allocates money set aside for reserves
• Provides a good guide to maintenance
Why a CIP?

- Gives you a inventory of all infrastructure
- Loan requirement
- Financial plan
- Member input
- Helps identify annual maintenance plan – to extend useful life of all infrastructure.
  - Maintenance, procurement, contract execution, W9 & insurance certificates, contractor evaluation, etc.
Best Practices When Working With Vendors

Every outside vendor hired to work for the Resident Owned Community (ROC) should be able to provide proof of insurance and a list of references. All vendors are required to provide a W-9.

If the ROC is seeking competitive proposals (bids), a written and detailed Scope of Work should be provided to all vendors the ROC is seeking proposals from. This ensures that all proposals are based on the same information and criteria. Once a vendor is selected, the ROC should enter into a contract executed by all parties before any work is performed. The ROC may choose to have the corporate attorney review any and all contracts before signing.

When creating a Scope of Work, be sure all vendors have the same due date. All proposals should be kept together and reviewed by a committee or the Board of Directors after the due date. When evaluating proposals to determine selection, it is best practice to consider the 5 C’s*:

1. **Competency** – When reaching out to references, inquire to the quality of workmanship and customer satisfaction. Do not be afraid to ask if there were any issues.
2. **Capacity** – Does this vendor have the time and staff to handle the ROC project? Is the vendor able to meet the ROC deadline? Does the vendor have the right skillset for the job? What kind of response times does the vendor have?
3. **Commitment** – Is this vendor willing to make the ROC project a priority? Does this vendor want to establish a long term relationship with the ROC?
4. **Communication** – Is the vendor aware of the ROC corporate structure? If not, are they willing to learn? Often times involving a committee and a Board of Directors can lengthen a process – are they understanding of this timeframe? Is the vendor willing to attend a Board of Directors or Membership Meeting for clarification? Is the vendor willing to give the ROC a heads up on all timing of work in order for the ROC to communicate with residents?
5. **Cost** – Most people consider cost to be a key factor when choosing a vendor, but remember to balance it against the other C’s. Is this bid the highest? Lowest? Did the vendor bid according to the Scope of Work?

*After a vendor has completed work, it is always best practice to re-evaluate the vendor based on the 5 C’s. The 5 C’s should be used to present a Preferred Vendor List to the Board of Directors for formal approval. A preferred vendor list should be kept in the Operations Handbook and updated no less than annually. Even when working with a preferred vendor a Scope of Work should be utilized for all quotes and updated insurance should be obtained periodically.
Types of Construction Bids
By Julia Detering
https://www.hunker.com/12417009/types-of-construction-bids

The type of construction bid used depends upon the type of project. Small projects most often will require a lump-sum bid. Large scale municipal projects will look for a unit-cost bid. The owner and contractor must work together to discover the type of construction bid that will fit their needs.

Lump-Sum Bid
This contract allows the contractor to affix a price to the project that includes materials, labor, profit and overhead. Lump-sum bids sometimes are as simple as, "Remove and replace vinyl in kitchen, $2,000." The assumption of this bid is that the contractor will move out the furniture and refrigerator and replace the molding in addition to replacing the vinyl. These types of assumptions should be clarified prior to signing the contract. This type of contract can cause issues for the contractor and the owner if the project runs into complications. Any errors in the original project plans will cause the contractor to submit change orders. Change orders are considered amendments to the original bid and not part of the lump-sum cost.

Design-Build Bid
In this bid, the contractor designs the project and then builds it. The fee for this type of contract is similar to the lump-sum bid. Design-build bids require that the owner produces a Request for Proposal. This document will outline what the owner needs from the project. This includes all project specifics, performance expectations and instructions. More commonly used is the design-bid-build contract. These contracts require the owner to obtain a
design and then give this design to the contractor or multiple contractors for bidding.

Cost-Plus-Fee Bid
This type of bid has also been called a time-and-materials bid. The cost-plus-fee bid requires the owner to pay for actual costs of labor and materials. The contractor then adds a profit charge on top of these actual costs. This type of bid must be highly detailed. The exact costs of materials, including receipts are provided by the contractor to the owner. Often these types of contracts are open-ended. The downside to this arrangement is that owner might not have a firm grasp on the final cost of the project at the beginning. Clear definitions of what are considered reimbursable costs will keep overall costs in check. Before the project begins, the owner and contractor should agree to types of labor that will be covered as costs, including overhead costs associated with the contractor's business.

Guaranteed-Maximum-Price Bid
This type of bid puts a cap on the costs incurred in a cost plus fee bid. The guaranteed maximum price bid favors the owner. If the project costs more than the projected maximum, the contractor must absorb the extra costs. This can motivate a contractor to work more efficiently.

Unit-Price Bid
Unit-price bids are most commonly used for large civil projects, such as road building. In this type of bid, the owner provides the type of quantities of materials to be bid upon. The contractor then bids on a unit cost of these materials. As the project progresses, the amount of materials may change, but the contractor is obligated to the original bid per unit agreed upon.